

## **Appendix A.**

# **References**

## Appendix A.

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## **Appendix B.**

# **Glossary of Terms**

## **Appendix B.**

### **Glossary of Terms**

**Adaptive Management** - The rigorous application of management, research, and monitoring to gain information and experience necessary to assess and modify management activities. A process that uses feedback from refuge research and monitoring and evaluation of management actions to support or modify objectives and strategies at all planning levels.

**Alkalinity** - Refers to the extent to which water or soils contain soluble mineral salts. Waters with a pH greater than 7.4 are considered alkaline.

**Alluvial** - Made of clay, sand, or dirt washed by flowing water.

**Alternatives** - Different sets of objectives and strategies or means of achieving refuge purposes and goals, helping fulfill the Refuge System mission, and resolving issues. (1) A reasonable way to fix the identified problem or satisfy the stated need. (40 CFR 150.2) (2) Alternatives are different means of accomplishing refuge purposes and goals and contributing to the System mission (Draft Service Manual 602 FW 1.5).

**Aquatic** - Pertaining to water, in contrast to land. Living in or upon water.

**Aquatic Habitat** - The physical, chemical, and vegetative features that occur within the water of lakes, ponds, reservoirs, rivers, irrigation canals, and other bodies of water.

**Artifact** - An object made by humans; usually in reference to primitive tools, vessels, weapons, etc.

**Biodiversity (biological diversity)** - Refers to the full range of variability within and among biological communities, including genetic diversity, and the variety of living organisms, assemblages of living organisms, and biological processes. Diversity can be measured in terms of the number of different items (species, communities) and their relative abundance, and it can include horizontal and vertical variability. The variety of life, including the variety of living organisms, the genetic differences among them, and the communities in which they occur.

**Biological Integrity** - Biotic composition, structure, and functioning at the genetic, organism, and community levels consistent with natural conditions, including the natural biological processes that shape genomes, organisms, and communities.

**California Special Concern Species** - A California Department of Fish and Game designation given to certain vertebrate species because declining population levels, limited ranges, and/or continuing threats have made them vulnerable to extinction.

**Categorical Exclusion (CE, CX, CATEX, CATX)** - A category of actions that do not individually or cumulatively have a significant effect on the human environment and have been found to have no such effect in procedures adopted by a Federal agency pursuant to the National Environmental Policy Act (40 CFR 1508.4).

**Closed-cone pines** - Pine species that rely upon fire to open their cones and release seeds.

**Community** - The combined populations of all organisms in a given area, and their interactions. For example, the frogs, fish, algae, cattails, and lily pads in a backyard pond make up a community.

Compatible Use - A wildlife-dependent recreational use or any other use of a refuge that, in the sound professional judgment of the Director, will not materially interfere with or detract from the fulfillment of the Mission of the System or the purposes of the refuge (Draft Service Manual 603 FW 3.6).

Comprehensive Conservation Plan (CCP) - A document that describes the desired future conditions of the refuge or planning unit; and provides long-range guidance and management direction to accomplish the purposes of the refuge, helps fulfill the mission of the Refuge System; maintains and, where appropriate, restores the ecological integrity of each refuge and the Refuge System; helps achieve the goals of the National Wilderness Preservation System; and meets other mandates.

Cultural Resource - The physical remains of human activity (artifacts, ruins, burial mounds, petro glyphs, etc.) and conceptual content or context (as a setting for legendary, historic, or prehistoric events, such as a sacred area of native peoples) of an area. It includes historical, archaeological and architectural significant resources.

Cultural Resource Inventory - A professionally conducted study designed to locate and evaluate evidence of cultural resources present within a defined geographic area. Inventories may involve various levels, including background literature search, comprehensive field examination to identify all exposed physical manifestations of cultural resources, or sample inventory to project site distribution and density over a larger area. Evaluation of identified cultural resources to determine eligibility for the National Register follows the criteria found in 36 CFR 60.4 (Service Manual 614 FW 1.7).

Ecosystem - The sum of all interacting parts of the environment and associated ecological communities within a particular area; an ecological system. Many levels of ecosystems have been recognized. Very few, if any ecosystems are self-contained; most influence, or are influenced by, components or forces outside the system. For administrative purposes, we have designated 53 ecosystems covering the United States and its possessions. These ecosystems generally correspond with watershed boundaries, and their sizes and ecological complexity vary.

Effect - A change in a resource, caused by a variety of events including project attributes acting on a resource attribute (direct), not directly acting on a resource attribute (indirect), another project attributes acting on a resource attribute (cumulative), and those caused by natural events (e.g., seasonal change).

Emergent Vegetation - Rooted, aquatic plants that have most of their vegetative (non-root) parts above water.

Endemic Species - Plants or animals that occur naturally in a certain region and whose distribution is relatively limited to a particular locality.

Endangered Species - Any species that is in danger of extinction throughout all or a significant portion of its range and listed as such by the Secretary of the Interior in accordance with the Endangered Species Act of 1973. Endangered species are afforded protection under the Act as amended and under various State laws for State-listed species.

Environmental Assessment (EA) - A concise public document, prepared in compliance with the National Environmental Policy Act, that briefly discusses the purpose and need for an action, alternatives to such action, and provides sufficient evidence and analysis of impacts to determine whether to prepare an environmental impact statement or finding of no significant impact (40 CFR 1508.9).

Environmental Health - Abiotic composition, structure, and functioning of the environment consistent with natural conditions including the natural abiotic processes that shape the environment.

Estuarine - Of, relating to, or found in an estuary.

Estuary - The part of the wide lower course of a river where its current is met by the tides.

Euro American - A U.S. citizen or resident of European descent.

Finding of No Significant Impact (FONSI) - A document prepared in compliance with the National Environmental Policy Act, supported by an environmental assessment, that briefly presents why a Federal action will have no significant effect on the human environment and for which an environmental impact statement, therefore, will not be prepared (40 CFR 1508.13).

Flyway - A route taken by migratory birds between their breeding grounds and their wintering grounds. Four primary migration routes have been identified for birds breeding in North America: the Pacific, Central, Mississippi, and Atlantic Flyways.

Foraging - The act of feeding; another word for feeding.

Forbs - Herbaceous dicotyledonous plants.

Fragmentation - The process of reducing the size and connectivity of habitat patches.

GIS - Geographic Information System. Refers to such computer mapping programs as Arc View, ArcInfo, ERDAS, etc.

Goal - A descriptive, open-ended, and often broad statement of desired future conditions that conveys a purpose but does not define measurable units (Draft Service Manual 620 FW 1.5).

Habitat - Suite of existing environmental conditions required by an organism for survival and reproduction. The place where an organism typically lives.

Integrated Pest Management (IPM) - Methods of managing undesirable species, such as weeds, including education; prevention, physical or mechanical methods or control; biological control; responsible chemical use; and cultural methods.

Invasive species - An alien (non-native) species whose introduction does or is likely to cause economic or environmental harm or harm to human health

Invertebrate - Animals that do not have backbones. Included are insects, spiders, mollusks (clams, snails, etc.), and crustaceans (shrimp, crayfish, etc.).

Irrigation drainwater - Ideally, subsurface water that flows from irrigated land and generally transports higher concentrations of dissolved salts than the water applied to the land.

Irrigation return flow - Water which reaches surface drainage by overland flow or through groundwater discharge as a result of applied or natural irrigation.

Issue - Any unsettled matter that requires a management decision, e.g., an initiative, opportunity, resource management problem, threat to the resources of the unit, conflict in uses, public concern, or the presence of an undesirable resource condition.

Levee - An embankment raised to prevent a river from overflowing.

List 1B Plants (CNPS) - Plants that are rare, threatened or endangered in California and elsewhere.

List 4 Plants (CNPS) - Plants of limited distribution, often referred to as a plant watch list.

Marsh - An area of soft, wet, low-lying land, characterized by grassy vegetation and often forming a transition zone between water and land.

Memorandum of Understanding - A legal document outlining the terms and details of an agreement between parties, including each party's requirements and responsibilities.

Mitigation - To avoid or minimize impacts of an action by limiting the degree or magnitude of the action; to rectify the impact by repairing, rehabilitating, or restoring the affected environment; to reduce or eliminate the impact by preservation and maintenance operations during the life of the action.

National Environmental Policy Act (NEPA) - An act which encourages productive and enjoyable harmony between humans and their environment, to promote efforts that will prevent or eliminate damage to the environment and atmosphere, to stimulate the health and welfare of humans. The act also established the Council on Environmental Quality (CEQ). Requires all agencies, including the Service, to examine the environmental impacts of their actions, incorporate environmental information, and use public participation in the planning and implementation of all actions. Federal agencies must integrate NEPA with other planning requirements, and prepare appropriate NEPA documents to facilitate better environmental decision making (from 40 CFR 1500).

National Wildlife Refuge (Refuge or NWR) - A designated area of land or water or an interest in land or water within the system, including national wildlife refuges, wildlife ranges, wildlife management areas, waterfowl production areas, and other areas (except coordination areas) under the Service jurisdiction for the protection and conservation of fish and wildlife. A complete listing of all units of the Refuge System may be found in the current "Report of Lands Under Control of the U.S. Fish and Wildlife Service."

National Wildlife Refuge System, Refuge System, or System - Various categories of areas that are administered by the Secretary for the conservation of fish and wildlife, including species that are threatened with extinction; all lands, waters, and interest therein administered by the Secretary as wildlife refuges; areas for the protection and conservation of fish and wildlife that are threatened with extinction; wildlife ranges; game ranges; wildlife management or waterfowl production areas.

Native Species - Species that normally live and thrive in a particular ecosystem.

No Action Alternative - An alternative under which existing management would be continued.

Objective - A concise statement of what we want to achieve, how much we want to achieve, when and where we want to achieve it, and who is responsible for the work. Objectives derive from goals and provide the basis for determining strategies, monitoring refuge accomplishments, and evaluating the success of strategies. Make objectives attainable, time-specific, and measurable.

Ornithology - The branch of zoology that deals with the study of birds.

pH - An index of acidity/alkalinity of a solution, being an expression of concentration of hydrogen ions.

Palustrine - being, living, or thriving in a marsh.

Palustrine Wetland - All non-tidal wetlands dominated by trees, shrubs, and persistent emergent vegetation.

Piscivorous - Habitually feeding on fish; fish-eating.

Plant Community - An assemblage of species populations of plants in a particular area at a particular point in time; the biological part of an ecosystem as distinct from its physical environment. The plant community of an area can change over time due to disturbance (e.g., fire) and succession.

Population - All the members of a single species coexisting in one ecosystem at a given time.

Preferred Alternative - This is the alternative determined (by the decision maker) to best achieve the Refuge purpose, vision, and goals; contributes to the Refuge System mission, addresses the significant issues; and is consistent with principles of sound fish and wildlife management. The Service's selected alternative at the Draft CCP stage.

Prescribed Fire - The skillful application of fire to natural fuels under conditions of weather, fuel moisture, soil moisture, , etc., that allows confinement of the fire to a predetermined area and produces the intensity of heat and rate of spread to accomplish planned benefits to one or more objectives of habitat management, wildlife management, or hazard reduction.

Priority public uses - Compatible wildlife-dependent recreation uses (hunting, fishing, wildlife observation and photography, and environmental education and interpretation).

Propagules - Any of various usually vegetative portions of a plant, such as a bud or other offshoot, that aid in dispersal of the species and from which a new individual may develop.

Proposed Action - The Service's proposed action for Comprehensive Conservation Plans is to prepare and implement the CCP.

Public involvement - A process that offers impacted and interested individuals and organizations an opportunity to become informed about, and to express their opinions on Service actions and policies. In the process, these views are studied thoroughly and thoughtful consideration of public views is given in shaping decisions for refuge management.

Public scoping - See public involvement.

Purposes of the Refuge -"The purposes specified in or derived from the law, proclamation, executive order, agreement, public land order, donation document, or administrative memorandum establishing, authorizing, or expanding a refuge, refuge unit, or refuge subunit." For refuges that encompass congressionally designated wilderness, the purposes of the Wilderness Act are additional purposes of the refuge.

Raptor - A bird of prey, such as a hawk, eagle, or owl.

Refuge – Short form of National Wildlife Refuge.

Refuge Operating Needs System (RONS) - The Refuge Operating Needs System is a national database that contains the unfunded operational needs of each refuge. We include projects required to implement approved plans and meet goals, objectives, and legal mandates.

Sand - A sedimentary material, finer than a granule and coarser than silt, with grains between 0.06 and 2.0 millimeters in diameter.

Salinity - An expression of the amount of dissolved solids in water.

Silt - A sedimentary material consisting of very fine particles intermediate in size between sand and clay.

Siltation – The process of becoming covered with silt.

Sound professional judgment - A finding, determination, or decision that is consistent with principles of sound fish and wildlife management and administration, available science and resources, and adherence to the requirements of the Refuge Administration Act and other applicable laws.

Species - A distinctive kind of plant or animal having distinguishable characteristics, and that can interbreed and produce young. A category of biological classification.

Step-down management plan - A plan that provides specific guidance on management subjects (e.g., habitat, public use, fire, safety) or groups of related subjects. It describes strategies and implementation schedules for meeting CCP goals and objectives.

Strategy - A specific action, tool, or technique or combination of actions, tools, and techniques used to meet unit objectives (Draft Service Manual 602 FW 1.5).

Stratigraphy - The study of rock strata, especially the distribution, deposition, and age of sedimentary rocks.

Threatened Species - Any species that is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range, and one that has been designated as a threatened species in the Federal Register by the Secretary of the Interior. Threatened species are afforded protection under the Endangered Species Act of 1973.

Trust Resources - Those resources for which the Service has been given specific responsibilities under federal law. These include migratory birds, interjurisdictional fishes (fish species that may cross state lines), federally listed threatened or endangered species, some marine mammals, and lands owned by the Service.

Upland - An area where water normally does not collect and where water does not flow on an extended basis. Uplands are non-wetland areas.

Vision Statement - A concise statement of what the planning unit should be, or what we hope to do, based primarily upon the Refuge System mission and specific refuge purposes, and other mandates. We will tie the vision statement for the refuge to the mission of the Refuge System; the purpose(s) of the refuge; the maintenance or restoration of the ecological integrity of each refuge and the Refuge System; and other mandates.

Wading bird - A long-legged bird, such as a crane, heron, or stork, that frequents shallow water, especially in search of food.

Waterfowl - A group of birds that include ducks, geese, and swans (belonging to the order Anseriformes).

Watershed - The entire land area that collects and drains water into a river or river system.

Wetland - Lands transitional between terrestrial and aquatic systems where the water table is usually at or near the surface or the land is covered by shallow water. For purposes of this classification wetlands must have one or more of the following three attributes: (1) at least periodically, the land supports predominantly hydrophytes; (2) the substrate is predominantly undrained hydric soil; and (3) the substrate is nonsoil and is saturated with water or covered by shallow water at some time during the growing season of the year (from USFWS Classification of Wetlands and Deepwater Habitats of the United States).

Wilderness Review - The process we use to determine if we should recommend Refuge System lands and waters to Congress for wilderness designation. The wilderness review process consists of three phases: inventory, study, and recommendation. The inventory is a broad look at the refuge to identify lands and waters that meet the minimum criteria for wilderness. The study evaluates all values (ecological, recreational, cultural), resources (e.g., wildlife, water, vegetation, minerals, soils), and uses (management and public) within the Wilderness Study Area. The findings of the study determine whether or not we will recommend the area for designation as wilderness.

Wildfire - A free-burning fire requiring a suppression response; all fire other than prescribed fire that occurs on wildlands (Service Manual 621 FW 1.7).

Wildlife - All non-domesticated animal life; included are vertebrates and invertebrates.

Wildlife-Dependent Recreational Use - "A use of a refuge involving hunting, fishing, wildlife observation and photography, or environmental education and interpretation." These are the six priority public uses of the Refuge System as established in the National Wildlife Refuge System Administration Act, as amended. Wildlife-dependent recreational uses, other than the six priority public uses, are those that depend on the presence of wildlife. We also will consider these other uses in the preparation of refuge CCPs; however, the six priority public uses always will take precedence.

## **Appendix C.**

# **Environmental Assessment**

## **Appendix C.**

# **Draft Environmental Assessment for Ellicott Slough NWR Comprehensive Conservation Plan**

Prepared By:

U.S. Fish and Wildlife Service  
Pacific Southwest Region  
Refuge Planning  
2800 Cottage Way, W-1832  
Sacramento, CA 95825-1846

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# Draft Environmental Assessment for Ellicott Slough NWR Comprehensive Conservation Plan

## Chapter 1. Purpose and Need for Action

### Introduction

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

### Proposed Action

The Service proposes to implement Alternative B as the Comprehensive Conservation Plan for Ellicott Slough NWR, as described in this EA. The preferred alternative (Alternative B) was identified based on the analysis presented in the Draft CCP/EA. The Service examined a range of management alternatives in the EA. Of the alternatives evaluated, Alternative B appears to best achieve the purpose, vision, and goals for the Refuge, while also appropriately addressing the major issues and relevant mandates identified during the CCP process. Specific details regarding the preferred alternative and the other alternatives are provided in Chapter 2 of this EA. The preferred alternative is described in more detail in Chapter 5 of the CCP.

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.

### Purpose of and Need for the Proposed Action

The development of a CCP provides guidance for conducting 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 this CCP is to describe the desired future conditions of Ellicott Slough NWR over the next 15 years and provide guidance for achieving those conditions. The CCP:

- 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. The NEPA requires that an EA or environmental impact statement (EIS) be prepared to accompany the CCP to evaluate the effects of different alternatives which meet the goals of the refuges and identifies the Service's proposed action for implementing the CCP.

## **Project Area**

The Ellicott Slough National Wildlife Refuge (Refuge) is located on the southern coast of Santa Cruz County, approximately 4 miles west of the city of Watsonville. Santa Cruz County is part of the larger Monterey Bay area and is heavily influence by marine conditions of the Pacific Ocean. This area is small, but diverse with mountains, foothills, valleys, and marine scenery. The soil is productive, making the area an important agricultural base. Residential and agricultural development surrounds the Refuge. Figures C-1 and C-2 show the location of the Refuge.

## **Decisions to be Made**

Based on the analysis documented in the EA, the Regional Director must determine the type and extent of management and visitor access that will occur on the Refuge and whether the selected management alternative would have a significant effect on the quality of the human environment.

## **Issues and Challenges Identification**

The Service identified issues, concerns and opportunities through early planning discussions and the public scoping process. The scoping process officially began on July 14, 2008, when the Service published a Notice of Intent to prepare a CCP in the Federal Register (Vol. 73, No. 135, p. 40360). The first planning update was distributed in summer 2008 to interested stakeholders that had been identified through other prior planning processes, to further solicit public input. A full discussion of the planning process and issues raised can be found in Chapter 2 of the CCP.

The planning team helped to further define the issues and challenges. The core planning team includes Service employees from the Ellicott Slough NWR, the San Francisco Bay National Wildlife Refuge Complex and the Pacific Southwest Region, Refuge Planning.

## **Public Involvement**

A Notice of Intent to prepare a Comprehensive Conservation Plan (CCP) and Environmental Assessment (EA) was published in the Federal Register on July 14, 2008. A planning update, which introduced the Refuge and the planning process, was mailed to over 100 agency and organization representatives, members of the public, media, and elected representatives in Santa Cruz County. While no public scoping meeting was held, the mailing solicited interest for a meeting. Approximately 12 people responded with interest in attending a meeting. These individuals included neighbors and representatives of organizations. The Service scheduled individual meetings and/or calls with these organizations and neighbors to acquaint them on the CCP process. Comments were collected through August 13, 2008. Service staff met with representatives from the California Department of Fish and Game on April 1, 2008 to provide them with a preview of the CCP process. They agreed to serve as core team members in the CCP process.

The planning staff has incorporated into the CCP and EA the public input received in response to these updates and public outreach; a summary of major issues and challenges is included in Chapter 2 of the CCP and a summary of comments is included in Appendix J, Public Involvement. The original comments are available for review in the administrative files at the San Francisco Bay NWR Complex headquarters in Fremont, California.

## **Refuge Purposes**

Ellicott Slough National Wildlife Refuge was established under the authority of two acts. These acts and the corresponding purposes for the Refuge are:

Endangered Species Act of 1973 (16 U.S.C. 1531) - "...to conserve (A) fish or wildlife which are listed as endangered species or threatened species .... or (B) plants ..."

Emergency Wetlands Resources Act of 1986 (16 U.S.C. 3901-3932) - "... the conservation of the wetlands of the Nation in order to maintain the public benefits they provide and to help fulfill international obligations contained in various migratory bird treaties and conventions ..."

## **Ellicott Slough NWR Goals**

**Goal 1:** Restore, protect and enhance native and special status amphibian populations in Santa Cruz County.

**Goal 2:** Conserve, restore, and enhance migratory and other native wildlife populations.

**Goal 3:** Conserve, restore, and enhance grassland, wetland, oak woodland, coastal scrub and chaparral plant communities and special status plant species representative of the Santa Cruz County.

**Goal 4:** Conserve and restore all Refuge resources through the prevention and control of invasive species.

**Goal 5:** Promote long-term viability of the Pajaro Valley Watershed through ecosystem-based management (including endangered and threatened species management across boundaries).

**Goal 6:** Identify, assess, and adapt to current and future climate change impacts to Refuge resources.

**Goal 7:** Provide the public with accessible, safe, high-quality wildlife-oriented recreation and environmental education opportunities to enhance public appreciation and understanding of the natural resources of the Refuge and the Refuge System.

## **Chapter 2. Alternatives, Including the Proposed Action**

### **Introduction**

This chapter describes three alternatives for managing the Ellicott Slough NWR: Alternative A (No Action), Alternative B, and Alternative C. These alternatives are described below. Figure C-3 shows a graphical representation of the areas described in the visitor services alternatives for Ellicott Slough NWR. Under Alternative A, the No Action alternative, the Service would continue managing the Refuge as it currently does. Alternatives B and C presented in this chapter are "action alternatives" that would involve a change in the current management of the Refuge. The Service's preferred alternative or proposed action is Alternative B.

### **Current Management of Ellicott Slough NWR**

For a complete description of the current management practices, please see Chapter 4 of the CCP.

### **Management Actions Considered but Eliminated from Detailed Analysis as Part of the Alternatives**

During the public scoping period, some alternative actions for managing the Refuge were suggested. Some of these suggestions were consistent with Refuge purposes and the mission of the Refuge System and influenced the action alternatives. Other suggestions for Refuge uses were found to be not appropriate, through an appropriate use determination, and were removed from further consideration. Others actions were found to be infeasible. The actions that were removed from further consideration and the rationale for removal are as follows.

#### ***Mountain Bike Riding***

Mountain biking was determined to be not appropriate because the current Refuge staffing levels are insufficient to provide the required oversight to manage the use and prevent destruction of habitat for Federally-protected species. Additionally, mountain biking would be unnecessarily disruptive to wildlife

and to visitors engaging in priority wildlife-dependent activities on Service-guided Refuge tours. Mountain biking is not a wildlife-dependent activity and tends to degrade and destroy habitat given its off-road nature. Mountain biking could also pose a hazard to those using the trails for walking or hiking. Furthermore, the trails for wildlife observation are anticipated to be short and narrow given the terrain of the area, making it difficult to accommodate slower activities like walking with fast-paced activities like biking.

### ***Horseback Riding***

Horseback riding was determined to be not appropriate because the current Refuge staffing levels are insufficient to provide the required oversight to manage the use and prevent destruction of sensitive habitat for Federally-protected species. Because there is no on-site Refuge office, public access to the Refuge is limited to Service-guided Refuge tours. Without a substantial amount of monitoring and oversight, horseback riding can degrade habitat. The presence of horses is disruptive to wildlife.

### ***Dog Walking***

Dog walking was determined to be not appropriate because the current Refuge staffing levels are insufficient to provide the required oversight to manage the use and the presence of dogs is disruptive to wildlife and to other visitors engaging in priority wildlife-dependent activities on Service-guided Refuge tours. Because there is no on-site Refuge office, public access to the Refuge is limited to Service-guided Refuge tours.

### ***Off-Road Vehicle Use***

Off-road vehicle use was determined to be not appropriate because the current Refuge staffing levels are insufficient to provide the required oversight to manage the use and prevent destruction of sensitive habitat for Federally-protected species. Because there is no on-site Refuge office, public access to the Refuge is limited to Service-guided Refuge tours. The presence of off-road vehicles is disruptive to wildlife. Wildlife can be flushed by fast-moving vehicles and there is the potential for wildlife mortality due to vehicle strikes. Off-road vehicle use is not wildlife-dependent activity and without a substantial amount of monitoring and oversight, tends to degrade and destroy habitat given its off-road nature. Off-road vehicle use could also pose a hazard to those using the trails for walking or hiking. Furthermore, the trails for wildlife observation are anticipated to be short and narrow given the terrain of the area, making it difficult to accommodate slower activities like walking with fast-paced activities like off-road vehicle use.

### ***Fishing***

Allowing access for public fishing was considered for Harkins Slough Unit, but is not included in the alternatives considered in this EA. Prior to opening the Refuge for fishing, the Service would first prepare a compatibility determination for fishing and, if determined to be compatible, would then prepare a Fishing Plan that would be available for public review and comment. The CCP addresses the need for further evaluation of fishing as a public use.

## **Management Actions not Analyzed as Part of the Alternatives**

### ***Construction of Additional Breeding Ponds***

The construction of additional new breeding ponds was considered, but is not included in the alternatives considered in this EA. While assessment of the need for additional ponds is included in the CCP, the construction is not. Additional water resources may be necessary for breeding pond management. Identifying and if possible obtaining additional man-made water sources for Calabasas and Buena Vista units is outside of the scope of the CCP and this EA. The Service will comply with all applicable environmental laws, including NEPA in a separate document. When the assessment and a proposed action (project design) are complete, the Service will initiate Section 7, ESA consultation and complete ESA and NEPA compliance for any new pond projects, as required.

### **Reintroduction, Captive Rearing and Propagation of Listed Species**

Because of the status and limited distribution and possible population declines of SCLTS, CTS, CRLF, robust spineflower and Santa Cruz tarplant, reintroduction, captive rearing, and propagation was considered. However, a proposed action (project description) has not been determined at this time. Because there is no project description, reintroduction of special status species is outside the scope of the CCP and this EA. When the Refuge staff develops plans for reintroduction and/or captive rearing/propagation and a proposed action is complete (a more detailed step-down plan), the Service will initiate section 7, ESA consultation and complete ESA, NEPA and all other environmental compliance requirements, as required.

## **Features Common to All Alternatives**

### **Endangered Species and Species of Concern Management**

The Refuge would continue to provide habitat for the Santa Cruz long-toed salamander (*Ambystoma macrodactylum croceum*) (SCLTS) (Federally-listed as endangered) (state-listed as Endangered); the California tiger salamander (*Ambystoma californiense*) (CTS) (Federally-listed as threatened) (state-listed as endangered); the robust spineflower (*Chorizanthe robusta*) (Federally-listed as endangered) (no state listing); and the California red-legged frog (*Rana aurora draytonii*) (CRLF), which is Federally-listed as threatened and has no state listing status. The actions that are included in this section are the same for all alternatives that are analyzed in this EA.

The SCLTS and the robust spineflower have existing Recovery Plans that were developed by the Service (USFWS 1999 and USFWS 2004, respectively). The CTS does not currently have a Recovery Plan. The measures below would be implemented in accordance with and reflect the goals of the existing Recovery Plans for these species.

#### *For the Santa Cruz long-toed salamander (SCLTS) and the California tiger salamander (CTS)*

All of the alternatives include the following.

- Conduct dip-netting on all of the ponds once annually to check for presence or absence, recruitment, health, and abnormalities of the Federally-protected species and species of special concern including: SCLTS and CTS
- Conduct opportunistic winter night-time surveys to check for movement, recruitment, and health of SCLTS and CTS
- Augment water levels in Ellicott Pond as needed to provide optimal habitat for SCLTS and CTS
- Complete planning to rehabilitate the existing non-functional breeding pond (Prospect Pond) on the Ellicott Unit

### **Other Wildlife Management**

All alternatives include the following.

- Collect incidental data for other wildlife while conducting field work and surveys for special status species.

### **Habitat Management**

#### *Controlling Invasive Species*

All alternatives include the following.

- Control priority invasive weeds: pampas grass and eucalyptus
- Work with partners to remove stands of pampas grass and eucalyptus
- Remove poison hemlock, cotoneaster and thistle in core areas
- Participate in Santa Cruz County Weed Management Area meetings

The Refuge staff will continue to manage invasive plant species by the use of Integrated Pest Management (IPM) strategies (mechanical, chemical, biological, and cultural).

Refuge management activities periodically include the use of Service-approved pesticides. Service-approved pesticides (which include herbicides) would be used with all alternatives. A Pesticide Use

Proposal (PUP) is required for all pesticides used on lands owned or managed by the Service. PUPs specify the appropriate and safe use of pesticides and require that the pesticide use is also in compliance with applicable State pesticide laws and regulations. This approach includes a detailed evaluation of the proposed pesticide use noting environmental hazards, efficacy, vulnerability of the target pest, and the State-issued Certified Pesticide Applicators' identification number for proposed use of any restricted use pesticides.

When managing invasive plants with chemical methods, the Refuge staff limits the application of herbicides to target plants/stumps by using spray bottles, backpack sprayers or a tank and hose. Mechanical methods used to remove invasive plants can include digging by hand, a nylon filament trimmer (weed "whacker"), chain saw, uprooting the plant with a jack or hand pulling, among other mechanical methods. All control methods are only conducted during the months when the salamander is over-summering underground, to prevent direct mortality from the control measures. Also, because stands of invasive plants provide poor quality habitat for salamanders, the chance of encountering a salamander is reduced. The areas where weed removal occurs are then monitored for natural recruitment of native vegetation. If natural recruitment does not occur, the areas are replanted with native species.

### *Restoration*

All alternatives include the following.

- Collect seeds and cuttings from native plants on various units and propagate them at the native plant nursery located in Newark
- Work with volunteers, students and partners to plant native species in areas where invasive plants have been removed

Restoration involves removal of invasive plants and, if needed, the area is replanted with vegetation that is native to the particular habitat being restored. Plantings do not normally require large-scale earth moving and is usually limited to small, shallow individual holes (usually about a foot deep or even less) to plant small seedlings, cuttings or seeds. Or, in the case of grass, the native seeds would be broadcast seeded over the area where the invasives were removed.

The Refuge will enhance the plant communities as habitat for native wildlife species by planting appropriate native, understory plants. Newly installed plants may be protected from deer browsing through individual plant protection tubing or similar exclusion devices designed for that purpose, as needed. Plantings also may have geo-textile fabric mats installed at the base of each plant to reduce weed growth and competition for water around young plants.

### **Visitor Services**

All alternatives include the following.

- Conduct interpretive tours as requested by resource-related organizations
- Allow the Santa Cruz County Mosquito and Vector Control (SCCMVC) District to monitor and manage mosquito populations using *Bacillus thuringiensis* var. *israelensis* (Bti), a mosquito larvicide, for public health and safety purposes. Bti is highly specific to mosquito larvae and is intended to control mosquitoes in wetlands prior to their emergence as adults.

Mosquito monitoring by SCCMVC District is authorized on the Refuge through Special Use Permits (SUP) and approved Pesticide Use Proposals (PUP), both of which are produced on an annual basis. The SUP identifies permitted dates, access points and conditions, monitoring and data reporting requirements, approved PUPs, treatment notification requirements, and sensitive areas to be avoided. The PUPs identify specific mosquito control products approved for use on the Refuges, and include details on target pests, products applied, application dates, rates, methods, number of applications, site description, sensitive habitats and best management practices to avoid them.

For more information refer to Appendix G for a Compatibility Determination for mosquito management.

- Conserve the Refuge's cultural resources in coordination with the Service's Region 1/Region 8 Archaeologist and in compliance with all applicable laws and regulations

**Environmental Education and Outreach**

All alternatives include the following.

- Conduct the Environmental Education Program at the Ellicott Unit. The Refuge conducts a small field-based Environmental Education Program. School groups from Renaissance High School come to the Refuge to assist in the planting of native plants and wildlife survey data collection.

**Ongoing Projects**

Under all alternatives, the Service would continue to plan the in-progress project to evaluate the design of the approximately 1-acre Prospect Pond on the Ellicott Unit. Prospect Pond was built by the Service in the 1990s, with the goal of providing additional breeding habitat for special status amphibians including the SCLTS and CTS. However, after construction, it did not function hydrologically, as intended. The duration of water retention was limited and did not last throughout the time period needed for successful metamorphosis. A hydro-geologic study and a re-design of the pond that were completed to help evaluate possible solutions to improve the pond water retention. When funding becomes available, the Service plans to rebuild Prospect Pond to function as a successful breeding pond. The effects of the original construction of Prospect Pond are analyzed in an environmental assessment for the Service’s Habitat Enhancement Plan and Finding of No Significant Impact (FONSI) (USFWS 1993). In 1993, the Service found that, with the mitigation measures, the creation of Prospect Pond, while expected to have beneficial effects on the SCLTS population and other species that use ephemeral wetlands, it would have no significant impact to the environment.

The re-construction (remodel) of Prospect Pond is not a part of the actions in the alternatives in this EA; therefore, the effects of the re-construction of Prospect Pond are not analyzed in this EA. The project description (proposed action) is not available at this time. When the project description is available, the Service will analyze the effects of re-constructing Prospect Pond in compliance with NEPA, the ESA, and all applicable laws and policies.

**Description of Alternatives**

**Table C-1. Summary Table of Alternatives with Environmental Effects: Ellicott Slough National Wildlife Refuge**

<b>Issue Area</b>	<b>Alternative A: No Action (current management continues)</b>	<b>Alternative B: Wildlife emphasis; increase visitor services and environmental education.</b>	<b>Alternative C: Same as Alternative B, but invasive management emphasis and full visitor services program.</b>
<b>Endangered Species and Species of Concern Management</b>			
Santa Cruz long-toed salamander (FE)(SE) and California tiger salamander (FT)(SE)	<ul style="list-style-type: none"> <li>• Conduct dip-netting on ponds once annually to check presence/absence, recruitment, health, and abnormalities</li> <li>• Conduct opportunistic winter night-time surveys for movement, recruitment, and health</li> <li>• Augment water levels in Ellicott Pond as needed</li> </ul>	<ul style="list-style-type: none"> <li>• Same as Alternative A</li> <li>• Conduct winter night-time surveys during most rain events (after on-site office installed)</li> <li>• Construct trap arrays around various units to identify dispersal locations</li> <li>• Conduct drift fence surveys at each pond to obtain baseline population estimates</li> <li>• Conduct hydrological and soil surveys for each ephemeral pond.</li> <li>• Monitor ponds for siltation and vegetation encroachment and determine management needs</li> <li>• Minimize mortality from roads (e.g., tunnel improvements, “reduce speed” signs)</li> </ul>	<ul style="list-style-type: none"> <li>• Same as Alternative A</li> <li>• Same as Alternative B</li> <li>• Same as Alternative B</li> <li>• Design and conduct drift fence surveys at each pond annually for multi-year population estimates</li> <li>• Same as Alternative B</li> <li>• Same as Alternative B</li> <li>• Same as Alternative B</li> </ul>

<b>Issue Area</b>	<b>Alternative A: No Action (current management continues)</b>	<b>Alternative B: Wildlife emphasis; increase visitor services and environmental education.</b>	<b>Alternative C: Same as Alternative B, but invasive management emphasis and full visitor services program.</b>
		<ul style="list-style-type: none"> <li>• Monitor and research over-summering needs (e.g., grassland, oak woodland habitats) and incorporate results into restoration efforts and management</li> <li>• Assess, control and reduce threats (e.g., disease, predators, contaminants, roadkill)</li> </ul>	<ul style="list-style-type: none"> <li>• Same as Alternative B</li> <li>• Same as Alternative B</li> </ul>
<i>California red-legged frog* (CLRF) (FT) (no state listing)</i>	<ul style="list-style-type: none"> <li>• No formal monitoring program in place; monitoring consists of incidental sightings</li> </ul>	<ul style="list-style-type: none"> <li>• Determine presence/absence of CRLF at all units</li> <li>• Identify, control, and reduce threats to CRLF (e.g., chytrid disease)</li> <li>• Assess restoration potential at Harkins Slough for CRLF and other amphibians</li> </ul>	<ul style="list-style-type: none"> <li>• Same as Alternative B</li> <li>• Same as Alternative B</li> <li>• Same as Alternative B</li> </ul>
robust spineflower* (FE) (no state listing)	<ul style="list-style-type: none"> <li>• No formal monitoring program in place</li> </ul>	<ul style="list-style-type: none"> <li>• Determine presence/absence on Harkins Slough and Calabasas Units</li> <li>• Monitor and map spineflower populations every 3 to 5 years on all units where it is present</li> </ul>	<ul style="list-style-type: none"> <li>• Same as Alternative B</li> <li>• Increase level of effort for monitoring and mapping spineflower populations annually</li> </ul>
Santa Cruz tarplant (FT) (SE)	<ul style="list-style-type: none"> <li>• No formal monitoring program in place</li> </ul>	<ul style="list-style-type: none"> <li>• Determine presence/absence of tarplant</li> <li>• If present, monitor and map tarplant populations every 3 to 5 years</li> </ul>	<ul style="list-style-type: none"> <li>• Same as Alternative B</li> <li>• Same as Alternative B</li> </ul>
<b>Other Wildlife Management</b>			
	<ul style="list-style-type: none"> <li>• Incidental data collection when conducting field work and surveys</li> </ul>	<ul style="list-style-type: none"> <li>• Develop standardized quantitative and qualitative monitoring protocols and implement; repeat at intervals depending on the species</li> </ul>	<ul style="list-style-type: none"> <li>• Same as Alternative B</li> </ul>

<b>Issue Area</b>	<b>Alternative A: No Action (current management continues)</b>	<b>Alternative B: Wildlife emphasis; increase visitor services and environmental education.</b>	<b>Alternative C: Same as Alternative B, but invasive management emphasis and full visitor services program.</b>
<b>Habitat Management</b>			
Controlling invasive species	<ul style="list-style-type: none"> <li>• Control priority invasive weeds: pampas grass and eucalyptus trees</li> <li>• Work with partners to remove stands of pampas grass and eucalyptus trees</li> <li>• Remove poison hemlock, cotoneaster and thistle in core areas</li> <li>• Participate in Santa Cruz County Weed Management Area meetings</li> </ul>	<ul style="list-style-type: none"> <li>• Same as Alternative A</li> <li>• Map priority invasive weeds</li> <li>• Develop Weed Management Program (i.e., identify control methods, priority species within Vegetation Management Plan)</li> <li>• Develop prevention and early detection plan for invasive plants</li> <li>• Partner with others to identify and control invasives, learn new control techniques</li> <li>• Determine presence/absence of native and non-native predators and conduct baseline assessments of predators of concern</li> </ul>	<ul style="list-style-type: none"> <li>• Same as Alternative A</li> <li>• Same as Alternative B</li> <li>• Expand invasive weed management to include acacia, ice plant, cape ivy and French broom</li> <li>• Remove invasive wildlife (e.g. bullfrogs and crayfish) from Harkins Slough Unit</li> </ul>

<b>Restoration</b>	<ul style="list-style-type: none"> <li>Collect seeds and cuttings from native plants on various units and propagate at native plant nursery in Newark</li> <li>Conduct plantings with volunteers and students in areas where eucalyptus has been removed</li> </ul>	<ul style="list-style-type: none"> <li>Seek partners to assist and conduct seed collection from local native sources for propagation and/or restoration</li> <li>Same as Alternative A</li> <li>Conduct baseline comprehensive vegetation mapping at repeat at 10-year intervals</li> <li>Develop a Vegetation Management Plan</li> </ul>	<ul style="list-style-type: none"> <li>Partner with local organization to collect native seeds and cuttings to propagate locally</li> <li>Same as Alternative A</li> <li>Same as Alternative B</li> <li>Same as Alternative B</li> <li>Introduce or restore local native plants historically found on or near the Refuge</li> </ul>
<b>Ecosystem-based Management</b>			
	Not applicable	<ul style="list-style-type: none"> <li>Identify, map, and control wildland urban interface areas, hazardous fuels</li> </ul>	<ul style="list-style-type: none"> <li>Same as Alternative B</li> </ul>
<b>Climate Change</b>			
	<ul style="list-style-type: none"> <li>Use "green" standards to establish a mobile office</li> </ul>	<ul style="list-style-type: none"> <li>Same as Alternative A</li> <li>Improve energy efficiency where feasible</li> </ul>	<ul style="list-style-type: none"> <li>Same as Alternative A</li> <li>Same as Alternative B</li> </ul>
<b>Visitor Services</b>			
	<ul style="list-style-type: none"> <li>As requested by resource-related organizations, conduct FWS-led interpretive tours</li> <li>Allow the SCCMVC District to manage mosquito populations in certain cases using Bti and manual methods</li> <li>Conserve the Refuge's cultural resources</li> </ul>	<ul style="list-style-type: none"> <li>Close, cap or remove abandoned wells and buildings that pose potential safety hazards to the public per state regulations</li> <li>Schedule and conduct up to 3 tours annually</li> <li>Create walking trails with interpretation at Harkins Slough Unit</li> <li>Install/designate parking area(s) at Harkins Slough Unit</li> <li>Work with stakeholders to assess fishing at Harkins Slough Unit</li> <li>Install general info kiosks at units open to the public</li> <li>Install bilingual info signs at closed units</li> <li>Develop a Mosquito Management Plan including thresholds for control, assessment of control methods and conservation measures</li> <li>Same as Alternative A</li> </ul>	<ul style="list-style-type: none"> <li>Same as Alternative B</li> <li>Create and implement a year-round schedule of seasonal Refuge activities</li> <li>Same as Alternative B</li> <li>Same as Alternative A</li> <li>Improve 1 trail at Harkins Slough Unit for staff vehicle and wheelchair access</li> </ul>
<b>Environmental Education (EE) and Outreach</b>			
<b>Schools</b>	<ul style="list-style-type: none"> <li>Conduct the EE Program at Ellicott Unit</li> </ul>	<ul style="list-style-type: none"> <li>Expand on-site EE Program to Harkins Slough Unit and include additional local schools</li> </ul>	<ul style="list-style-type: none"> <li>Same as Alternative B</li> </ul>

\*The actions will be in accordance with and reflect the goals of the existing Recovery Plans for these species.

FT - Listed as Threatened under the Federal ESA;

FE - Listed as Endangered under the Federal ESA;

ST - Listed as Threatened under the State ESA;

SE- Listed as Endangered under the State ESA.

The Summary of Alternatives table, above, provides a comparison of the actions in each of the alternatives (Alternatives A, B and C) that are described below. Figures C-3 shows graphical representations of the visitor services alternatives.

## **Alternative A: No Action**

Under Alternative A, the Refuge would continue to be managed as it has been in the recent past (see Chapter 4 of the CCP). The focus of the Refuge would remain the same: (1) to conserve existing populations of and provide habitat for the listed plant and animal species protected under the Federal Endangered Species Act; and (2) to conserve wetlands to maintain the public benefits they provide. Existing staffing and funding levels would remain approximately the same. The Refuge would continue to be closed to the public. In addition to actions described above in Features Common to all Alternatives, Alternative A would include the following.

### ***Endangered Species and Species of Concern Management***

*Santa Cruz long-toed salamander (SCLTS) and California tiger salamander (CTS)*  
Alternative A includes the measures in the Common to All Alternatives section.

*California red-legged frog (CRLF)*

Alternative A includes no measures for CRLF.

- No formal monitoring program for CRLF; monitoring would consist of incidental sightings

*Robust spineflower*

Alternative A includes no measures for the robust spineflower.

- No formal monitoring program for the spineflower

*Santa Cruz tarplant*

Alternative A includes no measures for the Santa Cruz tarplant.

- No formal monitoring program for the tarplant

### ***Other Wildlife Management, and Habitat Management***

Alternative A includes the measures in the Common to All Alternatives section.

### ***Ecosystem-based Management***

Alternative A includes no ecosystem-based management measures.

- No formal wildland urban interface management actions are in place

### ***Visitor Services, and Environmental Education Outreach***

Alternative A includes the measures in the Common to All Alternatives sections.

## **Alternative B: Preferred Alternative**

Alternative B emphasizes wildlife management. Alternative B includes the same measures as in Alternative A plus standardization of survey and monitoring protocols; developing water management plans for the ponds; reducing threats to amphibians; improving native habitat; increasing visitor use opportunities; and expanding environmental education.

### ***Endangered Species and Species of Concern Management***

*Santa Cruz long-toed salamander (SCLTS) and California tiger salamander (CTS)*

Alternative B includes the same measures as in Alternative A for the SCLTS and CTS plus the following.

- Conduct winter night-time surveys during most rain events (after on-site mobile office installed)
- Construct trap arrays around various units to identify dispersal locations
- Conduct drift fence surveys at each pond to obtain baseline population estimates
- Conduct hydrological and soil surveys for each ephemeral pond
- Monitor ponds for siltation and vegetation encroachment and determine management needs
- Develop water management plan for all ephemeral ponds, maintaining optimal hydrologic conditions to support SCLTS, CTS and other species
- Assess the need and, where appropriate, construct additional new breeding ponds
- Minimize mortality from roads; for example, by installing tunnel improvements and/or “reduce speed” signs

- Monitor and research over-summering needs (e.g., grassland, oak woodland habitat) and incorporate results into restoration efforts and management
- Assess, control, and reduce threats (i.e., disease outbreaks, predators, contaminants, major roadkill)

#### *California red-legged frog (CLRF)*

Alternative B includes the same measures as in Alternative A for the CLRF plus the following.

- Determine presence/absence of CRLF at all units
- Identify, control, and reduce threats to CRLF such as chytrid disease (chytridiomycosis caused by a fungus, *Batrachochytrium dendrobatidis*)
- Assess restoration potential at Harkins Slough for CRLF and other amphibians

#### *Robust spineflower*

Alternative B includes the following measures for the spineflower.

- Determine presence/absence on Harkins Slough and Calabasas Units
- Monitor and map spineflower populations every 3 to 5 years on all units where it is present

#### *Santa Cruz tarplant*

Alternative B includes the following measures for the tarplant

- Determine presence/absence of tarplant
- If present, monitor and map tarplant populations every 3 to 5 years

#### **Other Wildlife Management**

Alternative B includes the same incidental data collection as in Alternative A for species that are not Federally-protected under ESA plus the following.

- Develop standardized quantitative and qualitative monitoring protocols to repeat at intervals depending on the species
- Seek partners to assist or conduct baseline surveys of birds, fish, mammals, reptiles, and invertebrates (e.g., USGS, NGOs, universities, natural resource-related organizations)
- Identify and encourage research through partners (e.g., universities, organizations, academics) that benefit refuge management needs

#### **Habitat Management**

Alternative B includes the same measures as in Alternative A for habitat management plus the following.

#### *Controlling Invasive Species*

- Map priority invasive weeds
- Develop Weed Management Program within a Vegetation Management Plan (i.e., identify control methods, priority species)
- Develop prevention and early detection plan for invasive species
- Partner with others to identify and control invasives, learn new control techniques
- Determine presence/absence of native and non-native predators and conduct baseline assessments of predators of concern

#### *Restoration*

Alternative B includes the same measure as in Alternative A for conducting plantings with volunteers and students plus the following.

Alternative B includes collecting native seeds and cuttings for restoration as follows:

- Seek partners to assist and conduct seed collection from local native plants sources for propagation at Newark and/or restoration plantings

Alternative B for restoration includes the same measures as Alternative A plus the following measures.

- Conduct baseline comprehensive vegetation mapping and repeat at 10-year intervals
- Develop a Vegetation Management Plan (consider use of propagation, manual/chemical control, disease monitoring and rapid response)

When the Service develops an adaptive Vegetation Management Plan, it will include an evaluation of methods such as prescribed burning or grazing. Before implementation of these methods in a step-down (more detailed) management plan such as this, associated NEPA documentation may be required, as appropriate, to address impacts associated with these methods.

### ***Ecosystem-based Management***

Alternative B includes the following measure.

- Identify, map, and control hazardous fuel conditions on Refuge lands at wildland urban interface areas and work with adjoining private landowners to reduce the wildfire risks

Hazardous fuels include large stands of invasive vegetation or dead brush that are highly flammable and considered fuel for wildfires (e.g., eucalyptus and pampas grass). The methods used to remove hazardous fuels are the same as those used to remove invasive plants for habitat management; (see above, Common to All Alternatives, Habitat Management, *Controlling Invasive Species*). The wildland urban interface for Ellicott Slough NWR is considered to be the entire Refuge because at least a portion of each unit of the Refuge is adjacent to urbanized areas.

### ***Visitor Services***

Alternative B includes the same measure as in Alternative A for visitor services plus the following.

- Close, cap or remove abandoned wells and buildings that pose potential safety hazards
- Schedule and conduct up to 3 tours annually
- Create walking trails with interpretation at Harkins Slough Unit
- Install/designate parking area(s) at Harkins Slough Unit
- Work with stakeholders to assess fishing at Harkins Slough Unit
- Install general information kiosks at units open to the public (Harkins Slough Unit)
- Install bilingual information signs at closed units to explain why sensitive areas are closed to the public
- Develop a Mosquito Management Plan including thresholds for control, assessment of control methods and conservation measures

### ***Environmental Education and Outreach***

Alternative B includes the same measure as in Alternative A for environmental education and outreach plus the following.

- Expand on-site Environmental Education program to Harkins Slough Unit and include additional local schools in program

## **Alternative C**

Alternative C emphasizes management of non-natives and invasive species. Alternative C includes the same measures as in Alternative B plus planning and designing additional breeding habitat for amphibians; expanding invasive species control; and public outreach.

### ***Endangered Species and Species of Concern Management***

*Santa Cruz long-toed salamander (SCLTS) and California tiger salamander (CTS)*

Alternative C includes the same measures as in Alternatives A and B for the SCLTS and CTS plus the following measures.

- Design and conduct drift fence surveys around each pond annually to get multi-year population estimates

*California red-legged frog (CLRF)*

Alternative C includes the same measures as in Alternative B for the CLRF.

### *Robust spineflower*

Alternative C includes the same measures as in Alternative B for the spineflower plus the following measure.

- Increase level of effort for monitoring and mapping spineflower populations annually

### *Santa Cruz tarplant*

Alternative C includes the same measures as in Alternative B for the tarplant plus the following measure.

- Identify potential partners for tarplant recovery (e.g., High Ground Organics)

### **Other Wildlife Management**

Alternative C includes the same measures as in Alternatives A and B.

### **Habitat Management**

#### *Controlling Invasive Species*

Alternative C includes the same measures as in Alternatives A and B for controlling invasives plus the following measures.

- Expand weed management to include acacia, ice plant, cape ivy and French broom
- Remove invasive wildlife (e.g., bullfrogs and crayfish) from Harkins Slough Unit

#### *Restoration*

Alternative C includes collecting native seeds and cuttings as follows:

- Partner with local organization to collect native seeds and cuttings to propagate locally

Alternative C also includes the same measures as in Alternatives A and B for restoration plus the following.

- Introduce or restore local native plants that historically were found on or near the Refuge

### **Ecosystem-based Management**

Alternative C includes the same measure as in Alternative B.

### **Climate Change.**

Alternative C includes the same measure as in Alternative B.

### **Visitor Services**

Alternative C includes the same measures as in Alternatives A and B to address visitor services plus the following measures.

- Create and implement a year-round schedule of seasonal Refuge activities
- Improve 1 trail at Harkins Slough Unit for staff vehicle access and wheelchair access

### **Environmental Education and Outreach**

Alternative C includes the same measures as in Alternatives A and B for environmental education and outreach.

## **Proposed Action Criteria**

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

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

**Staffing Needs**

Under Alternatives B and C, the Refuge is proposing four new, permanent positions: Maintenance Worker, an Outdoor Recreation Planner, a Park Ranger/Law Enforcement Officer, and a Biological Technician. The effects of adding new permanent positions are analyzed in terms of the effects of the proposed management actions implemented by the staff; the actions differ among alternatives and are analyzed within the resource sections in Chapter 3, Environmental Consequences.

**The Preferred Alternative**

Alternative B is the preferred alternative. The preferred alternative was identified based on the analysis presented in the Draft CCP/EA, which may be modified following the completion of the public comment period based on comments received from other agencies, Tribal governments, non-governmental organizations, or individuals. The proposed action (preferred alternative) described in this EA is preliminary. The action ultimately selected and described in the final CCP will be determined, in part, by the comments received on the Draft EA. The proposed action presented in the final CCP may or may not be the preferred alternative presented in this version.

## Chapter 3. Affected Environment

Chapter 3 of the CCP provides a detailed description of the affected environment for Ellicott Slough National Wildlife Refuge.

## Chapter 4. Environmental Consequences

### Overview of the NEPA Analysis Parameters

This chapter analyzes the environmental effects expected to result from the implementation of the alternatives described in Chapter 2. Impact evaluation has been conducted for each aspect of the environment described in the affected environment (see Chapter 3), including physical, biological, and social, and economic resources. Direct, indirect, and cumulative impacts are described for each alternative by resource (for example, soils, water quality, air quality, etc.). Alternative A (the No Action Alternative) is a continuation of management practices that are in place today and serves as a baseline against which Alternatives B and C are compared.

The National Environmental Policy Act (NEPA) requires mitigation measures to be identified and discussed for adverse impacts to habitats, wildlife, or the human environment. While the purpose of the CCP is to develop a management plan for the refuge that maintains and improves the quality of habitat available for fish and wildlife, and improves the visitor's experience; implementation of the plan may result in temporary degradation of soil, water quality, and air quality. Therefore, the Service is including a number of best management practices (BMPs or conservation measures) in the implementation of the preferred alternative. These conservation measures will further minimize any impacts from implementation. The conservation measures are presented in Appendix 1 to the EA.

In describing the significance of impacts, the Service defers to the Council on Environmental Quality's regulations implementing NEPA at 40 CFR 1508.27.

"Significantly" as used in NEPA requires considerations of both context and intensity:

**Context.** This means that the significance of an action must be analyzed in several contexts such as society as a whole (human, national), the affected region, the affected interests, and the locality. Significance varies with the setting of the proposed action. For instance, in the case of a site-specific action, significance would usually depend upon the effects in the locale rather than in the world as a whole. Both short-and long-term effects are relevant.

**Intensity.** This refers to the severity of impact. Responsible officials must bear in mind that more than one agency may make decisions about partial aspects of a major action.

Significance of impacts to the human environment determines whether preparation of an EIS is warranted. Thus, an EA provides a discussion of the magnitude of the impacts within the context of the situation for each impact topic.

## Environmental Consequences by Resource

### Soils

#### **Common to All Alternatives**

##### *Other Wildlife Management*

None of the management activities described for *Other Wildlife Management* are soil-disturbing activities. As a result, no adverse effects to soils and soil microorganisms are anticipated for these management activities.

##### *Habitat Management*

For all alternatives, the habitat restoration activities proposed, such as removing invasive plants by mechanical methods (digging) and installing new plantings, will result in some localized disturbance to soils. Seed and plant cutting collection activities could also disturb soils. Some areas may experience a short-term temporary increase in rates of erosion depending on soil type and action. In the long-term, once the root systems of new planting are established, areas with vegetative cover are expected to have a lower potential for erosion than bare soil. These habitat management actions are expected to provide stability to soils on the Refuge.

For all alternatives, restoration planting and seeding activities would be done in the fall and winter allowing time for seed germination and root growth during the winter rains. Seed germination and plant establishment reduces the potential for soil erosion and loss of soil and the potential reduction of water quality due to sedimentation/siltation (see also Water Quality, below). Soil compaction or erosion due to Refuge management activities including herbicides treatments, and restoration activities including seed and cutting collecting and plantings, would be considered negligible because the activities are temporary in nature, localized, and conservation measures to avoid and reduce soil erosion would be implemented. The effects of habitat management activities and pesticide use are discussed further below.

**Table C-2. Herbicides that May be Used to Control Invasive Plants on Ellicott Slough NWR**

<b>Herbicide</b>	<b>Active ingredient(s)</b>	<b>Target invasive plant</b>	<b>Ecotoxicology (from manufacturer's MSDS*)</b>
Rodeo, AquaMaster	glyphosate 54%	aquatic invasive plants, thistle	practically non-toxic to aquatic organisms on an acute basis
Roundup pro	glyphosate 41%	pampas grass, eucalyptus, poison hemlock, cotoneaster, thistle, poison oak**	moderately toxic to fish, slightly toxic to aquatic invertebrates, slightly toxic to green algae, practically non-toxic to: birds, arthropods, earthworms
Garlon 4	triclopyr 61.6%	Eucalyptus, poison hemlock, cotoneaster, French broom	highly toxic to aquatic organisms on an acute basis
Transline	clopyralid 40.9%	thistle, vetch, French broom	practically non-toxic to aquatic organisms on an acute basis

\*MSDS - A Material Safety Data Sheet (MSDS) is required under the US Dept. of Labor's Occupational Safety and Health Administration (OSHA) Hazard Communication Standard. The MSDS is a detailed informational document prepared by the manufacturer or importer of a hazardous chemical. It describes the physical and chemical properties of the product. MSDSs contain useful information such as flash point, toxicity, procedures for spills and leaks, and storage guidelines. Information included in a Material Safety Data Sheet aids in the selection of safe products.

For all alternatives, the Refuge would continue to periodically use Service-approved herbicides including: Rodeo (glyphosate) and AquaMaster; and terrestrial herbicides such as Roundup pro (glyphosate), Transline (clopyralid) and Garlon 4 (triclopyr) to control invasive plants on the Refuge. Glyphosate, the active ingredient in Rodeo and Roundup pro, is considered nonmobile in soils and sediments because it rapidly and strongly adheres to soil particles and degrades in the soil. Glyphosate is moderately persistent

in the soil. Glyphosate has no known effect on soil microorganisms. Glyphosate is highly adsorbed on most soils especially those with high organic content. The compound is so strongly attracted to the soil that little is expected to leach from the applied area. Microbes are primarily responsible for the breakdown of the product. The time it takes for half of the product to break down (half-life) ranges from 1 to 174 days. Because glyphosate is so tightly bound to the soil, little is transferred by rain or irrigation water. One estimate showed less than 2 percent of the applied chemical was lost to runoff (USFS 1984). The herbicide could move when attached to soil particles in erosion run-off. In water, glyphosate is strongly adsorbed to suspended organic and mineral matter and is broken down primarily by microorganisms also. Its half-life in pond water ranges from 12 days to 10 weeks. (Cornell University 1994) With the implementation of the Service's PUP requirements and conservation measures described in Appendix 1 to the EA, the Service anticipates there will be no adverse effects to soils.

The half-life of triclopyr in soil is from 30 to 90 days, depending on soil type and environmental conditions, with an average of about 46 days. The half-life of one of the breakdown products (trichloro-pyridinol) in 15 soil types (similar to those at the Refuge) ranged from 8 to 279 days with 12 of the tested soils having half-lives of less than 90 days. Longer half-lives occur in cold or arid conditions. How herbicides interact with the soil and could potential effect or contaminate aquatic areas is discussed under Water Quality, below.

Clopyralid has a very high potential of mobility in soil. The half-life of clopyralid in soil is greater than 12 years and in water is 261 days. Under aerobic soil conditions, the half-life is 71 days. In the soil, *clopyralid* has a half-life of 8 to 66 days. Degradation is faster in warm, moist conditions and slower in cold, dry conditions. It degrades in the environment through the activity of soil microbes. Bioconcentration potential is low and biodegradation under aerobic lab conditions is below detectable levels. Transline is low in toxicity to mammals, birds, fish and bees.

#### *Visitor Services, and Environmental Education and Outreach*

For all alternatives, the visitor service opportunities (Service-led tours) at Ellicott Unit and environmental education activities (hosting school environmental education classes on-site) may result in disturbance to soils by foot and vehicle traffic. Tours would be confined to existing roads and disturbed areas and avoid sensitive areas and seasons. Because the tours are guided by Refuge staff, the presence of visitors is not anticipated to have adverse effects on soils. Use is expected to be low given the size of the Refuge and the supervision of these activities by Refuge staff.

Based on the above analysis, the Service's PUP requirements, and the use of conservation measures to mitigate any potentially adverse effects to soils, the Service has concluded that there would be no adverse effects to soils and soil microorganisms for these actions common to all alternatives.

#### **Alternative A: No Action**

##### *Endangered Species and Species of Concern Management*

For Alternative A, none of the management activities described are soil-disturbing activities. Therefore, no adverse effects to soils or soil micro-organisms are anticipated for these management activities.

##### *Other Wildlife Management, and Habitat Management*

Alternative A would have the same effects on soils as described under Common to All Alternatives, above.

##### *Ecosystem-based Management*

Alternative A includes no ecosystem based actions.

##### *Visitor Services and Environmental Education and Outreach*

Alternative A would have the same effects on soils as described under Common to All Alternatives, above.

#### **Alternative B: Preferred Alternative**

##### *Endangered Species and Species of Concern Management*

For Alternative B, actions would include a drift fence with pitfall traps that require removal and compaction of soil. Soil will be replaced along the edge of the fence as well as replaced into holes after buckets are removed. Soil will not be brought in or removed off site for drift fence construction. Removal and

compaction of soil is expected to be localized and temporary. Conservation measures will be implemented to minimize soil disturbance.

#### *Other Wildlife Management*

For Alternative B, the effects on soils would be the same as described under Common to All Alternatives, above.

#### *Habitat Management*

For Alternative B, actions would be similar to Alternative A in that removal of invasive species and habitat restoration would continue, 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.

#### *Ecosystem-based Management*

For Alternative B, the methods used to reduce hazardous fuel loads (vegetation) would be the same as those used to remove invasive plants and the effects would be the same, with small and localized effects to soils. For example, pampasgrass and eucalyptus are considered to be hazardous fuels. Removing these and other hazardous fuels by mechanical methods (e.g., digging) would result in localized disturbance to soils. The soil erosion potential is expected to be small due to the implementation of conservation measures (see Appendix 1 to the EA).

#### *Visitor Services*

For Alternative B, the construction and maintenance of trails, signs, and parking areas will have temporary and localized effects on soils. Increased soil disturbance and erosion may also occur from ground clearing actions to create walking trails, interpretive signs and a parking area at Harkins Slough Unit. Soil disturbing activities would be localized to the immediate area where the improvement is installed. The equipment used for earthmoving (for example, a "Bobcat") could introduce various contaminants into soils, water bodies and wetlands. As a mitigation measure, the improvements will be placed in less sensitive areas and in areas that have already had the soil disturbed by past farming or residential uses. Erosion potential will be considered when siting the new trail at Harkins Slough Unit.

Prior to opening the Refuge to the proposed wildlife-dependant recreational uses described in Alternative B, abandoned wells must be closed/capped and abandoned buildings with safety hazards must be removed. Contractors hired to address these safety hazards or for any of the aforementioned work would be required to comply with conservation measures to reduce soil erosion, contaminants, and disturbances. See Appendix 1 to the EA for the conservation measures.

For Alternative B, the above soil disturbing activities could include a temporary increased potential for erosion, soil compaction (Liddle 1975), reduced seed emergence (Cole and Landres 1995), alteration of vegetative structure and composition, and sediment loading (Cole and Marion 1988). However, due to the relatively flat slopes at the parking, signs, and trail sites, limited area affected by the improvements, and with the conservation measures to reduce soil erosion, the Service anticipates that soil erosion due to visitor services improvements will be minimal and localized.

#### *Environmental Education and Outreach*

For Alternative B, the effects on soils from the expanded environmental education program would be expected to be similar to the effects described above for a potential increase in visitor use at Harkins Slough Unit. The potential for increased visitor use resulting from conducting the environmental education classes on-site at Harkins Slough Unit has the potential to also increase soil erosion and disturbance. The potential increase in soil disturbance due to visitors is expected to be small because the classes would be kept small in size and be led by Refuge staff.

Based on the above, and the use of conservation measures to mitigate any potentially adverse effects to soils, the Service has concluded that there would be no adverse effects to soils from Alternative B.

Alternative B would have comparatively more effects than Alternative A (no action alternative), but less than with Alternative C.

### **Alternative C**

#### *Endangered Species and Species of Concern Management and Other Wildlife Management*

For Alternative C, the effects on soils would be the same as with Alternative B.

#### *Habitat Management*

For Alternative C, the types of effects on soils would be the same as with Alternative B. However, Alternative C includes a greater emphasis on invasive species management and habitat restoration. These actions would continue, but at a more accelerated pace and more invasive plant species would be targeted for removal. This could result in greater area of soil disturbance, but will also result in an overall long-term increase in native plant communities that will stabilize soils and reduce long-term soil loss.

#### *Ecosystem-based Management*

For Alternative C, the effects on soils would be the same as with Alternative B.

#### *Visitor Services*

Alternative C includes all visitor services improvements and tours described in Alternative B, plus implementing year-round visitor activities at the Refuge, and improving one existing trail for staff vehicle access and wheelchair-access at Harkins Slough Unit. The soil disturbing activities that would occur during installation of the staff vehicle access and wheelchair-accessible trail would be one-time, temporary in nature and localized to the immediate area where the trail is improved. Alternative C would increase visitor opportunities, and therefore, could increase visitor use and the associated potential for soil disturbance and erosion. However, with the implementation of conservation measures described in Appendix 1 to the EA, no adverse effects on soils are expected.

#### *Environmental Education and Outreach*

For Alternative C, the effects on soils would be the same as with Alternative B.

Based on the above, and the use of conservation measures to mitigate any potentially adverse effects to soils, the Service has concluded that adverse effects to soils would be the negligible with Alternative C. Alternative C would have the greatest effect, Alternative B the next greatest, and Alternative A (no action alternative) would have the least effect on soils.

## **Water Quality**

The quality of the Refuge water resources is of foremost importance to uphold the Service's conservation mission and the purposes for which the Refuge was established. The ephemeral bodies of water on the Calabazas and Ellicott Units of the Refuge cover over 5 acres and would continue to be managed for beneficial uses, including as breeding habitat for the Federally-protected SCLTS, CTS, and CRLF (for more information on the species, see the Endangered Species and Species of Concern section, below). The permanent body of water on the Harkins Slough Unit covers nearly 51 acres. No Federally-protected species have been documented on the Harkins Slough Unit, but the unit would be managed consistent with the Refuge purposes to conserve protected and migratory species.

### **Common to All Alternatives**

#### *Endangered Species and Species of Concern Management, and Other Wildlife Management*

For all alternatives, annual dip-net surveys will disturb water quality by temporarily stirring up sediment from walking in the pond and from the dip-net sampling. This action causes short-term turbidity during the dip-netting and immediately afterward. Water clarity is expected to return to the pre-survey levels within the same day and no long-term negative effects to water quality are anticipated.

For all alternatives, the addition of water into Ellicott Pond using existing pumps may also have a short term disturbance to soil within each pond. However the disturbance will be similar to the turbulence that occurs during natural run-off and soil will settle shortly after pumping stops.

Actions prescribed in the alternatives may cause short-term impacts to water quality, but will result in the long-term benefits to water quality.

#### *Habitat Management*

For all alternatives, habitat restoration and mechanical removal (rather than chemical treatment with herbicides) of invasive vegetation may result in short-term soil erosion that may cause a temporary increase in turbidity in seasonal and permanent waterways. In the long-term, restoration activities are expected to improve water quality reducing turbidity and sedimentation due to soil erosion.

For all alternatives, the Refuge would continue to periodically use Service-approved aquatic herbicides including: Rodeo (glyphosate) and AquaMaster; and terrestrial herbicides such as Roundup pro (glyphosate) and Roundup pro concentrate (glyphosate), to control invasive plants on the Refuge. Glyphosate, the active ingredient in Rodeo, Roundup pro, and Roundup pro concentrate is considered nonmobile in soils and sediments because it rapidly and strongly adheres to soil particles and degrades in the soil. Glyphosate is moderately persistent in the soil. Glyphosate has no known effect on soil microorganisms. Glyphosate is highly adsorbed on most soils especially those with high organic content. The compound is so strongly attracted to the soil that little is expected to leach from the applied area. Microbes are primarily responsible for the breakdown of the product. The time it takes for half of the product to break down (half-life) ranges from 1 to 174 days.

Because glyphosate is so tightly bound to the soil, little is transferred by rain or irrigation water. One estimate showed less than 2 percent of the applied chemical was lost to runoff (USFS 1984). The herbicide could move when attached to soil particles in erosion run-off. In water, glyphosate is strongly adsorbed to suspended organic and mineral matter and is broken down primarily by microorganisms also. Its half-life in pond water ranges from 12 days to 10 weeks. (Cornell University 1994) With the implementation of the Service's PUP requirements and conservation measures described in Appendix 1 to the EA, the Service anticipates there will be no adverse effects to soils.

Triclopyr is not strongly adsorbed to soil particles, has the potential to be mobile, and is fairly rapidly degraded by soil microorganisms. Triclopyr was tested but not found in a host of groundwater sites throughout the country (Williams et al 1988).

For all alternatives, habitat restoration and fire break clearing activities may involve earthmoving equipment that have the potential to introduce various contaminants into water bodies and wetlands, such as fuel oils, grease, and other petroleum products, either directly from equipment or through surface runoff. Contaminants may be toxic to fish and amphibians and may adversely affect their respiration and feeding. With the implementation of conservation measures described in Appendix 1 to the EA, no adverse effects on water quality are expected.

#### *Visitor Services and Environmental Education and Outreach*

For all alternatives, the visitor service opportunities (Service-led tours) and use resulting from conducting the environmental education classes on-site at Ellicott Unit has the potential to affect water quality. . Tours would be confined to existing roads and disturbed areas and avoid sensitive areas (such as the ponds) and seasons. Because the tours are guided by Refuge staff, the presence of visitors is not anticipated to have adverse effects on water quality. The potential for the classes to adversely affect water quality is expected to be low because class activities occur in restoration areas, do not occur in the pond areas and are under the direct supervision of Refuge staff,

Based on the above information, the Service's PUP requirements, and the use of conservation measures to mitigate any potentially adverse effects to water quality, the Service has concluded that the use of these PUP-regulated pesticides (including herbicides), *Endangered Species and Species of Concern, Other Wildlife Management, Habitat Restoration, Visitor Services and Environmental Education and Outreach* activities would result in no adverse effects to water quality on and near the Refuge for these actions common all of the alternatives.

### **Alternative A: No Action**

#### *Endangered Species and Species of Concern Management, and Other Wildlife Management*

Alternative A, would have the same effects on water quality as described under Common to All Alternatives, above.

#### *Ecosystem-based Management*

Alternative A includes no ecosystem-based actions.

#### *Visitor Services*

Alternative A, would have the same effects on water quality as described under Common to All Alternatives, above.

#### *Environmental Education and Outreach*

Alternative A would have the same effects on water quality as described under Common to All Alternatives, above.

Based on the above analysis in Common to All Alternatives, and the use of conservation measures to mitigate potentially adverse effects to water quality, the Service has concluded that there would be no adverse effects to the beneficial uses of the water bodies on the Refuge and no adverse effects to water quality from Alternative A (no action alternative) and comparatively less than either of the other alternatives.

### **Alternative B: Preferred Alternative**

#### *Endangered Species and Species of Concern Management, and Other Wildlife Management*

Alternative B includes conducting hydrological and soil surveys for each ephemeral pond; monitoring ponds for siltation and vegetation encroachment; and developing water management plan for all ephemeral ponds to benefit species of concern and other wildlife that use ephemeral pond habitat. The Service anticipates that these actions will not only benefit wildlife, but will also provide information that will inform Service management decisions about how to improve the water quality of the ponds.

Alternative B would result in similar effects described in Alternative A. Drift fence with pitfall traps may increase sedimentation in waterbodies, and decrease water quality. However, installation of drift fence and pitfall traps will be completed prior to inundation of the ponds, further reducing the potentially adverse effects to water quality. Conservation measures will be implemented to decrease sedimentation.

For Alternative B, actions for SCLTS and CTS include the assessment, control and reduction of threats, such as water contaminants, to these protected species. Through the assessments, sinks and sources of contaminants on the Refuge will be identified for removal or remediation, which the Service anticipates would improve water quality.

#### *Ecosystem-based Management*

For Alternative B, the methods used to reduce hazardous fuel loads (vegetation) would be the same as those used to remove invasive plants and the effects would be the same. The removal of hazardous fuels by mechanical methods (digging) would result in localized disturbance to soils, which if not stabilized could erode and cause short-term turbidity and long-term sedimentation in any adjacent waterbodies, reducing water quality. However, the potential for soil erosion and resulting adverse effects to water quality are expected to be low due to the implementation of conservation measures (see Appendix 1 to the EA).

#### *Visitor Services and Environmental Education and Outreach*

As with the other activities, preparation for installation of visitor services improvements may involve some ground-clearing activities. Visitor services improvements that may require ground-clearing include a designated parking area, , information kiosks, interpretative panels (signs), and trails may involve earthmoving equipment (for example, a “Bobcat”) that could introduce various contaminants into water bodies and wetlands. With the implementation of conservation measures described in Appendix 1 to the EA, no adverse effects on water quality are expected.

Alternative B opens Harkins Slough Unit to environmental education activities and wildlife-dependant recreational activities such as wildlife observation and photography and provides trails and interpretive signs at the Refuge. Opening the Refuge to visitor use could increase the potential for a decrease in water quality due to littering and dumping of debris in Harkins Slough . However, because opening the Harkins Slough Unit to public is contingent upon adding an Outdoor Recreation Planner on-site, the Service anticipates that increased staff presence will mitigate potentially adverse effects to water quality due to visitor use.

Based on the above, and the use of conservation measures to mitigate any potentially adverse effects to water quality, the Service has concluded that adverse effects to water quality would be greater than Alternative A (no action alternative), but negligible with Alternative B.

### **Alternative C**

#### *Endangered Species, Species of Concern Management, and Other Wildlife Management*

Alternative C includes the same actions as in Alternative A and B (analyzed above). In addition, Alternative C includes annual drift fence surveys around each pond to estimate populations of amphibians; and building partnerships and research. While these actions are expected to be beneficial to species of concern and other wildlife, they are not anticipated to affect water quality.

#### *Habitat Management*

Alternative C is expected to have the same effects on water quality as Alternative B.

#### *Ecosystem-based Management*

Alternative C is expected to have the same effects on water quality as Alternative B.

#### *Visitor Services*

Alternative C includes the same actions as in Alternative B (analyzed above) and, in addition, Alternative C includes improvement of one existing trail at the Harkins Slough Unit for wheelchair-accessibility and staff vehicle access. With implementation of the conservation measures in Appendix 1 to the EA, improvement of one trail is anticipated to have no adverse effects to water quality.

#### *Environmental Education and Outreach*

Alternative C is expected to have the same effects on water quality as Alternative B.

Based on the above analysis, and the use of conservation measures to mitigate any potentially adverse effects to water quality, the Service has concluded that there would be no adverse effects to water quality from Alternative C and comparatively the same effects as Alternative B.

## **Air Quality**

### **Common to All Alternatives**

To meet and maintain ambient air quality standards in the region, the MBUAPCD prepares air quality plans for Ozone and particulate matter. MBUAPCD also issues air quality permits to business that operate equipment that can cause air pollution. Given the nature and scale of the actions proposed for the Refuge, none of the alternatives would conflict with the air quality plans or require a permit. The minimal air quality effects of Alternatives A, B, and C, as evaluated below, would not violate any air quality standard or contribute substantially to an existing air quality violation.

#### *Endangered Species and Species of Concern Management, and Other Wildlife Management*

For all alternatives, staff vehicle use associated with surveys and monitoring and other on-site research would result in negligible tailpipe emissions. Augmenting water levels in Ellicott Pond would involve infrequent and temporary operation of an existing electric water pump, with limited resulting air pollutant emissions.

### *Habitat Management*

For all alternatives, removal of invasive species and replanting (habitat restoration) may result in soil disturbance, which could cause temporary, localized increases in fugitive dust. The amount of dust is expected to be negligible due to the small scale of the clearing and earth moving and the implementation of conservation measures. Removal of some invasive plant species would be done with chain saws and nylon-filament trimmers (weed “whackers”). Wood chippers are also used for vegetation debris disposal. Restoration plantings would be done with hand tools. Since no motorized heavy equipment would be used, no emissions from heavy equipment would occur. Emissions from the aforementioned gas-powered equipment is expected to be localized and temporary due to the limited duration and intermittent use (approximately 2 weeks in about 3 months of the year, depending upon the project).

The use of herbicides for invasive plant removal is unlikely to affect air quality. Herbicide would be applied by backpack sprayers or truck/ATV-mounted tanks in close contact to the plant, and spraying would not occur during inclement weather or high winds. These measures would reduce or eliminate the possibility of chemical drift.

### *Visitor Services*

For all alternatives, the application of various forms of aquatic pesticides (Bti) for mosquito control by the SCCMVC District is not expected to cause air quality impacts because the powder, pellet or briquette forms of the pesticides, which are typically used, are not easily airborne. The granular form of Bti is typically broadcast by hand. The liquid form of Bti is usually applied by backpack sprayers, although the spray method has not been used by SCCMVC District in the last 5 years.

For all alternatives, interpretive staff-led tours and the environmental education program on the Ellicott Unit could result in tailpipe emissions from visitor travel to the Refuge, but given the small number and size of the tours and classes the impact on air quality would be negligible.

Based on the above analysis, the Service has concluded that the above actions common to all alternatives are not expected to adversely affect the Refuge resources or the ambient air quality.

### **Alternative A: No Action**

#### *Endangered Species and Species of Concern Management, and Other Wildlife Management*

Alternative A would have the same effects on air quality as described under Common to All Alternatives, above.

#### *Habitat Management*

Alternative A would have the same effects on air quality as described under Common to All Alternatives, above.

#### *Ecosystem-based Management*

Alternative A has no ecosystem-based actions.

#### *Visitor Services, and Environmental Education and Outreach*

Alternative A would have the same effects on air quality as described under Common to All Alternatives, above.

Based on the above analysis, the Service has concluded that Alternative A is not expected to adversely affect the Refuge resources or the ambient air quality.

### **Alternative B: Preferred Alternative**

#### *Endangered Species and Species of Concern Management*

Alternative B includes additional monitoring, surveying, and mapping activities that could result in increased tailpipe emissions from staff vehicle use. The increase in staff trips and resulting increase in emissions would be negligible due to the small scale and low frequency of the actions.

#### *Other Wildlife Management*

For Alternative B, surveys for native and non-native predators could result in a small increase in staff vehicles trips and a temporary, infrequent increase in tailpipe emissions.

### *Habitat Management*

For Alternative B, weed mapping and vegetation mapping could result in a small increase in staff vehicle trips and a temporary, infrequent increase in tailpipe emissions.

### *Ecosystem-based Management*

Alternative B includes reducing hazardous fuels on the Refuge's wildland urban interface. Reducing fuels would result in a small increase in staff or contractor vehicle trips to conduct the work on the Refuge. The resulting increase in tailpipe emissions would be temporary and localized while the work is ongoing.

### *Visitor Services*

Alternative B includes the potential removal of safety hazards (wells and buildings) and installation of visitor services improvements (walking trails, parking areas, kiosks, and interpretive panels). Tailpipe emissions from construction equipment and worker trips to and from the job site could be expected to increase temporarily during installation of the improvements. The increase would be temporary and localized.

Installation of visitor services improvements (parking area, trails, and signs) and conducting up to three tours annually may result in an increase in the number of visitors to the Refuge. More visitors could result in more vehicle trips to and from the Refuge, which could lead to an increase in tailpipe emissions. It is difficult to estimate how many more vehicle trips could result from more visitor opportunities being available at the Refuge. It is reasonable to assume that an increase in visitor use at the Refuge may reflect visitors' choosing the Refuge as their destination rather than another location offering similar opportunities in the Monterey Bay area (such as Elkhorn Slough National Estuarine Research Reserve, approximately 8 miles north of Harkins Slough Unit). For this reason the Service anticipates that there would be no new vehicle trips, but if there is an increase in tailpipe emissions resulting from increased visitor opportunities, it is likely to be minimal.

Surface excavation to clear areas for installation of visitor services improvements described above may result in temporary, localized increases in fugitive dust (particulate matter less than 10 microns [PM10]) from soil disturbance. The amount of dust is expected to be negligible due to the implementation of conservation measures (see Appendix 1 to the EA). Construction may also result in tailpipe emissions of PM10 and nitrogen oxides (NO<sub>x</sub>) from the operation of heavy equipment. These tailpipe emissions would be negligible due to the short duration and small size of the project.

Based on the above analysis, the Service has concluded that Alternative B is expected to have a greater effect on air quality as compared to Alternative A, but is not expected to adversely affect the Refuge resources or the ambient air quality.

## **Alternative C**

### *Endangered Species and Species of Concern Management*

Alternative C includes additional surveys, monitoring and mapping measures, which could result in a small increase in staff vehicle trips and a temporary, infrequent increase in tailpipe emissions. Obtaining additional water sources for Calabasas and Buena Vista Ponds could entail constructing new wells. Construction could result in temporary, localized increases in fugitive dust from soil disturbance and tailpipe emissions from the operation of heavy equipment. The amount of dust is expected to be negligible due to implementation of conservation measures. Tailpipe emissions would be negligible due to the relatively short duration and small size of the projects.

### *Other Wildlife Management*

Alternative C includes the same effects as Alternative B.

### *Habitat Management*

Alternative C includes expanded weed management, removal of non-native wildlife from Harkins Slough Unit, and additional native plant restoration. These activities could result in a small increase in staff vehicles trips and a temporary, infrequent increase in tailpipe emissions.

### *Visitor Services*

Alternative C includes all of the actions in Alternative B plus improvements to one existing trail at Harkins Slough Unit. Tailpipe emissions from construction equipment and worker trips to and from the job site could be expected to increase temporarily during installation of the improvements. The increase would be temporary and localized.

Alternative C also calls for a year-round schedule of Refuge activities. New activities and trail improvements could result in an increase in the number of visitors to the Refuge. More visitors could result in more vehicle trips to and from the refuge, which could lead to an increase in tailpipe emissions. It is difficult to estimate how many more vehicle trips will result from more visitor opportunities being available at the Refuge, but the increase is likely to be minimal.

### *Environmental Education and Outreach*

Alternative C would have the same effects on air quality as Alternative B.

Based on the above analysis, the Service has concluded that Alternative C is expected to have a greater effect on air quality as compared to Alternative A or B, but is not expected to adversely affect the Refuge resources or the ambient air quality.

## **Climate Change**

### ***Green House Gas Emissions***

Under NEPA, there are no Federal requirements mandating that climate change impacts be analyzed in NEPA documents at this time. However, in 1997, the CEQ issued a draft guidance memorandum titled, *Guidance Regarding Consideration of Global Climatic Change in Environmental Documents Prepared Pursuant to the National Environmental Policy Act*. Although the guidance was never approved in a final version and thus was never formally published, the findings and conclusions in the document are nonetheless useful for NEPA practitioners.

The draft memorandum states that "the NEPA process provides an excellent mechanism for consideration of ideas related to global climate change" and that "... Federal agencies must determine whether and to what extent their actions affect green house gases (GHGs). Further, federal agencies must consider whether the actions they take, e.g., the planning and design of federal projects, may be affected by any changes in the environment which might be caused by global climatic change." The draft document also points out that the scope of NEPA and the CEQ regulations is broad enough to include global climate change and its predicted effects. For example, section 1508.8 defines "effects" to include ecological, aesthetic, historic, cultural, economic, social, or health effects.

As of the writing of this EA, the agencies with jurisdiction over air quality regulation and GHG emissions, such as the Monterey Bay Unified Air Pollution Control District (MBUAPCD), have not established regulations, methodologies, significance thresholds, standards, or analysis protocols for the assessment of GHG emissions and climate change. The MBUAPCD is developing standards, thresholds, and/or guidance for greenhouse gas emission assessment, but they are not expected to be complete until the end of 2010. The most recent MBUAPCD CEQA Air Quality Guidelines document includes a reserved (currently blank) chapter titled Climate Change and Assessment of Project Impacts from Greenhouse Gases. (See [http://www.mbuapcd.org/mbuapcd/pdf/mbuapcd/pdf/CEQA\\_full.pdf](http://www.mbuapcd.org/mbuapcd/pdf/mbuapcd/pdf/CEQA_full.pdf)).

Several Federal court rulings (including *Centers for Biological Diversity vs. NHTSA*) have found that GHG emissions should be analyzed within NEPA documents. More background information on climate change, regulations, and guidance can be found in Chapter 3 of the CCP.

GHG contaminant emissions tend to accumulate in the atmosphere because of their relatively long lifespan. As a result, their impact on the atmosphere is mostly independent of the point of emission. Given the global scale of climate change, no individual project, by itself can actually "cause" global warming. Thus, project GHG contaminant emissions are evaluated in regards to their cumulative contribution to global GHG emissions. Although more appropriately termed a cumulative impact, GHG emissions are discussed in this section to include them with consideration of other air quality impacts.

The Refuge management actions that may affect GHG emissions include driving, construction of improvements that would attract more visitors, and restoring and maintaining habitats that improve carbon sequestration. The following sections present a qualitative analysis given the low level of activities that would generate GHG emissions in any of the alternatives.

### ***Common to All Alternatives***

All alternatives include using “green” standards to establish a mobile office building on the Refuge. This includes the use of products, methods, and procedures that result in the production of fewer GHG emissions than conventional methods. The Service considers reducing GHG emissions to have a long-term, indirect beneficial effect on the human environment.

### ***Habitat Management***

All of the alternatives include maintaining or restoring native habitats. Emissions from the hand-held, gas-powered equipment used to remove invasive plants are expected to be intermittent, localized and temporary. Invasive vegetation removal with small equipment is done only during the dry season to avoid adverse effects on SCLTS migration; therefore, invasive plant removal projects using small equipment do not occur year-round. The project duration varies from several weeks to several months depending upon the project and funding. Since no motorized heavy equipment would be used, no emissions of prominent GHGs from heavy equipment would occur.

For all alternatives, GHGs would be emitted by vehicles driven by Refuge staff, volunteers, researchers, and others carrying out Refuge management activities and visitor services activities. The vehicle trips resulting from habitat management activities and visitor services improvements and activities common to all alternatives are discussed under Air Quality, above.

### ***Alternative A: No Action***

For Alternative A, the effects on GHG emissions would be the same as Common to All Alternatives, above.

### ***Alternative B: Preferred Alternative***

Alternative B includes improving energy efficiency where feasible by reducing unnecessary vehicle trips or staff carpooling between Refuge Units and to the Complex Headquarters, evaluating energy efficiency at and reducing energy consumption, and recycling of office products used for Refuge administration (e.g., paper, printer cartridges, recyclable plastics).

New or more accessible trails may result in an increase in the number of visitors’ trips to the Refuge. The trail improvements and other improvements may result in visitors choosing the Refuge as their destination rather than another location offering similar opportunities in the Bay area. It is difficult to determine if the measures in Alternative B would generate *new* vehicle trips by visitors. The Refuge offers one of many locations in the Bay area for wildlife-dependent recreational opportunities.

Vehicle trips are discussed under Air Quality, above. While the number of vehicle trips from habitat management and visitor use may result in a slight increase in GHG emissions, improving energy efficiency by reducing vehicle trips, etc., is expected to reduce GHG emissions slightly.

Alternative B is expected to result in slightly more GHG emissions than Alternative A, and slightly less GHG emissions than Alternative B.

For Alternative B, measures related to climate change include conducting flood-risk analyses, climate change modeling, evaluating the results of modeling, supporting climate change research by others on listed species that are present at the Refuge, identifying additional acquisition needs based on habitat transitions predicted from climate change models, and assessing other effects of climate change. These measures are not ground-disturbing activities and are expected to have a long-term beneficial effect to the environment.

### **Alternative C**

Alternative C includes improving energy efficiency in the same way as Alternative B. Alternative C includes more habitat management and visitor services improvement activities than either of the Alternatives. Therefore, Alternative C has the potential to result in more staff vehicle trips than Alternatives A or B.

Alternative C is expected to result in more GHG emissions than Alternative A or Alternative B.

It is unknown whether more habitat restoration and management activities would improve carbon sequestration. Therefore, carbon sequestration is considered neutral (no gain, no loss) for the purposes of this analysis. With implementation of “green” standards with all of the alternatives, the Refuge will reduce emissions of GHG to the greatest extent practicable. The Service considers reducing GHG emissions to have a long-term, indirect beneficial effect on the human environment.

Alternative C includes the same measures related to climate change plus conducting additional modeling on wildlife and habitat response to climate change, and developing a climate change monitoring plan. These measures are not ground-disturbing activities and are expected to have a long-term beneficial effect to the environment.

## **Plant Communities**

One of the goals of the actions in the CCP is to conserve, restore, and enhance native plant communities and special status plant species representative of the Santa Cruz County. The Service manages the Refuge to protect and conserve existing plant communities to the maximum extent possible, both to provide habitat for wildlife species protected under the Federal Endangered Species Act, for which the Refuge was established, and to improve habitat for other wildlife. A plant list for the Refuge is presented in Appendix D to the CCP.

### **Common to All Alternatives**

#### *Endangered Species and Species of Concern Management*

For all alternatives, the action to augment water levels in Ellicott Pond to benefit endangered species is also anticipated to benefit ephemeral and riparian plant communities dependent upon the need for water for their species composition.

#### *Other Wildlife Management*

For all alternatives, incidental data collection through wildlife surveys and monitoring would be conducted by Service staff or under Compatibility Determinations or Special Use Permits with stipulations (or conservation measures) to protect existing plant communities from damage (see Appendix G for Compatibility Determinations). Conservation measures can be found in Appendix 1 to the EA. The goals of the actions in the CCP are to conserve, restore, and enhance native plant communities. Therefore, the surveying and monitoring included in all alternatives is not expected to adversely affect plant communities.

#### *Habitat Management*

For all alternatives, the habitat management actions are expected to result in beneficial effects to plant communities. Ongoing removal of priority invasive plants; working with partners to remove stands of pampas grass and eucalyptus; removal of additional e invasive plants in core areas; and participating in the local weed management area's coordination group are expected to improve the quality of all plant communities on and off of the Refuge.

Refuge staff improves or restores native plant communities by removing invasive species such as pampasgrass, jubatagrass, eucalyptus, poison hemlock, cotoneaster, thistle and others by using a variety of mechanical and chemical methods. The areas would then be re-planted (re-vegetated) with native species (e.g. Coast live oak, sticky monkey flower and coffeeberry), as appropriate for each plant community. The seed and cutting collection would occur in abundantly vegetated areas on the Refuge that could accommodate removal of seed and cuttings for propagation sources; collection would not appreciably deplete the naturally occurring seed stock or natural recruitment on the collection site. Removal of invasive plant species and revegetating the area are expected to result in improved native habitat quality.

For all alternatives, the collection of seeds and cuttings for restoration plantings on the Refuge would result in a long-term beneficial effect to native plant communities. Plantings that are propagated from Refuge stock would maintain the native integrity of the local plant communities (i.e., the local gene pool).

For all alternatives, use of herbicides would result in a reduction of invasive vegetation and allow for recruitment of native plant species. Timing of application would take into account wind speed and moisture in the air to reduce the potential of transfer of herbicide to non-target plants. Refuge management activities to control or reduce invasive species include the use of Service-approved herbicides in all alternatives. Pesticide Use Proposals (PUPs) are required for pesticide use on lands owned or managed by the Service.

Based on the information on PUPs and the analysis of effects of pesticide use discussed earlier in this chapter under the Soils and Plant Communities sections, the Service has concluded that the use of these PUP-regulated herbicides would result in decreasing the extent (vegetative cover area) of invasive species, which is expected to increase the quality and extent of the native plant communities on the Refuge and, therefore, benefit all plant communities on and off of the Refuge. More detail about the benefits of improved habitat quality is provided in the sections on Fish and Wildlife, below.

#### *Visitor Services, and Environmental Education and Outreach*

For all alternatives, the basic visitor service opportunities (Service-led tours and environmental education activities (hosting school environmental education classes on-site) at the Ellicott Unit may result in disturbance to the plant communities (vegetation) by foot and vehicle traffic. Tours would be confined to existing roads and disturbed areas and avoid sensitive areas and seasons. Because the tours are guided by Refuge staff, the presence of visitors is not anticipated to have adverse effects on plant communities. The activities of the on-site environmental education program concentrate on native habitat restoration and wildlife data collection. All education activities are supervised by Refuge staff. Effects of these activities would be the same as those described in the Other Wildlife Management and Habitat Management sections above.

Based on the above analysis and the use of conservation measures to mitigate any potentially adverse effects to vegetation, the Service has concluded that there would be no adverse effects to plant communities for the above actions common to all alternatives.

#### **Alternative A: No Action**

##### *Endangered Species and Species of Concern Management, Other Wildlife Management, and Habitat Management*

Alternative A includes the same effects as discussed above for all alternatives.

##### *Ecosystem-based Management*

Alternative A includes no ecosystem-based management actions.

##### *Visitor Services, and Environmental Education and Outreach*

Alternative A includes the same effects as discussed above for all alternatives.

#### **Alternative B: Preferred Alternative**

##### *Endangered Species and Species of Concern Management*

For Alternative B, the expanded surveying and monitoring for amphibians and to determine presence/absence of the Federally-protected robust spineflower and Santa Cruz tarplant is expected to

provide more information to inform management decisions about plant communities. The increased frequency and intensity (areas covered) of surveying and monitoring is not expected to have adverse effects to vegetation because Alternative B would implement the same conservation measures described in Alternative A to protect existing plant communities from damage.

#### *Other Wildlife Management*

The increase in frequency and in areas surveyed, d monitored and researched is not expected to have adverse effects to vegetation because Alternative B would implement the same conservation measures described in Alternative A to protect existing plant communities from damage.

#### *Habitat Management*

In addition to the actions common to all alternatives, Alternative B includes expansion of the existing program to map priority weeds; vegetation mapping and developing a vegetation management plan that includes a weed management plan; developing a prevention and early detection plan for non-natives; and partnering with others to identify and control invasive plants. These actions will have a beneficial effect on plant communities, as they will allow Refuge staff to plan restoration/management strategies and seek funding for projects to improve the health and extent of native plant communities.

As compared to Alternative A, all of the aforementioned activities are expected to provide additional habitat quality improvement on and off of the Refuge. As a result of these additional invasive species management actions, the Service has concluded that Alternative B would provide additional beneficial effects to plant communities (as compared to Alternative A).

#### *Ecosystem-based Management*

For Alternative B, the methods used to reduce hazardous fuel loads (vegetation) would be the same as those used to remove invasive plants and the effects would be the same. The removal of hazardous fuels would result in localized disturbance to the vegetative cover in the area treated. Hazardous fuels can include some invasive plants, accumulated shrubby undergrowth, and dead vegetation. Removal would reduce the intensity of a wildfire due to lack of a fuel load, or potentially prevent wildfires altogether resulting in a beneficial effect on plant communities. While individual plants would be removed, the potential for adverse effects to a plant community as a whole are expected to be low based upon the above information and .. the implementation of conservation measures (see Appendix 1 to the EA).

#### *Visitor Services*

Alternative B includes the effects described for all alternatives, plus the following effects. Disturbance and destruction of existing vegetation on the Harkins Slough Unit would be minimized by constructing the parking area and trails, as much as possible, in poor quality habitat areas that have already been disturbed by past farming and previous residences. Wildlife-oriented recreation opportunities (e.g., wildlife observation and photography) would not adversely affect the vegetation or plant communities on the Refuge, as public access areas would be limited to the trail system and parking lot. A general information kiosk will be located at the beginning of the trail system indicating that visitors should stay on the designated trails.

#### *Environmental Education and Outreach*

For Alternative B, the expanded on-site environmental education and outreach includes r introducing environmental education activities at the Harkins Slough Unit. This program is expected to foster a sense of stewardship in the participants. Although an increase in the sense of stewardship and responsibility for the local ecosystem (including plant communities) is intangible and unquantifiable, it is expected be result in an indirect, long-term beneficial effect on the Refuge and its plant communities. Classes will also assist Refuge staff with on-site restoration plantings, increasing the workforce available to perform habitat restoration improvement, which are considered to be a benefit to the plant communities on the Refuge (see also Habitat Management).

Based on the above analysis, the Service has concluded that Alternative B is expected to have no adverse effects on plant communities.

### **Alternative C**

#### *Endangered Species and Species of Concern Management, Other Wildlife Management, and Habitat Management*

In addition to the actions common to all alternatives and Alternative B, Alternative C includes an expanded weed management to include acacia, ice plant, cape ivy and French broom; and removing non-native wildlife such as bullfrogs and crayfish from Harkins Slough Unit.

As a result of these additional invasive species management actions, the Service has concluded that Alternative C would provide the greatest beneficial effects to plant communities (as compared to both Alternatives A and B).

#### *Ecosystem-based Management*

For Alternative C, the effects on plant communities would be the same as Alternative B for ecosystem-based management.

#### *Visitor Services and Environmental Education and Outreach*

Alternative C includes actions for Visitor Services that are the same as for Alternative B and would have the same effects as described for Alternative B, above; except Alternative C includes the improvement of an existing trail for wheelchair access and staff vehicle access. Improving an existing trail would have no additional effects on vegetation or plant communities.

The improvement of one trail will result in no additional vegetation loss beyond that analyzed in Alternative B because the improvements would be made to an existing trail.

Based on the above information, and the use of conservation measures to mitigate any potentially adverse effects, the Service has concluded that there would be no adverse effects to plant communities with Alternative C. The effects to plant communities with Alternative C would be substantially greater than Alternative A and slightly greater than Alternative B.

## **Fish and Wildlife**

In addition to providing habitat for the following special status species, the Refuge provides habitat for a variety of wildlife including amphibians, reptiles, birds, and mammals (for wildlife lists, see Appendix F to the CCP). The effects of the actions on special status species are addressed in the section by that name following the Fish and Wildlife section.

### **Common to All Alternatives**

#### *Endangered Species and Species of Concern Management*

For all alternatives, the actions for monitoring surveys for SCLTS, CTS and CRLF (dip-net surveys and winter night-time surveys) may have short term effects on other fish and wildlife species. Dip-nets are used during the breeding season to capture amphibians and invertebrates, to check presence/absence, recruitment, health and abnormalities. This activity requires short-term disturbance to aquatic wildlife. To minimize disturbance, specimens are only held if necessary and then only by permit requirements. Animals will be promptly returned to their original pond. Dip-net sweeps will be minimized to accomplish survey objectives. All equipment will be decontaminated before and after leaving each pond. Winter nighttime surveys will be conducted with at least one permitted person present, if amphibians are to be handled. Handling of amphibians will be limited to persons with moistened hands; when handling is done for the purpose of preventing road mortality and for obtaining required survey data (e.g., sex, measurements). The survey information collected will help inform Refuge management decisions about both special status species and other native wildlife populations.

The continuation of monitoring is expected have a long-term beneficial effect on fish and wildlife.

The augmentation of water in Ellicott Pond, as needed, will have a direct beneficial impact to wildlife. The addition of water will allow the completion of aquatic life stages, ensuring native amphibian and invertebrate population recruitment.

Based on the above information, and the use of conservation measures to mitigate any potentially adverse effects to fish and wildlife, the Service has concluded that the activities designed to benefit endangered and special status species would result in no adverse effects to other fish and wildlife on and near the Refuge for all alternatives.

#### *Other Wildlife Management*

For all alternatives, incidental data collection on non-Federally listed fish and wildlife species during field work and surveys is expected to be beneficial to fish and wildlife, as this data is needed to compile baseline information at an ecosystem level and inform management decisions about fish and wildlife. Based on the above information and the use of conservation measures to mitigate any potentially adverse effects to fish and wildlife, the Service has concluded that the Other Wildlife Management activities would result in no adverse effects to fish and wildlife on and near the Refuge for all alternatives.

#### *Habitat Management*

For all alternatives, the actions proposed for Habitat Management would result in short-term and long-term benefits for wildlife due to the implementation of invasive vegetation control, and native plant restoration activities. These activities would result in short-term disturbance to individual animals, but are not expected to result in population-level effects and would be outweighed by the net increase in native habitat for wildlife.

The restoration of native plant communities will cause temporary disturbance in wildlife habitat and may temporarily flush wildlife while the work is being done. Restoration includes manual and chemical removal of invasive species such as eucalyptus. The removal of invasives may result in temporary and short-term disturbance to individual animals while the work is being done. The Service expects that the removal of invasive plants would improve wildlife habitat and, in the long-term, would be a benefit to wildlife populations because invasive do not provide quality habitat. Herbicides will be applied to plants using spray application techniques 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. The use of the PUP process addresses 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. In the long-term, plant community restoration activities will benefit wildlife by providing additional quality habitat.

Based on the above information, the Service's PUP requirements, and the use of conservation measures to mitigate any potentially adverse effects to fish and wildlife, the Service has concluded that the use of these PUP-regulated herbicides for Habitat Management activities would result in no adverse effects to fish and wildlife on and near the Refuge for all alternatives.

#### *Visitor Services*

For all alternatives, mosquito control actions for public and resource safety are included. For all alternatives, the Service would continue allow the Santa Cruz County Mosquito and Vector Control (SCCMVC) District to use *Bacillus thuringiensis* var *israelensis* (Bti) as mosquito larvicide under limited conditions. Although Bti is highly specific to mosquito larvae and intended to control mosquitoes, the potentially adverse effects from the application of Bti, should it need to be used, are: lethal effects on mosquitoes and non-target water-borne insects closely related to mosquitoes (e.g., black flies and some midges); potential non-lethal effects to fish and wildlife; and temporary disturbance to fish and wildlife species may occur in the immediate area during application. With the implementation of the Service's PUP requirements and conservation measures described in Appendix 1 to the EA, no adverse effects on fish and wildlife are anticipated.

#### *Environmental Education and Outreach*

For all alternatives, Environmental Education activities may result in temporary disturbance of wildlife. However, these educational activities are based upon native plant restoration activities that will have long-

term benefits in providing additional wildlife habitat, as analyzed above for habitat management activities. A Refuge staff member and high school teacher are present to supervise all activities and to minimize wildlife disturbance during educational activities. In addition to environmental education, interpretive tours are occasionally led on the Refuge. These tours are led by Refuge staff or a Special Use Permit holder familiar with Refuge regulations. The number of people on the tours is limited to reduce disturbance to wildlife.

Based on the above information, the Service has concluded that the visitor services activities would result in no adverse effects to fish and wildlife on and near the Refuge for all alternatives.

***Alternative A: No Action***

*Endangered Species and Species of Concern, Other Wildlife Management, and Habitat Management*  
The effects of the actions would be the same effects as described above for all alternatives.

*Ecosystem-based Management*

Alternative A includes no ecosystem-based actions.

*Visitor Services*

Because Alternative A includes no formal visitor services program and only minimal visitation with Service-guided tours as requested, the Service expects no adverse effects to fish and wildlife. The effects to fish and wildlife with Alternative A would be less than Alternatives B or C.

*Environmental Education and Outreach*

Alternative A includes the same effects as discussed above for all alternatives

For Alternative A, the Service expects no adverse effects to fish and wildlife.

***Alternative B: Preferred Alternative***

*Endangered Species and Species of Concern Management and Other Wildlife Management*

For Alternative B, conducting additional surveys for SCLTS, CTS and CRLF (trap arrays, drift fence/pitfall surveys) will have a short-term, temporary, direct effect on target and non-target wildlife species during the surveys. Installation of survey fencing and traps will temporarily flush surrounding wildlife. When pitfall traps are in use during the night, non-target wildlife could potentially be caught. Measures will be implemented to protect non-target species caught in traps and to aid in their ability to exit the trap. Wildlife that remains in the trap will immediately be released at the trap site the following morning.

Implementing new monitoring efforts to gather base line information on wildlife and fish populations may have temporary effects on wildlife and fish individuals. Protocols for monitoring and surveys will be reviewed by Refuge staff to ensure that disturbance to wildlife, fish and habitat is minimized and that conservation measures (best management practices) are in place (see Appendix 1 to the EA). The additional data collected will help to inform management decisions and benefit wildlife and fish species populations.

*Habitat Management*

For Alternative B, developing and implementing a plan for adaptive vegetation management and for invasive vegetation control, early detection, and rapid response would help to improve and maintain high quality habitat and vegetation for wildlife species. Short-term effects of increased control efforts would include additional disturbance to wildlife through the use of chemical and manual removal of invasive 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.

### *Ecosystem-based Management*

For Alternative B, the effects of reducing hazardous fuel loads would be similar to the effects of invasive vegetation removal analyzed in the Habitat Management section above. Reducing the intensity of a potential wildfire or preventing a wildfire from occurring altogether through the removal of hazardous fuel loads would have a direct benefit in protecting fish and wildlife habitat.

### *Visitor Services and Environmental Education and Outreach*

For Alternative B, installation of a parking lot, trails, interpretive signage and general information kiosk on the Harkins Slough Unit will result in short-term disturbance to wildlife during installation and permanent habitat loss where they are installed. Where possible, these structures will be placed in areas that have already been disturbed by past farming practices and residential use, or where habitat is low quality to minimize habitat loss.

The addition of a parking area, trails, and other associated infrastructure is expected to increase the number of visitors to the Refuge. Alternative B includes up to 3 Service-guided tours annually. The increased tours and opening the Harkins Slough Unit to the public for wildlife observation, photography and environmental education will result in more traffic in habitat areas and may cause wildlife to temporarily flush from the area. 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. The proposed visitor services are not expected to result in a population-level effect on wildlife or fish. 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 include restoration activities such as planting native plants and removing invasive species will improve wildlife habitat.

Ground clearing for the parking areas; preparation for installation of trails, interpretive panels, and information kiosks (signs) may involve earthmoving equipment that could introduce various contaminants, such as fuel oils, grease, and other petroleum products, either directly from equipment or through surface runoff. Contaminants may be toxic to fish and amphibians and may adversely affect their respiration and feeding. With the implementation of the conservation (avoidance and minimization) measures described in Appendix 1, no adverse effects on fish, amphibians, or other wildlife are expected.

Based on the above information, and the use of conservation measures to mitigate any potentially adverse effects, the Service has concluded that there would be no adverse effects to fish and wildlife with Alternative B. The effects to fish and wildlife with Alternative B would be more than Alternative A, but less than Alternative C.

### **Alternative C**

Alternative C would include those activities and effects in Alternative B plus, there would be increased benefits and disturbances from activities prescribed in this alternative.

### *Endangered Species and Species of Concern Management*

For Alternative C, identifying additional water sources to benefit endangered and species of concern at Calabasas Pond (and Buena Vista Pond after a management agreement with CDFG is completed) is expected to provide beneficial effects on other fish and wildlife as well. The addition of water will allow the completion of aquatic life stages, ensuring native amphibian and invertebrate population recruitment.

Should local landowners and partners choose to create and/or protect breeding ponds and upland areas for Federally-protected amphibians on lands adjacent to the Refuge, the Service anticipates a beneficial effect for other wildlife.

Alternative C includes increased monitoring and mapping of spineflower populations above the levels in Alternative B. The Service anticipates that increasing monitoring, and mapping, would have no adverse effects on fish and wildlife.

Alternative C includes research for the Santa Cruz tarplant. The Service anticipates that this would have no adverse effects on fish and wildlife.

#### *Other Wildlife Management*

Alternative C includes actions for Other Wildlife Management that are the same as for Alternative B and would have the same effects as described for Alternative B, above.

#### *Habitat Management*

For Alternative C, expanded invasive vegetation management and restoration activities to include a larger area of control and an increase in the invasive species controlled (e.g. acacia, ice plant and cape ivy) will cause additional temporary disturbance to wildlife while activities are occurring. In the long-term, increased invasive control will benefit wildlife species by enhancing native plant communities.

#### *Ecosystem-based Management*

For Alternative C, the effects on fish and wildlife would be the same as Alternative B for ecosystem-based management.

#### *Visitor Services*

Alternative C includes actions for Visitor Services that are the same as for Alternative B and would have the same effects as described for Alternative B, above; except Alternative C includes the improvement of an existing trail for wheelchair-access and staff vehicle access. The availability of the wheelchair trail would increase opportunities for visitor use at the Harkins Slough trails by this user group, but the Service anticipates that the potential increase in wildlife disturbance would be minimal as the increase in visitor use would be small.

The improvement of one trail at Harkins Slough Unit for staff vehicle access and wheelchair access would result in the short-term disturbance of wildlife during the improvement process. No additional habitat loss should occur beyond that analyzed in Alternative B, as the improvements would be made to an existing trail.

Based on the above information, and the use of conservation measures to mitigate any potentially adverse effects, the Service has concluded that there would be no adverse effects to fish and wildlife with Alternative C. The effects to fish and wildlife with Alternative C would be greater than Alternative A and greater than Alternative B.

## **Special Status Species**

### ***Common to All Alternatives***

#### *Endangered Species and Species of Concern Management and Other Wildlife Management*

Monitoring salamanders by dip-net surveys and winter night-time surveys may have short term effects on SCLTS, CTS, and CRLF. Dip-nets are used during the breeding season to capture amphibians and invertebrates, to check presence/absence, recruitment, health and abnormalities. This activity requires short-term disturbance to salamander larvae and frog tadpoles. To minimize disturbance, specimens are only held if necessary and then only by permit requirements. Animals will be promptly returned to their original pond. Dip-net sweeps will be minimized to accomplish survey objectives. All equipment will be decontaminated before and after leaving each pond. Winter nighttime surveys will be conducted with at least one person that holds the applicable ESA permit present, if animals are to be handled. Handling for the purpose of preventing road mortality and for obtaining required survey data (e.g., sex, measurements) will be limited to trained persons with moistened hands. Amphibians have porous skin and a protective coating. Handlers should minimize handling of amphibians and should make sure hands are free of lotions, chemicals, perfumes, etc., that may be absorbed into amphibious skin. In addition, wet hands prevent additional harm to the protective coating caused by friction, warmth of dry hands and desiccation. By implementing these mitigation measures, the Service anticipates that surveys will have no adverse effects to special status amphibians.

Augmentation of water to Ellicott Pond is possible with the use of the CDFG pump and well located at the Ellicott Unit. Water may be added to Ellicott pond when both USFWS and CDFG agree that it is necessary for amphibian reproduction and that additional water will not harm any threatened and endangered species present. This action will be beneficial to special status species, as the addition of water will allow the completion of aquatic life stages, ensuring SCLTS and CTS population recruitment.

#### *Habitat Management*

Under all alternatives, individual animals may be temporarily disturbed during the habitat restoration work, but restoration activities are expected to benefit the long-term population of special status species including listed species such as the SCLTS, CTS, CRLF and robust spineflower. Restoration activities such as plantings, could disturb over-summering SCLTS, CTS, and CRLF. Activities could result in direct mortality of SCLTS, CTS, CRLF and robust spineflower if they were present in areas where habitat restoration was implemented. In the long-term additional native breeding and over-summering 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; preventing cover and burrows from trampling, providing a buffer near spineflower populations; avoiding activities during rain events (when possible).

Under all alternatives, the use of herbicides, mechanical removal, and hand-pulling of invasive plants has the potential to impact wildlife. Short-term impacts of plant removal include potential disturbance of SCLTS, CTS and CRLF that are found outside of the breeding pond. Such disturbance may alter burrows, protective cover, and crevices making refugia temporarily inaccessible. Herbicide spraying would not be conducted within breeding ponds or during the breeding season to reduce exposure to wildlife. Herbicide spraying would also not be conducted on robust spineflower or within an approved buffer around the spineflower location. With use of herbicides, conservation measures would be implemented to reduce the risk of adverse affects to special status species.

All of the alternatives include native plant restoration and invasive plant management activities. Increasing native plant cover will provide additional suitable habitat for robust spineflower and additional breeding and non-breeding habitat for listed amphibians.

#### *Environmental Education and Outreach*

Under all alternatives Service led-tours and environmental education would occur on the Ellicott Unit. Students are supervised by Refuge staff as well as at least one teacher. Education occurs outside of sensitive areas that contain threatened and endangered species. However on the slight chance a salamander may be uncovered, all participants get a briefing about identifying salamanders and proper procedure if a salamander is found. In addition to environmental education, interpretive tours are occasionally led on the Refuge. These tours are led for Refuge staff or Special Use Permit holder. Tours are limited in size to reduce disturbance to threatened and endangered species.

#### *Visitor Services*

Mosquito monitoring includes regular visits by SCMVC District personnel to sample mosquito larvae (dip counts) and adults (landing counts) in wetlands and adjacent areas. Mosquito monitoring and application of pesticides will cause direct and indirect disturbance effects. Disturbance would include altering wildlife behavior and habitat use, and entering a number of wetland areas to collect mosquito samples. Habitat for special status species could be trampled by foot traffic as a result of monitoring and application of pesticide. However, most of these effects would be temporary and short-term. The sampling interval would typically be once a week year-round, when standing water is present or suspected. Long-term effects would be eliminated or reduced because sufficient restrictions would be included as part of the SUP, and SCCMVC District activities would be monitored by Refuge staff. Additionally, SUP conditions would include conditions to further ensure that potentially adverse effects to wildlife, including special status species, and their habitats are avoided and minimized.

For all alternatives, section 7, Endangered Species Act compliance will be completed before implementation of the CCP.

### **Alternative A: No Action**

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

### **Alternative B: Preferred Alternative**

#### *Endangered Species and Species of Concern Management*

Alternative B would be similar to Alternative A. Monitoring of threatened and endangered amphibians will be increased in this alternative. Winter nighttime surveys will be standardized and will include most rainy events. Increased night-time surveys will include more opportunities to locate and handle salamanders. Even though surveys will be increased individual captures will be limited to approximately one time per breeding season, because of salamander movement and timing of surveys. In addition to Alternative A, trap arrays lined with drift fences and pitfall traps will be placed around salamander breeding ponds as well as potential dispersal locations. Survey protocols will follow Federal and state requirements. Dip-net surveys will be extended to include Harkins Slough unit for presence/absence of CRLF and CRLF call counts will be conducted at all ponds. Because no known threatened and endangered species occur at Harkins Slough Unit, dip-net surveys will not affect these amphibians. Call count surveys for CRLF should not cause any additional disturbance.

Sampling that is part of monitoring ponds for siltation will be done only when the ponds are dry to avoid adversely affecting the special status species that use the ponds in the rainy season and when they are wetted. Monitoring and mapping robust spineflower and determining presence/absence of Santa Cruz tarplant increases opportunities for trampling. Trampling will be minimized by proper training, including identification and avoidance measures.

A water management plan for the Refuge will be developed and implemented in Alternative B. Portions of the water management plan that may affect threatened and endangered amphibians include monitoring water levels and implementing water augmentation protocols. The addition of water will benefit the amphibians by providing additional water for reproduction and food base.

There are many threats facing threatened and endangered amphibians, such as nonnative bullfrogs and crayfish. Because there are no estimates for these predators, control measures have not been determined. However, control measures will follow federal and state guidelines on effectively and efficiently reducing nonnative predators to protect special status species.

#### *Habitat Management*

Restoration and invasive plant removal will be increased. A vegetation management plan, including invasive management, will include measures to minimize disturbance to threatened and endangered species, including buffers and least-disturbance solutions.

#### *Ecosystem-based Management*

Hazard fuels both on the Refuge and in the adjoining wildland urban interface may pose a threat to special status species because they can carry unwanted wildfires. Hazardous fuel removal will take place during the non-rainy season to prevent disturbance to migrating amphibians. Spineflower will be avoided when removing fuel loads. All personnel will be trained to identify and avoid disturbing special status species.

#### *Visitor Services and Environmental Education and Outreach*

Visitor Services improvements such as signs, trail, on-site environmental education and parking area will occur at Harkins Slough Unit only. Since there are no threatened and endangered species present at Harkins Slough Unit, none will be affected by these improvements. In addition to improvements at Harkins Slough, interpretive tours at all units will be slightly increased. These tours are led for Refuge staff or Special Use Permit holder and are limited in size to reduce disturbance to threatened and endangered species.

### **Alternative C**

#### *Endangered Species and Species of Concern Management*

Alternative C includes actions similar to Alternative A and B, but with some additions.

In addition to trap arrays identified in Alternative B, there would be an increase to the amount and timing of trap arrays placed around salamander breeding ponds. Survey protocols will follow Federal and state requirements to protect threatened and endangered species.

Known nonnative threats to amphibians at Harkins Slough unit, including crayfish and bullfrogs, will be removed under this alternative. Because there are no threatened and endangered species at Harkins Slough unit, none will be affected by this action.

#### *Habitat Management*

Restoration and invasive plant removal would be increased under this alternative. Weed management will include additional weed species to control, such as acacia and ice plant. Restoration will be increased to include collection of native plants by volunteers and possible construction of a small greenhouse on-site. Increased weed control may have short-term effects to special status species, however they will benefit in the long-term. Construction of the greenhouse is outside the realm of this EA. The Service will comply with all applicable environmental laws, including NEPA in a separate document.

#### *Climate Change*

Increased research, including climate change, will have minimal effects to threatened and endangered species. If research objectives require disturbance or take, required permits and protocols will be necessary.

#### *Visitor Services*

Alternative C would have more visitor services improvements than Alternative B. Seasonal interpretive programs and will be established at Harkins Slough Unit and one existing trail will be improved for wheelchair access and staff vehicle access. Since there are no threatened and endangered species present at Harkins Slough Unit, none will be affected by these programs and improvements.

#### *Environmental Education and Outreach*

For Alternative C, Environmental Education and Outreach will be the same as with Alternative B.

## **Visitor Services**

The effects from visitor services on water quality, air quality, plant communities, fish and wildlife, and special status species are analyzed in those resource sections above.

### ***Common to All Alternatives***

#### *Visitor Services*

For all alternatives, a mosquito control program is anticipated to decrease the health risks for diseases for which the mosquito is a vector and decrease the mosquito nuisance to adjacent landowners and Refuge visitors. Both are considered to be beneficial effects of a mosquito control program.

### ***Alternative A: No Action***

For Alternative A, current management, the Refuge would remain closed to the general public and the Service would maintain current visitor opportunities that are afforded through Service-led interpretive tours, as requested, by resource-related organizations and educational institutions. The Service expects that visitor use at the Refuge would stay approximately the same as it is now under Alternative A, the No Action Alternative.

### ***Alternative B: Preferred Alternative***

For Alternative B, the Service would schedule and conduct up to 3 tours of the Refuge annually; and at Harkins Slough Unit: create walking trails with interpretative panels; install and designate a parking area; install general information kiosks; and install interpretive panel at entrance of closed Units to explain why sensitive areas are closed to the public. Although more visitor opportunities are provided to the public, it is difficult to estimate how many more visitor trips will actually result from more opportunities being available. New or more accessible trails may result in an increase in the number of visitors at the Refuge.

These additional improvements may result in visitors choosing the Refuge as their destination rather than another location offering similar opportunities in the Monterey Bay area.

For Alternative B, the environmental education (EE) and outreach measures specific to schools include collaborating with the local high school and with partners to expand the in-class EE curriculum. Other EE measures include outreach to neighbors and the community including developing a Refuge newsletter, website and brochure. These measures are expected to have a positive effect on the community.

Because other comparable or higher quality wildlife-dependant recreational opportunities are available within 9 miles of the Refuge at Elkhorn Slough National Estuarine Research Reserve, the Service anticipates that a slight net increase in visitor use at the Refuge would occur with the improvements under Alternative B, as compared to the No Action Alternative A; and an equal increase in visitor use as compared to Alternative C.

### **Alternative C**

For Alternative C, the Service would implement all visitor services improvements under Alternative B, plus the Service would create a schedule of seasonal Refuge activities (in addition to a minimum of 3 tours annually); improve 1 trail at Harkins Slough Unit for staff vehicle access and wheelchair-accessible. As described in Alternative B, above, additional visitor services improvements may result in an increase in the number of visitors at the Refuge. These additional facilities may result in visitors choosing the Refuge as their destination rather than another location offering similar opportunities in the Monterey Bay area, generating no new vehicle trips.

For Alternative C, the environmental education (EE) and outreach measures are the same as Alternative B. Other EE measures include additional outreach mailings to neighbors and the community, and outreach to under-represented groups. These measures are expected to have a positive effect on the community.

The Service anticipates that a slight net increase in visitor use at the Refuge may occur under Alternative C, as compared to the No Action Alternative A; and an approximately equal increase in visitor use as compared to Alternative B.

## **Cultural Resources**

Preserving the culture and history of the nation's past are the goals of regulations that include the National Historic Preservation Act (NHPA), Antiquities Act of 1906, Archeological Resource Protection Act of 1979, and Historic Sites Act of 1935. The NHPA regulations (Title 36 Code of Federal Regulations Section 800 [36 CFR 800]) require that Federal agencies seek information, as appropriate, from the State Historic Preservation Officer (SHPO), the Advisory Council on Historic Preservation (ACHP), Indian tribes, and other individuals and organizations likely to have knowledge of, or concerns with, historic properties in the potentially affected area. These organizations and individuals are integral in identifying issues related to the proposed project's potential effects on historic properties. Similar State regulations protect archeological, paleontological, and historical sites and specifically provide for identification. Cultural resources defined within the framework of these regulations include archeological sites, historic sites, and traditional cultural properties associated with the values of Native Americans and other cultural groups.

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. Under all alternatives, if any additional cultural resources are discovered on the Refuge, the Service would take all necessary steps to comply with section 106 of the National Historic Preservation Act of 1966, as amended. During early planning of any projects, the Refuge will provide the State Historic Preservation Officer (SHPO) a description and location of all projects and activities that affect ground and/or structures, including project requests from third-parties. Information will also include any alternatives being considered. The SHPO will analyze these undertakings for potential to affect historic properties and enter

into consultation with the State Historic Preservation Officer and other parties as appropriate. The Refuge will also notify the public and local government officials to identify any cultural resource impact concerns. This notification is generally done in conjunction with the review required by the National Environmental Policy Act or Service regulations on compatibility of uses. Visitor services improvements and restoration activities do have the potential to locate undiscovered cultural resources. If any previously unrecorded cultural resources are discovered during this action, all project-related activities would cease immediately and the consultation process as outlined in Section 800.13 of the Advisory Council on Historic Preservation's regulations (36 CFR 800) would be initiated.

Actions that physically disturb a site, alter its setting, or introduce elements out of character with the site may constitute an adverse affect. If a site is eligible for inclusion in the National Register of Historic Places (National Register), any type of physical damage results in a permanent loss of information that reduces the understanding of the site's contribution to the past.

### ***Common to all Alternatives***

The Refuge will comply with all applicable regulations and statutes regarding cultural resources. In consultation with the State Historic Preservation Office (SHPO) and the Tribal Historic Preservation Officer (if applicable), the Service will evaluate the eligibility of cultural resources, traditional cultural properties and unique archeological resources on the Refuge.

The process of identifying and mitigating potential adverse effects to cultural resources listed or eligible to be listed on the National Register of Historic Places is found in 36CFR800. As individual projects generated by the CCP come forward, the Service will exercise Section 106 of the National Historic Preservation Act (NHPA) including consultation with the SHPO and the pertinent Tribes, in accordance with the programmatic agreement with the SHPO and the Service.

Continuing to manage and conserve Ellicott Slough NWR cultural resources on a project-by-project basis in coordination with the Service's Regional Archaeologist is expected to have no adverse effects on cultural resources.

### ***Alternative A: No Action***

Alternative A includes continuing to manage and conserve Ellicott Slough NWR cultural resources on a project-by-project basis in coordination with the Service's Region 1/8 Archaeologist. There would be no change in effects on cultural resources. Under Alternative A, the Service will continue to exercise Section 106 of the NHPA to avoid or minimize adverse effects to cultural resources as it presently does.

### ***Alternative B: Preferred Alternative***

Alternative B includes visitor services improvements at Harkins Slough Unit, including a designated parking area, a general information kiosk at the entrances to unit, and a trail system with interpretive panels. Alternative B also includes installing an interpretive panel at entrance of closed Units to explain why sensitive areas are closed to public. Under Alternative B, the Service will continue to exercise Section 106 of the NHPA to avoid or minimize adverse effects to cultural resources as it presently does.

### ***Alternative C***

Alternative C proposes the improvement of 1 trail for staff vehicle and wheelchair access. Because the improvement will occur on an existing trail, it is not considered to be a Federal undertaking that requires compliance with Section 106 of the National Historic Preservation Act (NHPA).

## **Effects on the Social and Economic Environment**

This section discusses the direct and indirect economic effects on the regional economy of implementing the various alternatives presented for the Ellicott Slough NWR. Economic or social changes resulting from an action are considered to produce significant effects if the changes result in a substantial adverse physical change in the environment.

## **Socioeconomics**

### ***Common to All Alternatives.***

It is well known that Americans value recreational opportunities, although there is no general agreement on the best methodology to precisely measure the effects of recreational opportunities on local economics. Wildlife dependant recreational use of the Refuge is likely to have an indirect economic benefit to the local community however no formal economic study of these benefits has been conducted. However, it is probable that the local “consumption” of recreational use opportunities on the Refuge will approximate national trends to the extent that the uses are allowed on the Refuge. 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.

None of the alternatives are expected to adversely affect the social and economic environment of the Watsonville Slough area, Santa Cruz County or the region.

## **Cumulative Effects**

Cumulative effects (or impacts) are those effects on the environment resulting from incremental consequences of the Service’s preferred alternative when added to other past, present, and reasonably foreseeable future actions, regardless of who undertakes these actions. Cumulative effects can be the result of individually minor impacts, which can become significant when added over a period of time. Accurately summarizing cumulative effects is difficult, because while one action increases or improves a resource in an area, other unrelated actions may decrease or degrade that resource in another area. This section addresses the potential cumulative effects for all of the alternatives and is intended to consider the activities on the Refuge in the context of other actions on a larger spatial and temporal scale.

Past actions that could be considered similar with similar effects include the construction of Ellicott Pond on the Refuge (USFWS 1993). The Service is not aware of any other past, present, or future planned actions that would result in a significant cumulative impact when added to the Refuge’s proposed actions as outlined in the proposed alternative. However, similar actions may be planned at other refuges in the National Wildlife Refuge (NWR) System in different ecosystems.

Based on the above analyses, the Service has concluded that, with the conservation measures, the incremental contribution of the Ellicott Slough NWR activities and any increase in visitor use (from any alternative) to the effects on the local, regional, and flyway environment are expected to be beneficial overall, but less than cumulatively considerable.

### ***Habitat Management***

All alternatives would have long-term benefits for native wildlife species and habitats within the area. The protection of wildlife habitats within the Refuge would represent a benefit to the long-term conservation of threatened and endangered species and other native wildlife species. Alternatives B and C would provide greater benefits due to the increased amount of habitat restoration that would take place. However, despite all of these beneficial effects there are negative effects that have occurred and continue to occur within the Monterey Bay and San Francisco Bay Areas. The long-term cumulative negative effects of wildlife habitat degradation still outweigh the beneficial effects of the proposed action. The Refuge encompasses only a small portion of the Watsonville Slough System watershed. Moreover, the benefits derived from Alternatives B or C will only restore and protect a small fraction of the amount of habitat that has been lost within the region, the greater Monterey Bay and San Francisco Bay Areas. In summary, the long-term benefits resulting from ongoing habitat management and restoration are not considered cumulatively significant because of ongoing habitat degradation throughout the basin.

## **Other Past, Present, and Reasonably Foreseeable Actions and Anticipated Impacts**

All of the alternatives would preserve and enhance existing habitat on the Refuge and would have some long-term benefits for native wildlife species and habitats within the area. Alternatives B and C would result in an increase of restoration activities on the Refuge. The protection and improvement of wildlife habitats within the Refuges would represent a benefit to the long-term conservation of threatened and endangered species, migratory bird species, and other native wildlife species. However, these alternatives will not reverse or halt the regional trend of development and the associated reduction in biological diversity. Therefore, these long-term benefits are not cumulatively significant. The Refuge does not have control over the cumulative negative impacts from local development and increased demands on water resources. The Service helps to mitigate impacts by working with partners to protect important habitats from development.

## **Irreversible and Irrecoverable Commitment of Resources**

NEPA Section 102(C)(v) (CEQ Regulations Part 1502.16) requires Federal agencies to consider any irreversible and irretrievable commitments of resources with would be involved in the proposed action should it be implemented.

Alternatives B and C include the proposed installation of trails, a parking area and information panels and kiosks (signs). Installation activities would involve the consumption of nonrenewable natural resource such as soil, cement, and petroleum for fuel. The resources used in site preparation, transportation of construction materials, excavation, and disposal of excess excavated materials (unsuitable for fill), and the materials installed would be permanently committed to the project.

## **Relationship Between Short-term Uses of the Environment and Maintenance and Enhancement of Long-term Productivity**

NEPA Section 102(C)(iv) (CEQ Regulations Part 1502.16) requires Federal agencies to disclose the relationship between local short-term uses of man's environment and the maintenance and enhancement of long-term productivity. The Service expects that the proposed alternatives would lead to long-term productivity through the life of the CCP (15 years). This discussion focuses on the tradeoffs between short-term environmental costs and long-term environmental benefits.

Any adverse effects on or near the Refuge due to installation of trails, a parking area, information kiosks, interpretive panels or other signs are expected to be temporary, short-term (during construction), and localized. The National Wildlife Refuge System (Refuge System) is the only network of Federal lands dedicated specifically to wildlife conservation. The Refuge System support more than 700 types of birds, 220 different mammals, 250 reptiles, and more than 200 kinds of fish. The Ellicott Slough NWR was authorized by Congress under the Endangered Species Act to conserve fish, wildlife or plants that are listed as endangered species or threatened species; and under the Emergency Wetlands Resources Act of 1986 for the conservation of the wetlands of the Nation to maintain the public benefits they provide and to help fulfill international obligations contained in various migratory bird treaties and conventions. For more information on Refuge purposes, please refer to that section in Chapter 1 of the CCP. 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" (1997 Improvement Act). The long-term environmental benefits of the action alternatives to the NWR System are expected to outweigh the short-term environmental costs at the Refuge.

## **Indian Trusts Assets**

Indian trust assets (ITAs) are legal interests in assets that are held in trust by the United States Government for Federally recognized Indian tribes or individuals. The trust relationship usually stems from a treaty, Executive Order, or act of Congress. The Secretary of the Interior is the trustee for the United States on behalf of federally recognized Indian tribes. “Assets” are anything owned that holds monetary value. “Legal interests” means there is a property interest for which there is a legal remedy, such a compensation or injunction, if there is improper interference. Assets can be real property, physical assets, or intangible property rights, such as a lease, or right to use something. ITAs cannot be sold, leased or otherwise alienated without the United States’ approval. Trust assets may include lands, minerals, and natural resources, as well as hunting, fishing, and water rights. Indian reservations, Rancherias, and public domain allotments are examples of lands that are often considered trust assets. In some cases, ITAs assets may be located off trust land.

The Service shares the responsibility with all other agencies of the Executive Branch to protect and maintain ITAs reserved by or granted to Indian tribes, or Indian individuals by treaty, statute, or Executive Order.

There are no known tribes possessing legal property interests held in trust by the United States in the lands or natural resources related to the alternatives.

## **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 with any of the alternatives. In all 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.

## **Growth-Inducing Impacts**

None of the alternatives would affect human settlement or development. Therefore, the Service has concluded that no growth-inducing impacts are expected to result from any of the alternatives.

## **Related Projects, Programs, Environmental Assessments**

A related project is the Environmental Assessment and Finding of No Significant Impact (FONSI) for the Ellicott Slough NWR Habitat Enhancement Plan, USFWS, May 1993. This EA addresses the Prospect Pond on the Ellicott Unit.

Ellicott Slough National Wildlife Refuge Proposed Buena Vista Addition Environmental Assessment, Land Protection Plan and Conceptual Management Plan. Prepared by Ivette Loreda, Refuge Manager, San Francisco Bay NWR, USFWS, June 2005. This EA addresses the expansion of the Service's approved acquisition boundary to include the Buena Vista property.

## **Consultation and Coordination**

The Ellicott Slough NWR has conducted informal consultation with the Ventura Fish and Wildlife Office of the Service under section 7 of the Federal ESA, as amended. In compliance with section 7 of the Federal ESA, as amended, the Service will conduct intra-agency consultation regarding listed species. See also the Special Status Species sections of this EA and the appendices to the CCP: Appendix D - Plant List; Appendix E - Wildlife Species List, and Appendix F - Section 7, Endangered Species Act Compliance.

The Service coordinated with the public during the scoping process for the CCP/EA for the Ellicott Slough NWR. A Notice of Intent to prepare a CCP/EA was published in the Federal Register on July 14, 2008. A planning update (newsletter), which introduced the Refuge and the planning process, was mailed to over 100 agency and organization representatives, members of the public, media, and elected representatives in Santa Cruz County. Scoping comments were collected through August 13, 2008.

# References for the Environmental Assessment

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Figure C-1. San Francisco Bay National Wildlife Refuge Complex

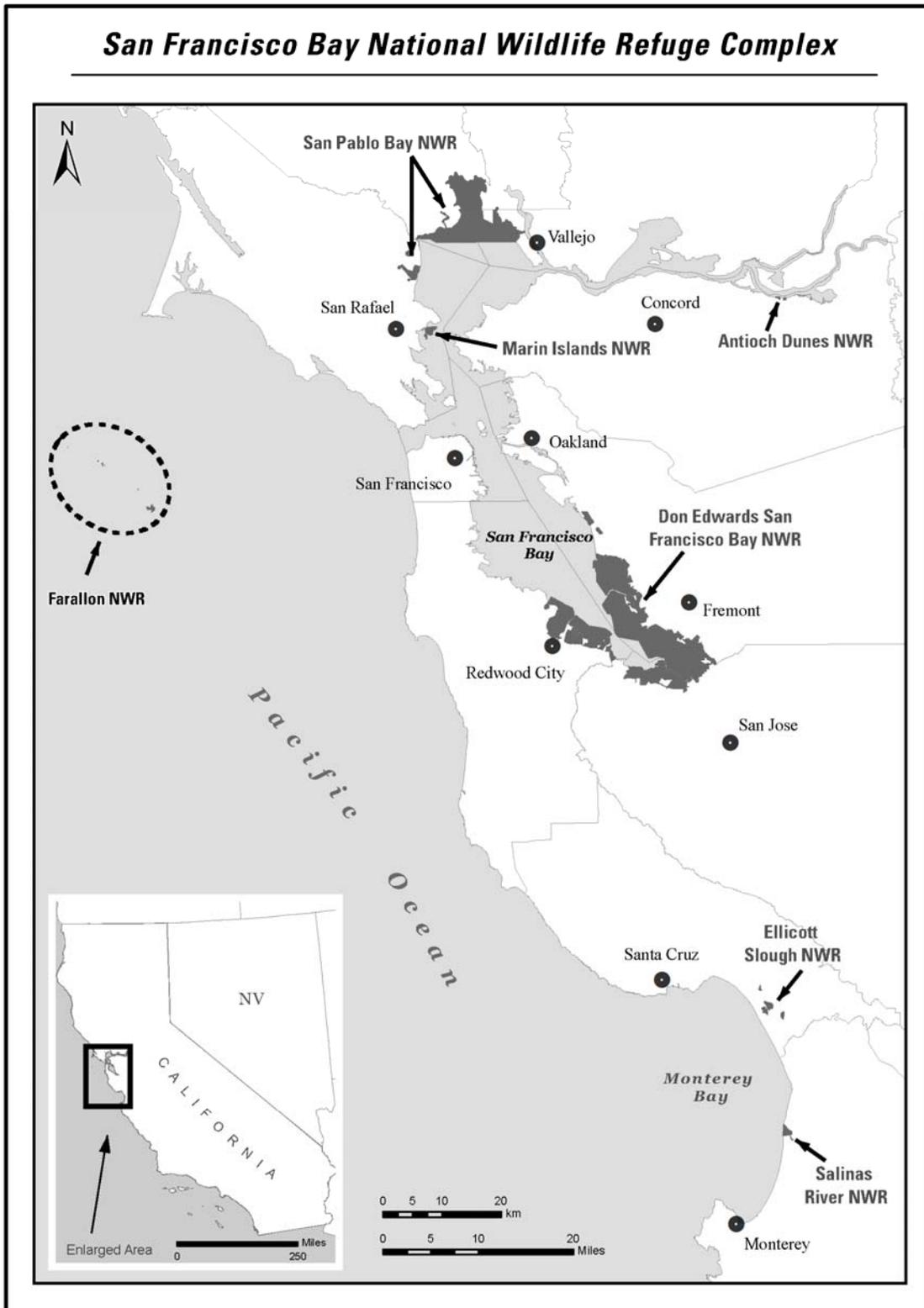


Figure C-2. Refuge Location Map

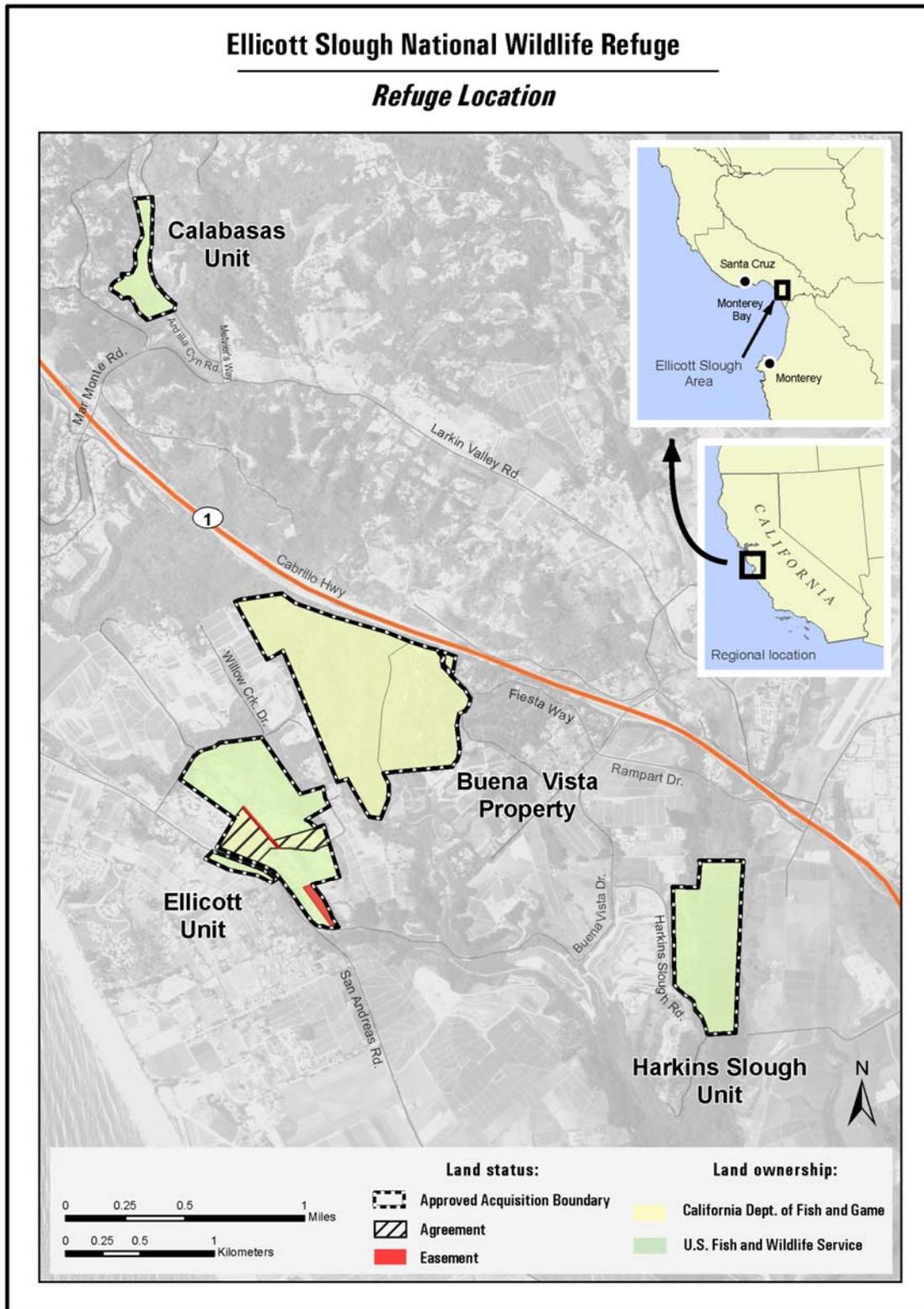
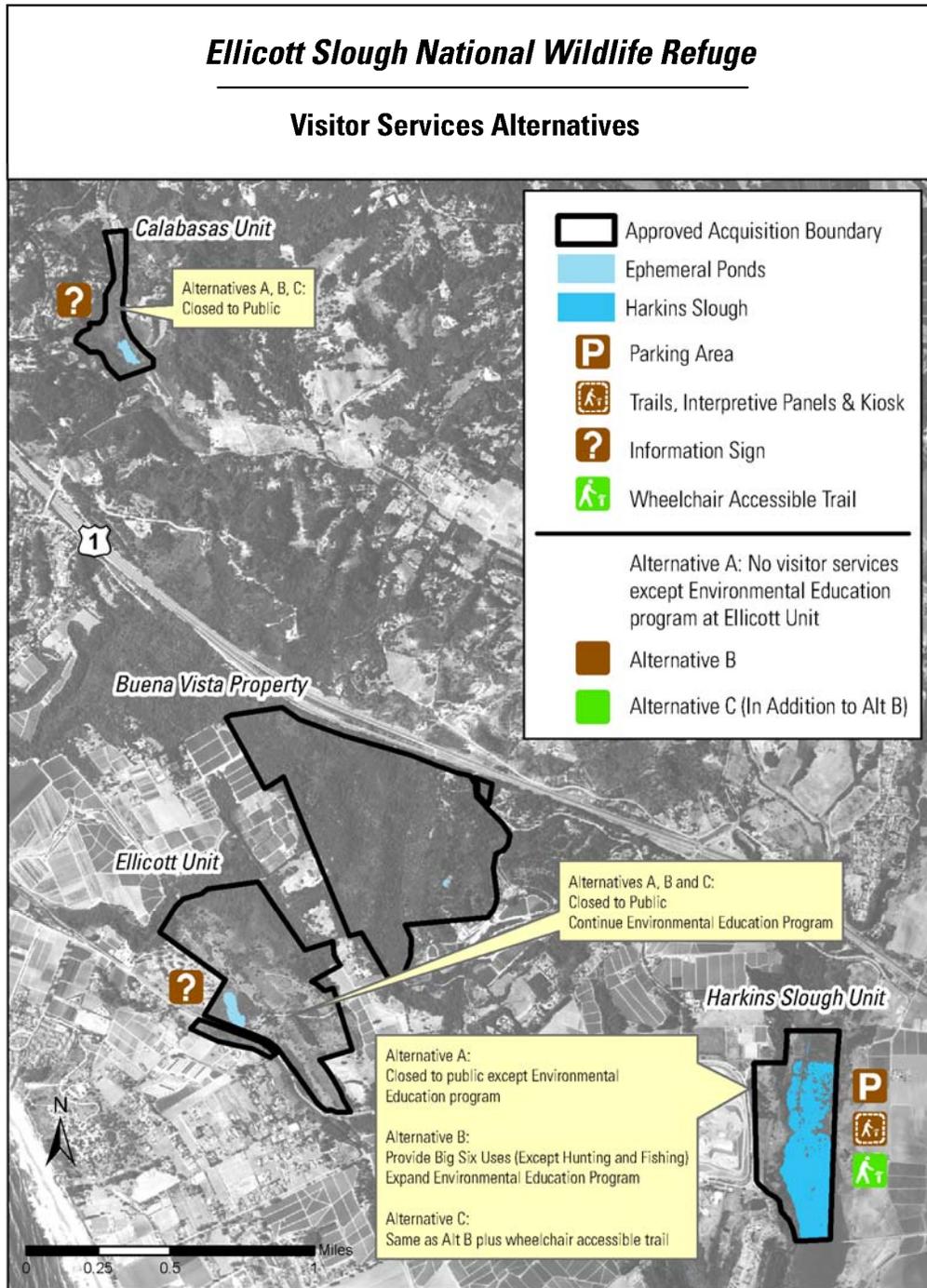


Figure C-3. Visitor Services Alternatives Map



# APPENDIX 1: Conservation Measures

Conservation measures or “best management practices” (BMPs) are designed to reduce adverse impacts to fish, wildlife, and plant species and their critical habitats. Appropriate conservation measures must be executed by all project coordinators. Measures are listed by main project categories, but in practice overlaps do exist among the categories. Individual measures are subject to becoming more stringent or additional measures may be instituted if restoration activities are changed.

## ***General Conservation Measures for all Project Categories:***

1. Follow all terms and conditions in regulatory permits and other official project authorizations to eliminate or reduce adverse impacts to any endangered, threatened, or sensitive species or their critical habitats.
2. Complete restoration activities at individual project sites in a timely manner. This will reduce disturbance and/or displacement of fish and wildlife species in the immediate project area.
3. Significant modifications to an approved work plan must be reviewed and approved by appropriate agency personnel and the landowner(s) before the work can be carried out or continued.
4. Unobstructed fish passage must be provided at all times during any restoration activity.
5. Use existing roadways or travel paths for access to project sites.
6. Avoid the use of heavy equipment and techniques that will result in excessive soil disturbances or compaction of soils, especially on steep or unstable slopes.
7. Vehicles and machinery must cross streams at right angles to the main channel whenever possible.
8. Excavation or transport equipment/machinery should be limited in capacity, but sufficiently sized to complete required restoration activities. Equipment and machinery coming in contact with water shall be inspected daily and cleaned of grease, oil, petroleum products or other contaminants.
9. Streams, riparian zones, and wetlands must not be used as staging or refueling areas. Equipment must be stored, serviced, and fueled away from aquatic habitats or other sensitive areas.
10. Native vegetation must be planted on disturbed sites. Native vegetation should be salvaged from areas where ground disturbances will be occurring on projects. Salvaged vegetation should then be replanted after the completion of project activities. The use of nonnative vegetation will be strictly limited and will apply to situations where native vegetation (i.e., grasses) is not commercially available. All nonnative vegetation must be a close subspecies or variety to native species or reproductively altered (i.e., sterilized) to avoid future ecological complications with native species. Vegetative planting techniques must not cause major disturbances to soils and slopes. Hand planting is the preferred technique for all plantings. Plantings must occur during the optimal seasonal growth period for the respective plant species involved. Vegetation growth should also be enhanced by bank sloping/grading, seedbed and site preparations, mulching, or fertilizing.
11. Boulder and rock materials used for restoration projects must come from non-streambed and non-wetland sources. Conifer and hardwood timber stands must not be specifically harvested to supply woody materials for any restoration activity, unless the harvest is part of an approved silvicultural operation. Boulder, rock, and woody materials must be collected during appropriate seasonal periods to reduce soil and slope disturbances.
12. A written contingency plan must be developed for all project sites where hazardous materials (e.g., pesticides, herbicides, petroleum products) will be used or stored. Appropriate materials/supplies (e.g.,

shovel, disposal containers, absorbent materials, first aid supplies, clean water) must be available on site to cleanup any small scale accidental hazardous spill; this action will protect the environment, project workers, and the public from direct contact with hazardous materials. Hazardous spills must be reported. Emergency response, removal, transport, and disposal of hazardous materials must be done in accordance with the U.S. Environmental Protection Agency. Hazardous materials and petroleum products shall be stored in approved containers or chemical sheds, and be located at least 100 feet from surface water in an area protected from runoff.

13. The evaluation of herbicide, pesticide, and fertilizer use must include the accuracy of applications, effects on target and non-target species, and the potential impacts to aquatic and terrestrial ecosystems. Treatments for the control or removal of invasive plants in riparian/wetland areas must be limited to hand or wick applications by qualified personnel. Apply chemicals during calm, dry weather and maintain unsprayed buffer areas near aquatic habitats and other sensitive areas. Chemical applications must be avoided where seasonal precipitation or excess irrigation water is likely to wash residual toxic substances into waterways. Consider persistence, soil/water mobility, toxicity, and plant uptake when selecting appropriate chemicals. All chemicals should be handled in strict accordance to label specifications. Proper personal protection (e.g., gloves, masks, clothing) must be used by all applicators. Obtain a copy of the material safety data sheet (MSDS) from the chemical manufacturer for detailed information on each chemical to be used. Refer to appropriate federal and state regulations concerning the use of chemicals. Chemicals must only be considered when other treatments would be ineffective or cannot be applied.
14. Sedimentation and erosion controls must be implemented on all project sites where the implementation of restoration activities will result in soil and/or slope disturbances. Soil and slope stabilization control structures/techniques must be bio-engineered to the extent possible. Structures/techniques must be placed and/or anchored appropriately to prevent adverse impacts to down slope habitats. Revegetate disturbed areas with native vegetation as soon as possible. Control structures/techniques may include, but are not limited to, silt fences, hay bale structures, seeding by hand and hydro-seeding, jute mats, and coconut logs. Contact the local state forester, state extension service agent, or Soil and Water Conservation District for information or assistance on control structures/techniques. **NOTE: This requirement refers to all sediment and erosion control measures addressed in the following project categories.**

***Air Quality Conservation Measures:***

1. All disturbed areas shall be effectively stabilized of dust emissions using water, approved chemical stabilizer/suppressant, tarp or other suitable cover or vegetative ground cover.
2. All land clearing, grubbing, scraping, excavation, land leveling, grading, cut and fill, and demolition activities shall be effectively controlled of fugitive dust emissions by applying water or by pre-soaking.
3. Following the addition of materials to, or the removal of materials from the surface of outdoor storage piles, said piles shall be effectively stabilized of fugitive dust emissions using sufficient water or approved chemical stabilizer/suppressant.
4. Brightly-colored construction fencing shall be installed around isolated special status plants to avoid disturbance.
5. An environmental education program shall be presented to all construction personnel to brief them on the status of the special status species and the penalty for not complying with these requirements.

***Soil Erosion Conservation Measures:***

1. Staging and stockpile areas must be located on or immediately beside the project area whenever possible. Sediment and erosion controls must be implemented around all stockpiled material and disturbed project sites to prevent the introduction of pollutants into water sources. This will reduce the disturbance and displacement potentials to fish and wildlife species in the surrounding areas.

2. Excess excavated materials removed during the completion of a restoration activity must be disposed of properly and/or stabilized to eliminate future environmental problems. Salvage of boulders, rock, and fill material is encouraged for use on nearby roads or other projects. Vegetation not salvaged will be removed to a county approved disposal site or chipped and composted off site to prevent spread of noxious weeds. If specific uses are not available for project spoils, they will be placed in upland areas, and contoured, with the assistance of an environmental engineer, to blend into the surrounding landscape. Under no circumstances will disposal sites be located in riparian, wetland, or floodplain areas unless used for dike construction. Dike construction would take place only to 1) restore historic hydrology when modifications on adjacent ownerships prevent re-contouring or use of other methods to restore the historic physical condition, or 2) prevent flooding of adjacent landowners' properties not involved in the project. Sedimentation and erosion controls must be implemented to prevent adverse impacts to down slope habitats. Disposal sites should be revegetated with native vegetation as soon as possible.
3. Project coordinators must ensure that all waste resulting from the completion of a project is removed and disposed of properly before work crews vacate the project site.
4. Structures containing concrete or wood preservatives must be cured or dried before they are placed in streams, riparian zones, or wetlands. Wet concrete or runoff from cleaning tools that have wet concrete slurry or lye dust must never enter aquatic habitats. Runoff control measures must be employed, such as hay bales and silt fences, until the risk of aquatic contamination has ended.
5. Monitoring is required during project implementation and for at least one year following project completion to ensure that restoration activities implemented at individual project sites are functioning as intended and do not create unintended consequences to fish, wildlife, and plant species and their critical habitats or adversely impact human health and safety. Corrective actions, as appropriate, must be taken for potential or actual problems.

***Riparian/Wetland Restoration Conservation Measures:***

1. Bank stabilizing vegetation removed or altered because of restoration activities must be replanted with native vegetation and protected from further disturbance until new growth is well established. Native shrubs and trees should also be included in the reclamation of disturbed sites. Waste organic materials (e.g., discarded lumber, woody vegetation) must not be used to stabilize soils and slopes in disturbed areas. Metal refuse or debris (e.g., petroleum containers, car bodies) must not be used for stream bank protection; this violates both state and federal regulations. Also, broken asphalt and tires must not be used due to potential seepage of petroleum and other toxic chemicals. Concrete is not recommended for bank stabilization projects. Do not use instream materials (e.g., stream debris and gravels) to replace or restore eroded stream banks. Stabilization projects should employ bioengineering methods to the greatest extent possible.
2. Sedimentation and erosion controls must be implemented on site at all times during wetland restoration or creation activities to maintain the water quality of adjacent water sources.
3. Restoration activities that require prescribed burning of slash material or invasive vegetation must be planned and managed to maximize the benefits and reduce the detrimental effects of burns. Slash control and disposal must also be completed in a way that reduces the occurrence of debris from entering stream channels. Reduce the potential for very hot burns to conserve litter layers and eliminate or reduce the development of hydrophobic soil conditions. Develop plans for rapid site revegetation. Always consider non-burning alternatives whenever possible. Fire suppression equipment must always be located at the immediate project site during prescribed burnings.
4. Slash materials should be gathered by hand or with light machinery to reduce soil disturbances and compaction of soils. Avoid accumulating or spreading slash in upland draws, depressions, intermittent streams, and springs. Slash control and disposal activities should be conducted in a way that reduces

the occurrence of debris in streams. These practices will eliminate or reduce debris torrents, avalanches, flows, and slides.

5. Retain or develop snags on project sites for cavity dependent wildlife species whenever possible.
6. Abandoned and decommissioned roadways must be re-vegetated. Compacted road surfaces will be tilled to promote vegetation establishment and growth. Ensure that drainage patterns on these roadways will not result in increased sedimentation rates or erosion to down slope habitats. Drainage improvements should be constructed and stabilized before the rainy season. Install water energy dissipaters (e.g., water bars and rolling dips) along roadways and on all cross drain outfalls. Do not side cast excavated road materials, and avoid accumulating or spreading these materials in upland draws, depressions, intermittent streams, and springs. Road entrances closed by tanking or ditching must have the excavated/disturbed areas stabilized as soon as possible.
7. Purchase seedlings from reputable suppliers or growers. Hardwood and conifer seedlings should be stored, handled, and planted properly. Seeds used to grow seedlings should have been collected in an area where the environmental conditions (e.g., elevation and range) closely match those on project sites; refer to a tree seed zone map and ensure that every purchased box or bag of seedlings are clearly marked with the seed zone and elevation. Reduce seedling competition by clearing grasses, forbs, and woody shrubs from around each seedling for a minimum distance of three feet. Employ the proper methods to protect seedlings from animal, insect, and environmental damages. Periodically examine planted seedlings for damages and diseases. Contact your local state forester or extension service agent for additional information or assistance.
8. Retain the appropriate amount of down and decaying woody debris to provide for wildlife habitats and nutrient recycling. Project coordinators should be aware of potential wildfire hazards in project areas because of retained woody debris.
9. Fall trees away from streams, riparian zones, and wetlands whenever possible. Tree falling on steep slopes should not be done or done in an appropriate manner to avoid damage to surrounding vegetation and soils. Employ the proper yarding technique on project sites to eliminate or reduce soil disturbances and compaction of soils.
10. Fence designs (e.g., wire type and wire spacing) and installations should not restrict the movement of any wildlife species; limit the use of woven wire fences whenever possible. The quality and durability of fencing materials must meet or exceed the intended management objectives. Fences must not be constructed in areas where natural barriers restrict livestock movements.
11. Livestock crossings and off-channel livestock watering facilities must not be located in areas where compaction and/or damage may occur to sensitive soils, slopes, or vegetation due to congregating livestock. Livestock fords across streams must be appropriately rocked to stabilize soils/slopes and prevent erosion. Do not use crushed rock to stabilize fords. Fords should be placed on bedrock or stable substrates whenever possible.
12. Silvicultural activities (e.g., herbicide treatment, thinning, and harvesting) should be limited or restricted on steep slopes and highly erodible soils to prevent accelerated soil erosion and increased sedimentation rates.
13. Fill material used on project sites must be from non-streambed and non-wetland sources that are free of fines. Deposition of materials must not violate state or federal regulations, standards, or guidelines as set forth by local Soil and Water Conservation Districts, U.S. Army Corps of Engineers, or other regulatory agencies.

## **Appendix D.**

## **Plant List**

**Appendix D.**

Compiled May 10, 2010

**Plant List - Ellicott Slough NWR**

**Ellicott Unit, Harkins Slough Unit, and Buena Vista**

Genus	Species	Family	Common name	Native	Buena Vista	Harkins Slough Unit	Ellicott Unit
Acacia	baileyana	Fabaceae	Cootamundra wattle	no	X		X
Acacia	dealbata	Fabaceae	Silver wattle	no	X	X	
Acacia	decurrens	Fabaceae	Green wattle	no	X		
Acacia	longifolia	Fabaceae	long-leaved wattle	no	X		
Acer	macrophyllum	Aceraceae	Big-leaf Maple	yes			X
Achillea	millefolium	Asteraceae	Yarrow	yes	X		X
Adenostoma	fasciculata	Rosaceae	Chamise	yes	X		
Aesculus	californica	Hippocastanaceae	Calif. Buckeye	yes		X	X
Ageratina	adenophora	Asteraceae	Sticky snake root	no	X		X
Agrostis	sp.	Poaceae	bent grass	yes	X		
Ailanthus	altissima	Simaroubaceae	Tree of Heaven	no			X
Aira	caryophylla	Poaceae	Silver hair grass	no	X		X
Alisma	plantago-aquatica	Alismataceae	Water plantain	yes		X	
Alopecurus	pratensis	Poaceae	Meadow foxtail	no		X	
Anagallis	arvensis	Myrsinaceae	Scarlet pimpernel	no	X		
Anagallis	arvensis	Primulaceae	Scarlet pimpernel	no		X	X
Anagallis	minimus	Myrsinaceae	Chaff weed	no	X		
Anaphalis	margaritacea	Asteraceae	Everlasting, pearly	yes		X	
Anthemis	cotula	Asteraceae	Mayweed	no		X	
Anthriscus	scandicina	Apiaceae	Chervil	no			X
Arabis	glabra	Brassicaceae		yes	X		
Arbutus	menziesii	Ericaceae	Madrone	yes	X	X	X
Arctostaphylos	hookeri ssp. h.	Ericaceae	Hooker's manzanita	yes	X		
Arctostaphylos	tomentosa ssp. crinita	Ericaceae	Hairy manzanita	yes	X		
Artemisia	biennis	Asteraceae	Biennial sagewort	no		X	
Artemisia	douglasiana	Asteraceae	Mugwort	yes	X		X
Aster	chilensis	Asteraceae	Common Calif. Aster	yes		X	
Atriplex	triangularis	Chenopodiaceae	Sparscale	yes		X	
Avena	barbata	Poaceae	Slender wild oat	no	X		X
Avena	sp	Poaceae	Oats	no		X	
Avena	sativa	Poaceae	Cultivated Oat	no			X

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Compiled May 10, 2010

Ellicott Unit, Harkins Slough Unit, and Buena Vista

Genus	Species	Family	Common name	Native	Buena Vista	Harkins Slough Unit	Ellicott Unit
Azolla	filiculoides	Azollaceae	Water fern	yes		X	
Baccharis	douglasii	Asteraceae	Salt marsh baccharis	yes	X		X
Baccharis	pilularis	Asteraceae	Coyote brush	yes	X	X	
Baccharis	pilularis var. consanguinea	Asteraceae	Coyote Brush	yes			X
Bidens	laevis	Asteraceae	Bur-marigold	yes		X	
Brassica	rapa	Brassicaceae	Field mustard	no	X	X	
Brassica	campestris	Brassicaceae	Field Mustard	no			X
Brassica	nigra	Brassicaceae	Black Mustard	no			X
Briza	maxima	Poaceae	Rattlesnake grass	no	X		X
Briza	minor	Poaceae	Little quaking grass	no	X		X
Bromus	carinatus	Poaceae	California brome	yes	X		
Bromus	diandrus	Poaceae	ripgut brome	no	X	X	X
Bromus	hordeaceus	Poaceae	Soft chess	no	X	X	X
Bromus	laevipes	Poaceae	Perennial brome	yes	X		
Bromus	madritensis ssp. m.	Poaceae	Spanish brome	no	X		
Bromus	briziformis	Poaceae	Rattlesnake Grass	no			X
Calandrinia	ciliata	Portulacaceae	Red Maids	yes			X
Callitriche	heterophylla var. bolanderi	Callitricaceae		yes	X		
Calystegia	sp.	Convolvulaceae	Morning glory			X	
Camissonia	micrantha	Onagraceae	miniature suncup	yes	X		
Camissonia	ovata	Onagraceae	Suncup	yes	X	X	X
Cardamine	oligosperma	Brassicaceae	Bitter cress	yes	X	X	
Cardionema	ramosissimum	Caryophyllaceae	Sand carpet	yes	X		
Carduus	pycnocephalus	Asteraceae	Italian thistle	no	X	X	X
Carduus	tenuiflorus	Asteraceae	Slender-flowered Thistle	no			X
Carex	barbarae	Cyperaceae	St. Barbara sedge	yes	X	X	
Carex	globosa	Cyperaceae	Round fruited sedge	yes	X		
Carex	harfordii	Cyperaceae	Harford's sedge	yes	X		
Carex	obnupta	Cyperaceae	Slough dedge	yes	X		
Carex	praegracilis	Cyperaceae	Clustered Field Sedge	yes			X
Carex	sp.	Cyperaceae	Sedge sp.				X

## Appendix D.

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## Ellicott Unit, Harkins Slough Unit, and Buena Vista

Genus	Species	Family	Common name	Native	Buena Vista	Harkins Slough Unit	Ellicott Unit
Carpobrotus	edulis	Aizoaceae	Ice plant	no	X	X	X
Castilleja	densiflora	Scrophulariaceae	Owl's clover	yes	X		
Castilleja	exserta	Scrophulariaceae	Pink owl's clover	yes		X	
Castilleja	exserta ssp. exserta	Scrophulariaceae	Escobita owl's clover	yes	X		
Casuarina	equisetifolia	Casuarinaceae	Australian pine	no	X		
Ceanothus	papillosus	Rhamnaceae	Ceanothus	yes	X		
Ceanothus	thyrsiflorus	Rhamnaceae	California Wild Lilac	yes			X
Centaurea	melitensis	Asteraceae	Napa Starthistle	no			X
Centaureae	solstitialis	Asteraceae	Star thistle	no	X		X
Centromadia	parryi ssp. congdonii	Asteraceae	Congdon's tarplant	yes		X	
Cerastium	glomeratum	Caryophyllaceae	Mouse ear chickweed	no	X	X	
Chamomilla	suaveolens	Asteraceae	Pineapple weed	no	X		
Chlorogalum	pomeridianum	Liliaceae	Soap plant	yes		X	
Chorizanthe	robusta v. robusta	Polygonaceae	Monterey spineflower	yes	X		X
Cirsium	brevistylum	Asteraceae	Indian thistle	yes	X	X	
Cirsium	vulgare	Asteraceae	Bull thistle	no	X	X	X
Clarkia	purpurea ssp. quadrivulnera	Onagraceae	four spot	yes	X		
Claytonia	perfoliata	Portulacaceae	Miner's lettuce	yes	X	X	X
Claytonia	parviflora	Portulacaceae	Miner's Lettuce (thin leaves)	yes			X
Conium	maculatum	Apiaceae	Poison hemlock	no	X	X	X
Convolvuls	arvensis	Convolvulaceae	bindweed	no		X	
Conyza	canadensis	Asteraceae	Horseweed	no	X	X	X
Corallorhiza	maculata (f. immaculata)	Orchidaceae	coral root	yes	X		
Corethrogyne	filaginifolia	Asteraceae	sand-aster	yes	X		
Cornus	sericea	Cornaceae	Western red dogwood	yes		X	
Cortaderia	jubata	Poaceae	Pampas grass	no	X		
Cortaderia	sellanoa	Poaceae	Pampas grass	no		X	X
Corylus	cornuta v. californica	Betulacaceae	Hazelnut	yes	X		
Cotoneaster	pannosa	Rosaceae	Cotoneaster	no		X	X
Cotula	coronopifolia	Asteraceae	brass buttons	no	X		
Crassula	aquatica	Crassulaceae	Water pygmy weed	yes	X		

Appendix D.

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Ellicott Unit, Harkins Slough Unit, and Buena Vista

Genus	Species	Family	Common name	Native	Buena Vista	Harkins Slough Unit	Ellicott Unit
Crassula	connata	Crassulaceae	Pygmy weed	yes	X		
Crassula	tillea	Crassulaceae	Moss pygmyweed	no	X	X	
Crypsis	schoenoides	Poaceae	Swamp grass	no		X	
Cryptantha	clevelandii	Boraginaceae	Cryptantha	yes	X		
Cryptantha	micromeres	Boraginaceae	Cryptantha	yes	X		
Cryptantha	sp.	Boraginaceae		yes			X
Cupressus	abramsiana ?	Cupressaceae	Santa Cruz cypress	yes		X	
Cupressus	macrocarpa	Cupressaceae	Monterey cypress	yes	X	X	X
Cuscuta	sp.	Cuscutaceae	Dodder	yes		X	
Cynodon	dactylon	Poaceae	Bermuda grass	no	X	X	X
Cynoglossum	grande	Boraginaceae	Houndstongue	yes	X		
Cyperus	eragrostis	Cyperaceae	Umbrella sedge	yes	X	X	
Cyperus	squarrosus	Cyperaceae		yes		X	
Cyperus	niger	Cyperaceae	Smooth Cyperus	yes			X
Cyperus	sp.	Cyperaceae	Nutsedge sp.				X
Cytisus	scoparius	Fabaceae	Scotch broom	no		X	X
Dactylis	glomerata	Poaceae	Orchard grass	no	X		
Danthonia	californica	Poaceae	Cal. Oat grass	yes	X		
Datura	sp.	Solanaceae					X
Deschampsia	cespitosa	Poaceae	hair grass	yes	X		
Deschampsia	elongata	Poaceae	hair grass	yes	X		
Dichelostemma	capitatum	Themidaceae	Blue dicks	yes	X		
Dipsacus	fullonum	Dipsacaceae	Wild teasel	no		X	
Dryopteris	arguta	Dryopteridaceae	California woodfern	yes	X	X	X
Dysphania	ambrosioides	Chenopodiaceae	Mexican tea	no	X	X	
Echinochloa	crus-galli	Poaceae	Barnyard grass	no		X	
Elatine	heteranda	Elatinaceae	water wort	yes	X		
Eleocharis	acicularis	Cyperaceae	spikerush	yes	X		
Eleocharis	macrostachya	Cyperaceae	spikerush	yes	X		X
Eleocharis	montevidensis	Cyperaceae	Dombey's spike rush	yes		X	
Eleocharis	sp.	Cyperaceae					X

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Ellicott Unit, Harkins Slough Unit, and Buena Vista

Genus	Species	Family	Common name	Native	Buena Vista	Harkins Slough Unit	Ellicott Unit
Elymus	californicus	Poaceae	Cal. Bottle-bush grass	yes	X		
Elymus	glaucus	Poaceae	blue wild-rye	yes	X		
Epilobium	ciliatum	Onagraceae	Calif. Willow herb	yes	X	X	
Epilobium	pygmaeum	Onagraceae	Smooth boiduvalia	yes		X	
Epilobium	angustifolium	Onagraceae	Fireweed	yes			X
Equisetum	hyemale	Equisetaceae	scouring rush	yes	X		
Equisetum	laevigatum	Equisetaceae	Smooth Scouring Rush	yes			X
Equisetum	telmateia	Equisetaceae	Horsetail	yes		X	
Erechtites	glomerata	Asteraceae	Cut-leaved Coast Fireweed	no	X		X
Erechtites	minus	Asteraceae	erechites	no	X		
Eriophyllum	confertiflorum	Asteraceae	golden yarrow	yes	X		
Eriophyllum	staechadifolium	Asteraceae	Lizard tail	yes	X		X
Erodium	botrys	Geraniaceae	storkbill filaree	no	X		X
Erodium	cicutarium	Geraniaceae	Redstem filaree	no	X	X	X
Erodium	moschatum	Geraniaceae	green stemfilaree	no	X		
Eschscholzia	californica	Papaveraceae	California poppy	yes	X	X	X
Eucalyptus	globulus	Myrtaceae	Blue gum	no	X		X
Eucalyptus	tereticornis	Myrtaceae	eucalyptus	no	X		
Euphorbia	crenulata	Euphorbiaceae	spurge	no	X	X	
Euphorbia	lathyris	Euphorbiaceae	caper spurge	no	X		
Euphorbia	spathulata	Euphorbiaceae	spurge	yes	X		
Euphorbia	esula	Euphorbiaceae	Leafy Spurge	no			X
Euthamia	occidentalis	Asteraceae	Western Goldenrod	yes	X	X	X
Festuca	californica	Poaceae	California Fescue	yes			X
Festuca	myuros	Poaceae	Rattail Fescue	no			X
Filago gallica		Asteraceae	Narrow Leaved Filago	no			X
Foeniculum	vulgare	Apiaceae	Fennel	no		X	X
Fragaria	vesca	Rosaceae	Strawberry	yes	X		
Galium	aparine	Rubiaceae	Goose grass	yes	X	X	
Galium	californicum	Rubiaceae	Calif. Bedstraw	yes	X		
Galium	porrigens	Rubiaceae	Climbing bedstraw	yes	X		

## Ellicott Unit, Harkins Slough Unit, and Buena Vista

Genus	Species	Family	Common name	Native	Buena Vista	Harkins Slough Unit	Ellicott Unit
Galium	trifidum	Rubiaceae	Bedstraw	yes			X
Garrya	elliptica	Garryaceae	Coast silk tassel	yes	X		
Genista	monspessulana	Fabaceae	French broom	no	X	X	X
Geranium	carolinianum	Geraniaceae	wild geranium	yes	X		
Geranium	dissectum	Geraniaceae	Cut-leaved geranium	no	X	X	X
Gnaphalium	californicum	Asteraceae	Calif. Everlasting	yes	X		
Gnaphalium	luteoalbum	Asteraceae	cudweed	no	X		X
Gnaphalium	palustre	Asteraceae	Cudweed	yes	X	X	
Gnaphalium	purpureum	Asteraceae	Purple cudweed	yes	X		
Gnaphalium	ramosissimum	Asteraceae	PINK EVERLASTING	yes	X		X
Gnaphalium	stramineum	Asteraceae	Cotton-batting	yes	X		X
Gnaphalium	sp.	Asteraceae	Everlasting sp.			X	X
Hedera	helix	Araliaceae	English ivy	no	X	X	
Helenium	puberulum	Asteraceae	sneezeweed	yes	X		
Helianthemum	scoparium	Cistaceae	Broom rose	yes	X		
Hemizonia	congesta	Asteraceae	tarweed	yes	X		
Hesperocnide	tenella	Urticaceae	black-hair nettle	yes	X		
Heterocodon	rariflorum	Campanulaceae	heterocodon	yes	X		
Heteromeles	arbutifolia	Rosaceae	Toyon	yes	X	X	X
Heterotheca	grandiflora	Asteraceae	telegraph weed	yes	X		X
Heuchera	sp.	Saxifragaceae		yes	X	X	
Hirschfeldia	incana	Brassicaceae	mustard	no	X		
Holcus	lanatus	Poaceae	Velvet grass	no	X	X	X
Hordeum	murinum	Poaceae	Barnyard foxtail	no	X	X	
Hordeum	vulgare	Poaceae	Barley	no			X
Horkelia	cuneata ssp. Sericea	Rosaceae	wedge-leaf horkelia	yes	X		
Hydrocotyle	ranunculoides	Apiaceae	Marsh pennywort	yes		X	
Hypochaeris	glabra	Asteraceae	Smooth cat's ear	no	X	X	
Hypochaeris	radicata	Asteraceae	Hairy cat's ear	no	X	X	X
Ilex	sp.	Aquafoliaceae	Holly	no	X		
Iris	douglasiana	Iridaceae	Douglas's Iris?	yes	X		

## Appendix D.

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## Ellicott Unit, Harkins Slough Unit, and Buena Vista

Genus	Species	Family	Common name	Native	Buena Vista	Harkins Slough Unit	Ellicott Unit
Juglans	regia	Juglandaceae	English walnut	no	X		
Juncus	bufonius	Juncaceae	Toad rush	yes	X	X	X
Juncus	capitatus	Juncaceae	rush	no	X		
Juncus	effusus	Juncaceae	rush	yes	X		
Juncus	effusus v. pacificus	Juncaceae	Pacific Bog Rush	yes		X	X
Juncus	falcatus v. f.	Juncaceae	Falcate rush	yes	X		X
Juncus	occidentalis	Juncaceae	rush	yes	X		
Juncus	patens	Juncaceae	rush	yes	X		X
Juncus	phaeococephalus	Juncaceae	rush	yes	X		X
Juncus	xiphiodes	Juncaceae	Iris-leaved Rush	yes			X
Kickxia	elatine	Scrophulariaceae	Sharp leaved fluellin	no		X	
Kniphofia	uvaria	Liliaceae	Candlelight Red Hot Poker	no			X
Lathyrus	sp.	Fabaceae	sweet pea-domestic	no	X		
Lathyrus	vestitus	Fabaceae	Woodland pea	yes		X	
Lavatera	arborea	Malvaceae	Tree mallow	no		X	
Lavatera	assurgentiflora	Malvaceae	English Lavander	yes			X
Layia	hieracioides	Asteraceae	layia	yes	X		
Lemna	gibba	Lemnaceae	Gibbous duckweed	yes		X	
Lepechinia	arbutifolia	Lamiaceae	White pitcher sage	yes	X		
Lepidium	latifolium	Brassicaceae	Perennial peppergrass	no		X	
Lepidium	nitidum	Brassicaceae	peppergrass	yes	X		
Leptochloa	fascicularis	Poaceae	Bearded Sprangletop	no			X
Lessingia	filaginifolia	Asteraceae	California Aster	yes			X
Lilaea	scilloides	Juncaginaceae	Juncaginaceae	yes	X		
Linanthus	bicolor	Polemoniaceae	Baby Stars	yes			X
Linaria	canadensis	Plantaginaceae	Toad flax	yes	X		
Linaria	canadensis	Scrophulariaceae	Blue Toadflax	yes			X
Lithocarpus	densiflorus	Fagaceae	Tanbark Oak	yes			X
Logfia	gallica	Asteraceae	cotton rose	no	X		
Lolium	multiflorum	Poaceae	Italian ryegrass	no	X	X	X
Lolium	perrene	Poaceae	Perennial ryegrass	no		X	

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## Ellicott Unit, Harkins Slough Unit, and Buena Vista

Genus	Species	Family	Common name	Native	Buena Vista	Harkins Slough Unit	Ellicott Unit
Lonicera	hispidula	Caprifoliaceae	Pink honeysuckle	yes	X		
Lotus	formosissimus	Fabaceae	witch's teeth	yes	X		
Lotus	purshianus	Fabaceae	pink lotus	yes	X		X
Lotus	scoparius	Fabaceae	Deerweed	yes	X		X
Lotus	wrangelianus	Fabaceae	yellow lotus	yes	X		
Lotus	corniculatus	Fabaceae	Birdfoot trefoil	no		X	
Lotus	oblongifolius	Fabaceae	Narrow-leaved Clover	yes			X
Lotus	strigosus	Fabaceae	Bishop's lotus	yes		X	
Ludwigia	peplodes	Onagraceae	Sixpetal water primrose	yes		X	
Lupinus	albifrons v. a. (chamissononis?)	Fabaceae	Silver lupine	yes	X		
Lupinus	arboreus	Fabaceae	Coastal bush lupine	yes	X	X	X
Lupinus	bicolor	Fabaceae	miniature lupine	yes	X		X
Lupinus	chamissonis	Fabaceae	Silver lupine	yes	X		
Lupinus	nanus	Fabaceae	sky lupine	yes	X		X
Luzula	comosa	Juncaceae	Wood rush	yes	X		
Lythrum	hyssopifolium	Lythraceae	Loosestrife	no	X	X	X
Madia	exigua	Asteraceae	miniature tarweed	yes	X		
Madia	gracilis	Asteraceae	Slender tarweed	Y	X		
Madia	sativa	Asteraceae	Coast tarweed	yes		X	X
Magnolia	grandiflora	Magnoliaceae	Southern magnolia	np	X		
Maianthemum	racemosum	Ruscaceae	false soloman's seal	yes	X		
Malacothrix	sp.	Asteraceae					X
Malus	sylvestris	Rosaceae	Apple	no	X		
Malva	parviflora	Malvaceae	Cheeseweed	no	X	X	X
Marah	fabaceous	Cucurbitaceae	Wild cucumber	no	X	X	X
Marrubium	vulgare	Lamiaceae	Common Horehound	no			X
Medicago	polymorpha	Fabaceae	Bur-clover	no	X	X	
Medicago	lupulina	Fabaceae	Black Medick	no			X
Medicago	minima	Fabaceae	Bur Clover	no			X
Melica	imperfecta	Poaceae	melic grass	yes	X		
Melilotus	alba	Fabaceae	White sweetclover	no		X	

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Ellicott Unit, Harkins Slough Unit, and Buena Vista

Genus	Species	Family	Common name	Native	Buena Vista	Harkins Slough Unit	Ellicott Unit
Melilotus	indica	Fabaceae	yellow sweet-clover	no	X		
Mentha	pulegium	Lamiaceae	pennyroyal	no		X	
Mimulus	aurantiacus	Phrymaceae	Sticky monkey-flower	yes	X		
Mimulus	aurantiacus	Scrophulariaceae	Sticky monkey flower	yes	X	X	X
Nassella	lepida	Poaceae	slender needlegrass	yes	X		
Nassella	pulchra	Poaceae	purple needlegrass	yes	X		
Navarretia	hamata	Polemoniaceae	Navarretia	yes	X		
Navarretia	mellita	Polemoniaceae	Navarretia	yes	X		
Navarretia	squarrosa	Polemoniaceae	Skunkweed	yes			X
Oenanthe	sarmentosa	Apiaceae	Pacific oenanthe	yes		X	
Oenothera	elata (ssp hookeri?)	Onagraceae	Evening primrose,Hook.	yes		X	
Oenothera	hookeri	Onagraceae	Evening Primrose	yes			X
Onopordum	acanthium	Asteraceae	Scotch thistle	no		X	
Orthocarpus	purpurascens	Scrophulariaceae	Owl Clover	yes			X
Oxalis	corniculata	Oxalidaceae	Creeping oxalis	no	X		
Oxalis	pes-caprae	Oxalidaceae	Lemon grass	no		X	X
Oxalis	albicans	Oxalidaceae	Hairy Wood Sorrel	yes			X
Paspalum	distichum	Poaceae	Knot grass	Yes		X	
Pectocarya	linearis	Boraginaceae	comb seed	yes	X		
Pennisetum	clandestinum	Poaceae	Kikuyu grass	no	X	X	
Pentagramma	triangularis	Pteridaceae	Goldback fern	yes	X	X	X
Perideria	kelloggii	Apiaceae	yampah	yes	X		
Phleum	pratense	Poaceae	Cultivated Timothy	no			X
Phyla	nodiflora	Verbenaceae	Garden lippia	no		X	
Picris	echioides	Asteraceae	Bristly oxtongue	no		X	
Pinus	muricata	Pinaceae	Bishop pine	yes	X		
Pinus	radiata	Pinaceae	Monterey pine	yes	X	X	X
Plagiobothrys	canescens	Boraginaceae	Valley popcorn flower	yes	X		
Plagiobothrys	sp.(trachycarpus?)	Boraginaceae	Popcorn flower	yes		X	
Plagiobothrys	undulatus	Boraginaceae	Coast popcorn flower	yes		X	
Plantago	coronopus	Plantaginaceae	Cutleaf plantain	no	X	X	X

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Ellicott Unit, Harkins Slough Unit, and Buena Vista

Genus	Species	Family	Common name	Native	Buena Vista	Harkins Slough Unit	Ellicott Unit
Plantago	erecta	Plantaginaceae	California plantain	yes	X		
Plantago	lanceolata	Plantaginaceae	English plantain	no	X	X	X
Plantago	sp.	Plantaginaceae					X
Poa	annua	Poaceae	blue grass	no	X		
Pogogyne	serpylloides	Lamiaceae	pogogyne	yes	X		
Polycarpon	depressum	Caryophyllaceae	allseed	yes	X		
Polygala	californicus	Polygalaceae	milkwort	yes	X		
Polygonum	amphibium	Polygonaceae	Water smartweed	yes		X	X
Polygonum	arenastrum	Polygonaceae	knot weed	no	X		
Polygonum	hydropiper	Polygonaceae	Marsh pepper	no		X	
Polygonum	hydropiperoides	Polygonaceae	Water pepper	yes		X	
Polygonum	lapathifolium	Polygonaceae	Willow weed	yes		X	
Polygonum	persicaria	Polygonaceae	Lady's thumb	no		X	
Polypogon	interruptus	Poaceae	beard grass	no	X		
Polypogon	monspeliensis	Poaceae	Rabbitsfoot grass	no	X	X	X
Polystichum	munitum	Dryopteridaceae	Western Sword Fern	yes			X
Populus	trichocarpa	Salicaceae	Black cottonwood	yes	X		X
Portulaca	oleracea	Portulacaceae	purslane	no	X		
Potamogeton	sp.	Potamogetonaceae	pondweed		X		
Potentilla	anserina ssp. pacifica	Rosaceae	Pacific cinquefoil	yes		X	
Potentilla	glandulosa	Rosaceae	Common cinquefoil	yes	X	X	
Prunus	amygdalus	Rosaceae	Peach	no	X		
Prunus	avium	Rosaceae	Sweet cherry	no	X		
Pseudotsuga	menziesii	Pinaceae	Douglas fir	yes	X	X	X
Psilocarpus	brevissimus	Asteraceae	wooly heads	yes	X		
Pteridium	aqualinum v. pubescens	Dennstaedtiaceae	Western bracken	yes	X		X
Pterostegium	drymarioides	Polygonaceae	notchleaf	yes	X		
Pyracantha	angustifolia	Rosaceae	Firethorn	no			X
Quercus	agrifolia	Fagaceae	Coast live oak	yes	X	X	X
Quercus	wislezenii	Fagaceae	Interior live oak	yes		X	
Ranunculus	californicus	Ranunculaceae	California buttercup	yes	X	X	X

## Appendix D.

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## Ellicott Unit, Harkins Slough Unit, and Buena Vista

Genus	Species	Family	Common name	Native	Buena Vista	Harkins Slough Unit	Ellicott Unit
Ranunculus	pusillus ?	Ranunculaceae	Low Buttercup	yes			X
Raphanus	sativus	Brassicaceae	radish	no	X	X	X
Rhamnus	californicus	Rhamnaceae	California Coffeeberry	yes	X	X	X
Ribes	(menziesii v. m.?)	Grossulariaceae	Gooseberry	yes		X	
Ribes	divaricatum v. pubiflorum	Grossulariaceae	Straggly gooseberry	yes	X		
Ribes	divaricatum	Grossulariaceae	Gooseberry	yes			X
Robinia	pseudoacacia	Fabaceae	Black Locust	no			X
Rorippa	palustris v. occidentalis	Brassicaceae	Marsh yellowcress	yes		X	
Rosa	californica	Rosaceae	California rose	yes	X	X	X
Rosa	gymnocarpa	Rosaceae	Wild rose	yes	X		
Rosa	spithamea	Rosaceae	Ground rose	yes	X		
Rosmarinus	sp.	Lamiaceae	common rosemary	no		X	
Rubus	discolor	Rosaceae	Himalayan blackberry	no		X	
Rubus	ursinus	Rosaceae	California blackberry	yes	X	X	X
Rubus	leucodermis	Rosaceae	Western Raspberry	yes			X
Rumex	acetosella	Polygonaceae	Sheep sorrel	no	X	X	X
Rumex	conglomeratus	Polygonaceae	Clustered dock	no	X	X	
Rumex	crispus	Polygonaceae	Curly dock	no	X	X	X
Rumex	maritimus	Polygonaceae	Golden dock	yes		X	
Rumex	salicifolius	Polygonaceae	willow-leaf dock	yes	X		X
Rupertia	physodes	Fabaceae	calif. Tea	yes	X		
Sagina	apetala	Caryophyllaceae	pearlwort	yes	X		
Salix	lasiolepis	Salicaceae	Arroyo willow	yes	X	X	
Salix	lucida var. lasiandra	Salicaceae	Yellow willow	yes	X		
Salix	laevigata	Salicaceae	Red Willow	yes			
Salix	lasiolepis var. bigelovii	Salicaceae	Arroyo Willow	yes			X
Salix	sp.	Salicaceae	Willow sp.	yes			X
Salix	stichensis	Salicaceae	Sitka willow	yes		X	X
Salvia	mellifera	Lamiaceae	Black sage	yes	X		
Sambucus	mexicana	Adoxaceae	Blue elderberry	yes	X		
Sambucus	mexicana	Caprifoliaceae	Blue elderberry	yes		X	X

## Appendix D.

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## Ellicott Unit, Harkins Slough Unit, and Buena Vista

Genus	Species	Family	Common name	Native	Buena Vista	Harkins Slough Unit	Ellicott Unit
Sanicula	crassicaulis	Apiaceae	Pacific sanicle	yes	X	X	X
Satureja	douglasii	Lamiaceae	Yerba buena	yes	X		X
Scirpus	americanus	Cyperaceae	Three square	yes		X	
Scirpus	californicus	Cyperaceae	California tule	yes	X	X	
Scrophularia	californica	Scrophulariaceae	California Figwort	yes			X
Scrophularia	californica ssp. floribunda	Scrophulariaceae	Figwort	Yes	X	X	
Senecio	vulgaris	Asteraceae	Ragwort	no	X	X	X
Senecio	mikanioides	Asteraceae	German ivy	no	X		
Sequoia	sempervirens	Taxodiaceae	Redwood	yes			X
Silene	gallica	Caryophyllaceae	catch-fly	no	X		X
Silybum	marianum	Asteraceae	Milk thistle	no		X	X
Sisymbrium	officinale	Brassicaceae	Hedge mustard	no		X	
Sisyrinchium	bellum	Iridaceae	Blue-eyed grass	yes	X	X	X
Solanum	americanum	Solanaceae	Small flowered niteshade	yes		X	
Solanum	douglasii	Solanaceae	nightshade	yes	X		
Solanum	nigrum	Solanaceae	Black nightshade	no	X		
Solanum	xanti	Solanaceae	purple nightshade	yes	X		
Solidago	canadensis	Asteraceae	Meadow goldenrod	yes		X	
Solidago	sp.	Asteraceae			X		
Solidago	spathulata	Asteraceae	Coast goldenrod	yes		X	
Solidago	velutinus sp. calif.	Asteraceae	Calif. Goldenrod	yes	X		
Sonchus	asper ssp. asper	Asteraceae	Prickly sow thistle	no	X	X	X
Sonchus	oleraceus	Asteraceae	common sow thistle	no	X	X	
Sparganium	eurycarpum	Typhaceae	Bur reed	yes		X	
Spartium	junceum	Fabaceae	Spanish broom	no	X		
Spergularia	sp.	Caryophyllaceae	sand-spurry	yes	X		
Stachys	ajugoides v. rigida	Lamiaceae	Rigid hedge nettle	yes		X	X
Stachys	bullata	Lamiaceae	California hedgenettle	yes	X	X	
Stellaria	media	Caryophyllaceae	Common chickweed	no	X	X	
Stylocline	sp. (gnaphaloides?)	Asteraceae	nest straw	yes	X		
Symphoricarpos	mollis	Caprifoliaceae	Snowberry	yes	X		

## Appendix D.

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## Ellicott Unit, Harkins Slough Unit, and Buena Vista

Genus	Species	Family	Common name	Native	Buena Vista	Harkins Slough Unit	Ellicott Unit
Symphyotrichum	chilensis	Asteraceae	Aster	yes	X		
Taraxacum	officinale	Asteraceae	Dandelion	no			X
Tetragonia	expansa	Aizoaceae	New Zealand Spinach	no			X
Toxicodendron	diversilobum	Anacardiaceae	Poison oak	yes	X	X	X
Tragopogon	porrifolius	Asteraceae	Salsify	no		X	
Trifolium	angustifolium	Fabaceae	Narrow leaf clover	no	X	X	X
Trifolium	bifidum	Fabaceae	notchleaf clover	yes	X		
Trifolium	campestre	Fabaceae	Hop clover	no	X		
Trifolium	ciliolatum	Fabaceae	foothill clover	yes	X		
Trifolium	dubium	Fabaceae	little hop clover	no	X		
Trifolium	hirtum	Fabaceae	Rose clover	no		X	
Trifolium	microcephalum	Fabaceae	little head clover	yes	X		
Trifolium	subterraneum	Fabaceae	Subterranean clover	no		X	
Trifolium	wildenovii	Fabaceae	tom-cat clover	yes	X		
Trifolium	barbigerum var. andrewsii	Fabaceae	Clover	yes			X
Trifolium	sp.	Fabaceae					X
Typha	latifolia	Typhaceae	broadleaf cattail	yes		X	
Urtica	dioica	Urticaceae	Stinging nettle	yes	X	X	
Urtica	holosericea	Urticaceae	Stinging Nettle	yes			X
Vaccinium	ovatum	Ericaceae	Huckleberry	yes	X		
Verbena	lasiostachys	Verbenaceae	common verbena	yes	X		X
Verbena	lasiostachys var. scabrida	Verbenaceae	Robust vervain	yes		X	
Verbena	litoralis	Verbenaceae	Seashore vervain	no		X	
Veronica	anagallis-aquatica	Scrophulariaceae	Water speedwell	no		X	
Veronica	persica	Scrophulariaceae	Persian speedwell	no		X	
Vicia	sativa	Fabaceae	spring vetch	no	X	X	X
Vinca	major	Apocynaceae	periwinkle	no	X	X	
Vulpia	bromoides	Poaceae	annual fescue	no	X		
Vulpia	myuros	Poaceae	fescue	no	X		
Vulpia	octoflora	Poaceae	six weeks fescue	yes	X		
Vulpia	sp.	Poaceae				X	

**Ellicott Unit, Harkins Slough Unit, and Buena Vista**

Genus	Species	Family	Common name	Native	Buena Vista	Harkins Slough Unit	Ellicott Unit
Wolffia	columbiana	Lemnaceae	Wolffia	yes		X	
Xanthium	strumarium	Asteraceae	Cockle burr	yes		X	
Zantedeschia	aethiopica	Araceae	Calla Lily	no			X
Zeltnera	davyi	Gentianaceae	Davy's centaury	yes	X		X
Zigadenus	fremontii	Melanthiaceae	Fremonts star lily	yes	X		
Plant list compiled from several surveys (does not include Calabasas Unit):							
<b>Ellicott Unit</b>							
1980 = plant study by Bruce Pavlik							
1997 = non-native plant inventory by Christine Aikens et. al.							
2001 = plant inventory by June Smith and Denise DellaSantina							
2003 = additions by Refuge staff							
<b>Buena Vista property</b>							
1995 = plant list from Coastal Resource Institute Survey							
2008-2010 = plant inventory by Tim Kask							
<b>Harkins Slough Unit</b>							
2007-2010 = plant inventory by Tim Kask							

**Appendix E.**

**Section 7, Endangered Species Act Compliance**



# United States Department of the Interior

FISH AND WILDLIFE SERVICE  
Ventura Fish and Wildlife Office  
2493 Portola Road, Suite B  
Ventura, California 93003



IN REPLY REFER TO:  
81440-2010-SL-0335

June 25, 2010

## Memorandum

To: Mark Pelz, Chief, Refuge Planning, Region 8

From: Douglass M. Cooper, Deputy Assistant Field Supervisor, Ventura Fish and Wildlife Office

Subject: Species List Request for Ellicott Slough National Wildlife Refuge, Santa Cruz County, California

We are responding to your request, dated June 14, 2010, for a list of federally threatened, endangered or candidate species that may occur at the Ellicott Slough National Wildlife Refuge in Santa Cruz County, California.

If you have any questions or need more information, please contact Chad Mitcham of my staff at (805) 644-1766, extension 335.

Enclosure



**FEDERALLY LISTED SPECIES WHICH MAY OCCUR AT THE ELLICOTT SLOUGH  
NATIONAL WILDLIFE REFUGE, SANTA CRUZ COUNTY, CALIFORNIA**

Birds

California least tern	<i>Sterna antillarum browni</i>	E
Western snowy plover	<i>Charadrius alexandrinus nivosus</i>	T
Southwestern willow flycatcher	<i>Empidonax trallii extimus</i>	E

Amphibians

California red-legged frog	<i>Rana aurora draytonii</i>	T
California tiger salamander	<i>Ambystoma californiense</i>	T
Santa Cruz long-toed salamander	<i>Ambystoma macrodactylum croceum</i>	E

Invertebrates

Smith's blue butterfly	<i>Euphilotes enoptes smithi</i>	E
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Plants

Santa Cruz tarplant	<i>Holocarpha macradenia</i>	T
Monterey spineflower	<i>Chorizanthe pungens</i> var. <i>pungens</i>	T
Robust spineflower	<i>Chorizanthe robusta</i> var. <i>robusta</i>	E

**Key:**

E Endangered

T Threatened

## **Appendix F.**

### **Wildlife List**

## Appendix F.

# Wildlife List

Table F-1. Wildlife Species of Ellicott Slough National Wildlife Refuge

	Common Name	Scientific Name	Federal	State	Occurrence
Amphibians	California tiger salamander	<i>Ambystoma californiense</i>	T	E	Known
	Santa Cruz long-toed salamander	<i>Ambystoma macrodactylum croceum</i>	E	E	Known
	Ensatina salamander	<i>Ensatina eschscholtzii</i>			Known
	Arboreal salamander	<i>Aneides lugubris</i>			Known
	California slender salamander	<i>Batrachoseps attenuatus</i>			Known
	Gabilan slender salamander	<i>Batrachoseps gabilanensis</i>			Possible
	Western toad	<i>Bufo boreas</i>			Possible
	Pacific chorus frog	<i>Pseudacris regilla</i>			Known
	California red-legged frog	<i>Rana aurora draytonii</i>	T		Known
	Bullfrog	<i>Rana catesbeiana</i>			Known
Reptiles	Western fence lizard	<i>Sceloporus occidentalis</i>			Known
	Coast horned lizard	<i>Phrynosoma coronatum frontale</i>		FP, SC	Possible
	Western skink	<i>Eumeces skiltonianus</i>		SC	Known
	Southern alligator lizard	<i>Elgaria multicarinata</i>			Known
	Ringneck snake	<i>Diadophis punctata</i>			Known
	Sharp-tailed snake	<i>Contia tenuis</i>			Possible
	Racer	<i>Coluber constricta</i>			Known
	Striped racer	<i>Masticophis lateralis</i>		T	Possible
	Gopher snake	<i>Pituophis melanoleuca</i>			Known
	Common kingsnake	<i>Lampropeltis getula</i>			Possible
	Common garter snake	<i>Thamnophis sirtalis</i>			Known
	Western terrestrial garter snake	<i>Thamnophis elegans</i>			Known
Birds	Snow goose	<i>Chen hyperborea</i>			Possible
	Canada goose	<i>Branta canadensis</i>			Known
	Tundra swan	<i>Cygnus columbianus</i>			Possible
	Gadwall	<i>Anas strepera</i>			Known
	Eurasian wigeon	<i>Anas penelope</i>			Possible

American wigeon	<i>Anas americana</i>			Known
Mallard	<i>Anas platyrhynchos</i>			Known
Blue-winged teal	<i>Anas discors</i>			Possible
Cinnamon teal	<i>Anas cyanoptera</i>			Possible
Northern shoveler	<i>Anas clypeata</i>			Possible
Northern pintail	<i>Anas acuta</i>			Known
Green-winged teal	<i>Anas crecca</i>			Possible
Canvasback	<i>Aythya valisineria</i>			Known
Ring-necked duck	<i>Aythya collaris</i>			Possible
Lesser scaup	<i>Aythya affinis</i>			Possible
Bufflehead	<i>Bucephala albeola</i>			Possible
Common goldeneye	<i>Bucephala clangula</i>			Possible
Hooded merganser	<i>Lophodytes cucullata</i>			Possible
Common merganser	<i>Mergus merganser</i>			Possible
Ruddy duck	<i>Oxyura jamaicensis</i>			Known
Ring-necked pheasant	<i>Phasianus colchicus</i>			Possible
California quail	<i>Callipepla californica</i>			Known
Pied-billed grebe	<i>Podilymbus podiceps</i>			Known
Eared grebe	<i>Podiceps nigricollis</i>			Possible
Western grebe	<i>Aechmophorus occidentalis</i>			Possible
Clark's grebe	<i>Aechmophorus clarkii</i>			Possible
American white pelican	<i>Pelecanus erythrorhynchos</i>			Known
Double-crested cormorant	<i>Phalacrocorax auritus</i>		SC	Known
American bittern	<i>Botaurus lentiginosus</i>			Known
Great blue heron	<i>Ardea herodias</i>			Known
Great egret	<i>Ardea alba</i>			Known
Snowy egret	<i>Egretta thula</i>			Known
Cattle egret	<i>Bubulcus ibis</i>			Possible
Green heron	<i>Butorides virescens</i>			Possible
Black-crowned night heron	<i>Nycticorax nycticorax</i>			Known
Turkey vulture	<i>Cathartes aura</i>			Known
Osprey	<i>Pandion haliaetus</i>	SC		Known
White-tailed kite	<i>Elanus coeruleus</i>		FP	Known
Northern harrier	<i>Circus cyaneus</i>		SC	Known
Sharp-shinned hawk	<i>Accipiter striatus</i>		SC	Possible
Cooper's hawk	<i>Accipiter cooperii</i>		SC	Known
Red-shouldered hawk	<i>Buteo lineatus</i>			Known
Red-tailed hawk	<i>Buteo jamaicensis</i>			Known
Rough-legged hawk	<i>Buteo lagopus</i>			Possible
Golden eagle	<i>Aquila chrysaetos</i>			Possible
American kestrel	<i>Falco sparverius</i>			Known
Merlin	<i>Falco columbarius</i>		SC	Possible
Peregrine falcon	<i>Falco peregrinus</i>	E	E, FP	Possible

Prairie falcon	<i>Falco mexicanus</i>			Possible
Virginia rail	<i>Rallus limicola</i>			Possible
Common moorhen	<i>Gallinula chloropus</i>			Possible
American coot	<i>Fulica americana</i>			Known
Semipalmated plover	<i>Charadrius semipalmata</i>			Possible
Killdeer	<i>Charadrius vociferus</i>			Known
American avocet	<i>Recurvirostra americana</i>			Possible
Spotted sandpiper	<i>Actitis macularia</i>			Possible
Greater yellowlegs	<i>Tringa melanoleuca</i>			Possible
Willet	<i>Catoptrophorus semipalmatus</i>			Possible
Long-billed curlew	<i>Numenius americanus</i>		SC	Possible
Marbled godwit	<i>Limosa fedoa</i>			Possible
Western sandpiper	<i>Calidris mauri</i>			Possible
Least sandpiper	<i>Calidris minutilla</i>			Possible
Long-billed dowitcher	<i>Limnodromus scolopaceus</i>			Possible
Common Snipe	<i>Gallinago gallinago</i>			Known
Ring-billed gull	<i>Larus delawarensis</i>			Possible
California gull	<i>Larus californicus</i>		SC	Possible
Herring gull	<i>Larus argentatus</i>			Possible
Western gull	<i>Larus occidentalis</i>			Known
Glaucous-winged gull	<i>Larus glaucescens</i>			Possible
Caspian tern	<i>Sterna caspia</i>			Possible
Forster's tern	<i>Sterna forsteri</i>			Possible
Rock pigeon	<i>Columba livia</i>			Known
Band-tailed pigeon	<i>Columba fasciata</i>			Known
Mourning dove	<i>Zenaida macroura</i>			Known
Barn owl	<i>Tyto alba</i>			Known
Western screech-owl	<i>Otus kennicottii</i>			Possible
Great horned owl	<i>Bubo virginianus</i>			Known
Burrowing owl	<i>Athene cunicularia</i>		SC	Possible
Short-eared owl	<i>Asio flammeus</i>		SC	Possible
Anna's hummingbird	<i>Calypte anna</i>			Known
Allen's hummingbird	<i>Selasphorus sasin</i>			Known
Belted kingfisher	<i>Ceryle alcyon</i>			Known
Acorn woodpecker	<i>Melanerpes formicivorus</i>			Known
Yellow-bellied sapsucker	<i>Sphyrapicus varius</i>			Possible
Nuttall's woodpecker	<i>Picoides nuttallii</i>			Possible
Downy woodpecker	<i>Picoides pubescens</i>			Known
Hairy woodpecker	<i>Picoides villosus</i>			Possible

Northern flicker	<i>Colaptes auratus</i>			Known
Western wood-pewee	<i>Contopus sordidulus</i>			Known
Pacific-slope flycatcher	<i>Empidonax difficilis</i>			Known
Olive-sided flycatcher	<i>Contopus cooperi</i>			Known
Black phoebe	<i>Sayornis nigricans</i>			Known
Say's phoebe	<i>Sayornis saya</i>			Possible
Ash-throated flycatcher	<i>Myiarchus cinerascens</i>			Known
Loggerhead shrike	<i>Lanius ludovicianus</i>		SC	Possible
Hutton's vireo	<i>Vireo huttoni</i>			Known
Warbling vireo	<i>Vireo gilvus</i>			Known
Steller's jay	<i>Cyanocitta stelleri</i>			Known
Western scrub-jay	<i>Aphelocoma coerulescens</i>			Known
American crow	<i>Corvus brachyrhynchos</i>			Known
Common raven	<i>Corvus corax</i>			Known
California horned lark	<i>Eremophila alpestris actia</i>		SC	Possible
Tree swallow	<i>Tachycineta bicolor</i>			Possible
Violet-green swallow	<i>Tachycineta thalassina</i>			Known
Northern rough-winged swallow	<i>Stelgidopteryx serripennis</i>			Known
Cliff swallow	<i>Petrochelidon pyrrhonota</i>			Known
Barn swallow	<i>Hirundo rustica</i>			Known
Chestnut-backed chickadee	<i>Poecile rufescens</i>			Known
Oak titmouse	<i>Baeolophus inornatus</i>			Possible
Bushtit	<i>Psaltiriparus minimus</i>			Known
Pygmy nuthatch	<i>Sitta pygmaea</i>			Known
Brown creeper	<i>Certhis americana</i>			Possible
Bewick's wren	<i>Thryomanes bewickii</i>			Known
House wren	<i>Troglodytes aedon</i>			Possible
Winter wren	<i>Troglodytes troglodytes</i>			Possible
Marsh wren	<i>Cistothorus palustris</i>			Possible
Wrentit	<i>Chamaea fasciata</i>			Known
Golden-crowned kinglet	<i>Regulus satrapa</i>			Known
Ruby-crowned kinglet	<i>Regulus calendula</i>			Known
Western bluebird	<i>Sialia mexicana</i>			Possible
Northern mockingbird	<i>Mimus polyglottos</i>			Known
California thrasher	<i>Toxostoma redivivum</i>			Known
Swainson's thrush	<i>Catharus ustulatus</i>			Known
Hermit thrush	<i>Catharus guttatus</i>			Known
American robin	<i>Turdus migratorius</i>			Known
Varied thrush	<i>Ixoreus naevius</i>			Possible
Wrentit	<i>Chamaea fasciata</i>			Known
European starling	<i>Sturnus vulgaris</i>			Known
American pipit	<i>Anthus rubescens</i>			Possible
Cedar waxwing	<i>Bombycilla cedrorum</i>			Known
Orange-crowned warbler	<i>Vermivora celata</i>			Known

	Yellow warbler	<i>Dendroica petechia</i>			Known
	Yellow-rumped warbler	<i>Dendroica coronata</i>			Known
	Townsend's warbler	<i>Dendroica townsendi</i>			Known
	MacGillivray's warbler	<i>Oporonis tolmiei</i>			Known
	Common yellowthroat	<i>Geothlypis trichas</i>			Known
	Wilson's warbler	<i>Wilsonia pusilla</i>			Known
	Western tanager	<i>Piranga ludoviciana</i>			Known
	Spotted towhee	<i>Pipilo maculatus</i>			Known
	California towhee	<i>Pipilo crissalis</i>			Known
	Savannah sparrow	<i>Passerculus sandwichensis</i>			Possible
	Fox sparrow	<i>Passerella iliaca</i>			Known
	Song sparrow	<i>Melospiza melodia</i>			Known
	Lincoln's sparrow	<i>Melospiza lincolni</i>			Known
	White-crowned sparrow	<i>Zonotrichia leucophrys</i>			Possible
	Golden-crowned sparrow	<i>Zonotrichia atricapilla</i>			Known
	Dark-eyed junco	<i>Junco hyemalis</i>			Known
	Black-headed grosbeak	<i>Pheucticus melanocephalus</i>			Possible
	Lazuli bunting	<i>Passerina amoena</i>			Possible
	Indigo bunting	<i>Passerina cyanea</i>			Possible
	Red-winged blackbird	<i>Agelaius phoeniceus</i>			Known
	Tricolored blackbird	<i>Agelaius tricolor</i>		SC	Possible
	Western meadowlark	<i>Sturnella neglecta</i>			Possible
	Brewer's blackbird	<i>Euphagus cyanocephalus</i>			Known
	Brown-headed cowbird	<i>Molothrus ater</i>			Possible
	Bullock's oriole	<i>Icterus bullockii</i>			Known
	Purple finch	<i>Carpodacus purpureus</i>			Known
	House finch	<i>Carpodacus mexicanus</i>			Known
	Pine siskin	<i>Carduelis pinus</i>			Known
	Lesser goldfinch	<i>Carduelis psaltria</i>			Known
	American goldfinch	<i>Carduelis tristis</i>			Known
	House sparrow	<i>Passer domesticus</i>			Possible
Mammals	Virginia opossum	<i>Didelphis virginianus</i>			Possible
	Monterey ornate shrew	<i>Sorex ornatus salarius</i>		SC	Possible
	Broad-footed mole	<i>Scapanus latimanus</i>			Possible
	Yuma myotis	<i>Myotis yumanensis</i>			Possible
	Long-eared myotis	<i>Myotis evotis</i>			Possible
	Long-legged myotis	<i>Myotis volans</i>			Possible
	California myotis	<i>Myotis californicus</i>			Possible
	Big brown bat	<i>Eptesicus fuscus</i>			Possible
	Western red bat	<i>Lasiurus blossevillii</i>			Possible
	Hoary bat	<i>Lasiurus cinereus</i>			Possible

Townsend's big-eared bat	<i>Corynorhinus townsendii</i>		SC	Possible
Pallid bat	<i>Antrozous pallidus</i>		SC	Possible
Brazilian free-tailed bat	<i>Tadarida brasiliensis</i>			Possible
Brush rabbit	<i>Sylvilagus bachmani</i>			Known
Desert cottontail	<i>Sylvilagus audubonii</i>			Possible
Black-tailed jackrabbit	<i>Lepus californicus</i>			Known
California ground squirrel	<i>Spermophilus beecheyi</i>			Known
Botta's pocket gopher	<i>Thomomys bottae</i>			Known
California pocket mouse	<i>Chaetodipus californicus</i>		SC	Possible
Narrow-faced kangaroo rat	<i>Dipodomys venustus</i>			Possible
Heermann's kangaroo rat	<i>Dipodomys heermanni</i>			Possible
Western harvest mouse	<i>Reithrodontomys megalotis</i>			Possible
California mouse	<i>Peromyscus californicus</i>			Known
Deer mouse	<i>Peromyscus maniculatus</i>		SC	Known
Piñon Mouse	<i>Peromyscus truei</i>			Known
House mouse	<i>Mus musculus</i>			Possible
Dusky-footed woodrat	<i>Neotoma fuscipes</i>			Known
California vole	<i>Microtus californicus</i>			Known
Common muskrat	<i>Ondatra zibethicus</i>			Known
Norway rat	<i>Rattus norvegicus</i>			Possible
Coyote	<i>Canis latrans</i>			Known
Red fox	<i>Vulpes vulpes</i>			Possible
Raccoon	<i>Procyon lotor</i>			Known
Long-tailed weasel	<i>Mustela frenata</i>			Possible
Striped skunk	<i>Mephitis mephitis</i>			Possible
Mountain lion	<i>Felis concolor</i>		FP	Known
Bobcat	<i>Felis rufus</i>			Known
Feral pig	<i>Sus scrofa</i>			Known
Mule deer	<i>Odocoileus hemionus columbianus</i>			Known

Federal status: E = Endangered, T = Threatened

State status: E = Endangered, T = Threatened, SC = Species of Concern, FP = Fully Protected

\* Possibly extirpated

## **Appendix G.**

# **Compatibility Determinations**

## **COMPATIBILITY DETERMINATION**

(April 29, 2010)

**Use:** Environmental Education and Interpretation

**Refuge Name:** Ellicott Slough National Wildlife Refuge, Santa Cruz County, California.

### **Establishing and Acquisition Authority:**

Ellicott Slough National Wildlife Refuge was established in 1975. Legal authority includes the Endangered Species Act of 1973 as amended (16 U.S.C. 1531-1543: 87 Statute 884).

### **Refuge Purpose(s):**

The Refuge's purposes are defined as the following:

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)

... the conservation of the wetlands of the Nation in order to maintain the public benefits they provide and to help fulfill international obligations contained in various migratory bird treaties and conventions ... 16 U.S.C. 3901(b) (Emergency Wetlands Resources Act of 1986)

**National Wildlife Refuge System Mission:** "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-ee]).

**Description of Use:** The National Wildlife Refuge System Improvement Act of 1997 identifies environmental education and interpretation as well as hunting, fishing, wildlife observation, and photography as priority wildlife-dependent public uses for Refuges. As two of the six priority public uses of the Refuge System, these uses are to be encouraged when compatible with the purposes of the Refuges. Environmental education and interpretation are considered simultaneously in this compatibility determination. Many elements of environmental education and interpretation are also similar to opportunities provided in the wildlife observation and photography program programs. These uses are identified and discussed in detail in the Draft Comprehensive Conservation Plan (CCP) and Environmental Assessment (EA) (USFWS 2010) which are incorporated by reference.

The guiding principles of the Refuge System's environmental education programs (605 FW 6 of the Service Manual) are to:

- Teach awareness, understanding, and appreciation of our natural and cultural resources and conservation history.
- Allow program participants to demonstrate learning through refuge-specific stewardship tasks and projects that they can carry over into their everyday lives.
- Establish partnerships to support environmental education both on- and off-site.
- Support local, State, and national educational standards through environmental education on refuges.
- Assist refuge staff, volunteers, and other partners in obtaining the knowledge, skills, and abilities to support environmental education.
- Provide appropriate materials, equipment, facilities, and study locations to support environmental education.
- Give refuges a way to serve as role models in the community for environmental stewardship.
- Minimize conflicts with visitors participating in other compatible wildlife-dependent recreation activities.

The guiding principles of the Refuge System's interpretive programs (605 FW 7 of the Service Manual) are to:

- Promote visitor understanding of, and increase appreciation for, America's natural and cultural resources and conservation history by providing safe, informative, enjoyable, and accessible interpretive opportunities, products, and facilities;
- Develop a sense of stewardship leading to actions and attitudes that reflect interest and respect for wildlife resources, cultural resources, and the environment;
- Provide quality interpretive experiences that help people understand and appreciate the individual refuge and its role in the Refuge System;
- Provide opportunities for quality recreational and interpretive experiences consistent with criteria describing quality found in 605 FW 1.6;
- Assist refuge staff, volunteers, and community support groups in attaining knowledge, skills, and abilities in support of interpretation; and
- Minimize conflicts with visitors participating in other compatible wildlife-dependent recreational activities.

### Environmental Education

The Refuge would continue the field-based program with Renaissance High School, using the Ellicott Unit as an on-site classroom. Renaissance students, under the direct supervision of Refuge staff, would assist in restoration activities and data collection.

The Refuge also proposes to expand the environmental education program to other local elementary, middle, and high schools using the Harkins Slough Unit as the on-site classroom. Harkins Slough is ideal for environmental education activities as no federally-listed species are known to occur on the Unit. Over the first few years of program implementation, anticipated environmental education could accommodate as many as a 50

percent increase (roughly an additional 48 participants) compared to the current program which had 95 participants in 2008 and 2009. Refuge staff and partners will direct and supervise the program with support from teachers and parents. The expanded program would continue to focus on on-site activities that bring students out to the Refuge where they can connect directly with wildlife and habitat resources. The program would include arranging activities on-site that develop awareness and protection of the local watershed, wildlife habitat, threatened and endangered species, and migratory birds.

Elements required for conducting the education program include:

- Develop a field-based environmental education program that meets California state education standards.
- Construct parking area and trail system on the Harkins Slough Unit.

### Interpretation

The Refuge would develop an on-site interpretative program to provide more opportunities for participants of all ages to learn about the Refuge, National Wildlife Refuge System, resource management and local wildlife populations and habitats. Several of the elements required to support an expanded interpretive program are the same as the education program (e.g., construct parking area and trail system on the Harkins Slough Unit).

Utilizing the trail system constructed on the Harkins Slough Unit, the Refuge proposes to create a self guided interpretive infrastructure using interpretive panels at scenic views and points of interest (e.g., restoration sites, wildlife viewing areas). A general information kiosk would be installed at the start of the trail system providing Refuge information (e.g., map of the area, rules and regulations,). In order to provide an interpretive experience at Units closed to the public (Ellicott, Buena Vista (when memorandum of understanding is in place), and Calabastas Units), interpretive/information panels will be installed at the front of the Unit, explaining the Unit's purpose and why it is closed.

Interpretive walks would be led on the Harkins Slough, Ellicott and Buena Vista (when memorandum of understanding is in place) Units at least one time per year. Partner organizations, educated in Refuge rules and regulations would be sought to lead tours on the Harkins Slough Unit, and Refuge staff would lead tours on the remaining Units due to their sensitive habitat.

Elements required for conducting the interpretive program include:

- Develop and install general information kiosk and interpretive panels required for the self guided interpretive trail system on the Harkins Slough Unit.
- Develop and install interpretive signage in front of closed Units.

**Availability of Resources:** Additional funds would be required to fully implement the environmental education and interpretation programs. Funding will be sought through

the Service budget process. Other sources may be sought through partnerships, grants, and additional refuge operations funding to support a safe and quality program as described above. Maintenance of the additional facilities will require a maintenance worker (position shared with Salinas River NWR) for mowing, trail, kiosk and sign repair, and trash collection throughout the year. An outdoor recreation planner (position shared with Salinas River NWR) would be needed to develop the expanded environmental education and interpretation programs.

The following funding/annual costs (based on FY 2010 costs) would be required to administer and manage environmental education and interpretation activities as described above:

<b>Item</b>	<b>One-Time Cost</b>	<b>Annual Costs</b>
Provide parking areas, bilingual informational kiosk, and trails at Harkins Slough Unit.	\$270,000	\$2,500
Create and install self-guided interpretive infrastructure along trails at Harkins Slough Unit.	\$30,000	\$500
Install bilingual information signage in front of closed units.	\$30,000	\$500
Maintenance Staff (0.1 FTE)	\$7,500	\$7,500
Park Ranger/Outdoor Recreation Planner (0.3 FTE)	\$33,000	\$33,000
<b>TOTAL</b>	<b>\$290,500</b>	<b>\$45,000</b>

**Anticipated Impacts of Use:** The use of on-site, hands-on action-oriented activities by school groups to accomplish environmental education objectives may impose a short-term, low level impact on the sites used for these activities. These low level impacts may include trampling of vegetation and temporary disturbance to wildlife species in the immediate vicinity. It is not anticipated that such impacts would be permanent or long-lasting because these activities take place on established trails and designated areas where wildlife is already somewhat habituated to human activities.

The presence of humans will disturb wildlife causing temporary displacement without long-term effects on populations. Some species will avoid the areas people frequent, while

others will seemingly be unaffected by the presence of humans. The response of wildlife to human activities includes: site departure (Owen 1973, Burger 1981, Henson and Grant 1991, Klein 1993), use of suboptimal habitat (Erwin 1980, Williams and Forbes 1980), altered behavior (Burger 1981, Morton et al. 1989, Havera et al. 1992, Klein 1993), and increase in energy expenditure (Morton et al. 1989, Belanger and Bedard 1990). McNeil et al. (1992) found that many waterfowl species avoid disturbance by feeding at night instead of during the day. The location of recreational activities impacts species in different ways. Miller et al. (1998) found that nesting success was lower near recreational trails, where human activity was common, than at greater distances from the trails. A number of species have shown greater reactions when pedestrian use occurred off trail (Miller et al. 1998).

For songbirds, Gutzwiller et al. (1997) found that singing behavior of some species was altered with low levels of human intrusion. Pedestrian travel can impact normal behavioral activities, including feeding, reproductive, and social behavior. Studies have shown that ducks and shorebirds are sensitive to pedestrian activity (Burger 1981, 1986). Resident waterbirds tend to be less sensitive to human disturbance than migrants, and migrant ducks are particularly sensitive when they first arrive (Klein 1993). In areas where human activity is common, birds tolerated closer approaches than in areas receiving less activity.

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).

The construction and maintenance of trails and parking lots will have minor impacts on soils and vegetation around the trails. This could include an increased potential for erosion, soil compaction (Liddle 1975), reduced seed emergence (Cole and Landres 1995), alteration of vegetative structure and composition, and sediment loading (Cole and Marion 1988).

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 and interpretation activities are public use management tools 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 and interpretation 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.

Section 7 consultations were completed with the Service (20\_\_ ) on the Draft CCP/EA for the following species: Santa Cruz long-toed salamander, California tiger salamander, California red-legged frog, and the robust spineflower.

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

**Determination (check one below):**

Use is Not Compatible

Use is Compatible with the Following Stipulations

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

1. Environmental education and interpretation would only be allowed between sunrise and sunset, unless they are part of a refuge-led activity.
2. Public access would be restricted to trails, other designated facilities/areas, and appropriate times of year where the least disruption to wildlife and their habitats would occur.
3. Environmental Education activities would be led by Refuge staff and/or partners and educators trained by Refuge staff to conduct activities in accordance with Refuge regulations and rules.
4. Environmental education activities will be arranged in advance of the visit and will have an established limit on number of students and number of adult per student to supervise.
5. Refuge tours will have an established limit on number of participants.
6. Refuge tours will be led by Refuge staff on Units with sensitive habitat to prevent impacts, and partners/volunteers leading tours at Harkins Slough will be trained in Refuge rules and regulations.

7. Regulations and wildlife friendly behavior (e.g., requirements to stay on designated trails, no dogs, etc.) would be posted at the general information kiosk and described in brochures.
8. Maps and visitor use information would also be available at the Refuge Headquarters and the Complex website.
9. Collection of plants, animals and other specimens, debris or artifacts would be prohibited unless the collection is part of a refuge-led activity.
10. Regulations would be enforced to insure public safety and to prevent resource impacts.

**Justification:**

After assessing the potential impacts from the uses proposed for the Refuge it was determined 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. Environmental education and interpretive programs would provide opportunities for the visiting public to learn about and experience native plants, fish and wildlife in their natural habitat. The Refuge can also educate the public about its role within the agency and the National Wildlife Refuge System, developing better community awareness, volunteer involvement and advocacy. The Refuge also has the opportunity to provide the community educational information on habitat restoration, federally listed species, migratory waterfowl and wetland conservation in the Monterey 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 Re-Evaluation Date (2025):**

- Mandatory 15-year Re-Evaluation, Date will be provided in Final EA/CCP (for priority public uses)
- Mandatory 10-year Re-Evaluation (for all uses other than priority public uses)

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

- Categorical Exclusion without Environmental Action Statement
- Categorical Exclusion and Environmental Action Statement
- 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)

Ellicott Slough NWR Compatibility Determination for Environmental Education and Interpretation

Refuge Manager/  
Project Leader  
Approval:

\_\_\_\_\_  
(Signature)

\_\_\_\_\_  
(Date)

**Concurrence**

Refuge Supervisor:

\_\_\_\_\_  
(Signature)

\_\_\_\_\_  
(Date)

Assistant Regional  
Director, Refuges:

\_\_\_\_\_  
(Signature)

\_\_\_\_\_  
(Date)

**COMPATIBILITY DETERMINATION**

**(July, 2010)**

**Use:** Mosquito Management

**Refuge Name:** Ellicott Slough National Wildlife Refuge, Santa Cruz County, California.

**Establishing and Acquisition Authority:**

Ellicott Slough National Wildlife Refuge was established in 1975. Legal authority includes the Endangered Species Act of 1973 as amended (16 U.S.C. 1531-1543: 87 Statute 884).

**Refuge Purpose(s):**

The Refuge's purposes are defined as the following:

to conserve (A) fish or wildlife which are listed as endangered species or threatened species ... or (B) plants ...16 U.S.C. 1531 (Endangered Species Act of 1973)

... the conservation of the wetlands of the Nation in order to maintain the public benefits they provide and to help fulfill international obligations contained in various migratory bird treaties and conventions ... 16 U.S.C. 3901-3932 (Emergency Wetlands Resources Act of 1986)

**National Wildlife Refuge System Mission:** "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-ee]).

**Description of Use:** The proposed use is the implementation of mosquito monitoring and management activities requested and conducted by the Santa Cruz County Mosquito and Vector Control District (SCMVCD) within Ellicott Slough National Wildlife Refuge. This is not a wildlife-dependent public use.

The SCMVCD has informed the wildlife refuge manager of their desire to conduct mosquito monitoring and, if necessary, management activities to protect the public from mosquito borne diseases. While mosquitoes are considered a nuisance because of their biting, some species are known vectors of serious diseases in California. There are primarily six mosquito species of concern potentially produced or harbored on the Refuge: *Culex tarsalis*, *Anopheles freeborni*, *Aedes sierrensis*, *Aedes washinoi*, *Culex erythrothorax*, and *Culex pipiens*. While these six species have potential to be found at

## Ellicott Slough NWR Compatibility Determination for Mosquito Management

the Refuge, only two have been found in recent years. There has been no detection of mosquito transmitted disease produced or harbored on the Refuge.

The main diseases of concern for mosquito control programs in northern California are Western Equine Encephalitis (WEE), St. Louis Encephalitis (SLE), California Encephalitis, West Nile Virus (WNV), and malaria. *Culex tarsalis* is the main vector identified in the transmission of these diseases, with the exception of malaria, which is vectored by *Anopheles freeborni* mosquitoes. The other mosquito species listed above can also potentially transmit WEE, SLE, and WNV, but are less competent vectors compared to *C. tarsalis*. WEE and SLE have caused significant outbreaks of human disease (CA Dept. of Health Services 2003). Public concern over human health issues related to mosquito-borne disease has intensified on the west coast with the advance of WNV across the United States, and its detection in California in 2003. There have been no human cases of West Nile virus in Santa Cruz County as of yet. Below, Table 1 shows the number of birds found dead per year due to WNV in Santa Cruz County:

Table 1

Year	# Birds
2009	1
2008	3
2007	6
2006	7
2005	0
2004	36

The three ponds on the Refuge are ephemeral and dry up naturally during the summer. The only permanent water body on the Refuge is Harkins Slough, which is part of an extensive slough system with no options to manipulate water levels. Harkins Slough unit is not hydrologically connected to any other Refuge pond. At this time, SCMVCD monitors mosquito larvae through direct sampling using a 250ml dipper in Refuge water bodies every one to two weeks. Adult mosquitoes are sampled on the Refuge to determine the direct threat posed by their distribution, abundance, species mix, and pathogen status. Direct surveillance is typically accomplished through a variety of traps that are configured to attract mosquitoes to the trap.

The SCMVCD treats a 980-foot drainage ditch along the border of the KOA campground, a drainage ditch next to the railroad and a Refuge created pond that has been overrun with willows on the Ellicott Slough Unit with *Bacillus thurengiensis israelensis* (Bti) using a backpack sprayer or granular distribution by hand when monitoring levels exceed the threshold (Table 2). The breeding ponds themselves have not been treated since 1996. The drainage ditches on the Ellicott Unit have been treated an average of 7 times per year during the last 16 years. The Refuge staff is working with SCMVCD to develop a protocol should the ponds need to be treated.

Interim guidelines to address mosquito management have been developed for implementation at the national level for the National Wildlife Refuge System (USFWS 2005).

Mosquito monitoring is currently authorized on the Refuge through Special Use Permits (SUP) and approved Pesticide Use Proposals (PUP), both of which are produced on an annual basis. The SUP identifies permitted dates, access points and conditions, monitoring and data reporting requirements, approved PUPs, treatment notification requirements, and sensitive areas to be avoided. The PUPs identify specific mosquito control products approved for use on the Refuges, and include details on target pests, products applied, application dates, rates, methods, number of applications, site description, sensitive habitats and best management practices to avoid them. Because the U.S. Fish and Wildlife Service (Service) uses insecticides, herbicides and fungicides on national wildlife refuges, a formal pesticide use review process is employed to ensure that all chemical pesticides approved for use have been reviewed for their potential impacts to groundwater, surface water and terrestrial and aquatic non-target vegetation and wildlife, including threatened and endangered species. Pesticides approved for use must be shown to pose the lowest toxicity-related threat to non-target terrestrial and aquatic ecosystems, while addressing the specific pest control objectives. Depending on the product, PUPs are reviewed and approved at the wildlife refuge manager, Regional Office, or Washington Office level.

Refuge and SCMVCD staff communicate annually to evaluate past and proposed mosquito management activities and to coordinate all necessary permitting and implementation planning required to conduct mosquito monitoring and control on the Refuge for the upcoming year. SCMVCD personnel are responsible for monitoring mosquitoes and are required to provide refuge staff with timely data collected on mosquito population trends and disease activity on the Refuge.

Mosquito monitoring and control is discussed in Chapter 4 of the Draft Comprehensive Conservation Plan (CCP) and Environmental Assessment (EA) (USFWS 2010) which are incorporated by reference.

**Table 2.**  
**Santa Cruz County Mosquito and Vector Control**  
**Larval Treatment Criteria**

	Species	Most Common Larval Habitats	Distance to Populated Area	Larval Treatment Threshold	Notes
<b>AEDES</b>	Salt marsh mosquito <i>Aedes dorsalis</i>	Salt marshes	0 meters - 2 miles	≥ 1 per 10 dips	High Pest Significance
	Asian tiger mosquito <i>Aedes albopictus</i>	Small Containers, Tires	ANY DISTANCE	IMMEDIATE TREATMENT IF ANY DETECTED	Found only once in San Francisco Bay area

# Ellicott Slough NWR Compatibility Determination for Mosquito Management

	<b>Tree hole mosquito</b> <i>Aedes sierrensis</i>	Tree Holes, Tires, Miscellaneous Containers	0 - 300 meters	≥ 1 per dip or baster sample	High Pest Significance Vector of Canine Heartworm
	<b>Winter salt marsh mosquito</b> <i>Aedes squamiger</i>	Salt Marshes Reclaimed Marshes	0 meters - 10 miles	≥ 1 per 10 dips	High Pest Significance
	<b>River mosquito</b> <i>Aedes vexans</i>	Temporary Pools	0 meters - 1 mile	≥ 1 per 10 dips	Rare
	<b>Woodland pool mosquito</b> <i>Aedes washinoi</i>	Temporary Woodland Pools	0 meters - 1 mile	≥ 1 per 10 dips	High Pest Significance
HELES	<i>Anopheles franciscanus</i>	Shallow Pools and Streams in Algae mats	0 - 500 meters	≥ 1 >3rd instar larva per dip	Low Pest Significance
	<b>Western malaria mosquito</b> <i>Anopheles freeborni</i>	Seepages, Streams, Lakes, Gravel Pits	0 meters - 1 mile	≥ 1 >3rd instar larva per dip	Low Pest Significant Vector of Malaria
	<i>Anopheles occidentalis</i>	Streams, Lakes, Pools Occasionally in Brackish Water	0 - 500 meters	≥ 1 >3rd instar larva per dip	Low Pest Significance
ANOP	<i>Anopheles punctipennis</i>	Temporary Pools, Streams	0 meters - 1 mile	≥ 1 >3rd instar larva per dip	Moderate Pest Significant Vector of Malaria
CULEX	<i>Culex apicalis</i>	Woodland Creeks, Pools	NO TREATMENT	NO TREATMENT	No Pest Significance
	<i>Culex boharti</i>	Slow Streams, Pools	NO TREATMENT	NO TREATMENT	No Pest Significance
	<i>Culex reevsi</i>	Slow Streams, Pools	NO TREATMENT	NO TREATMENT	No Pest Significance
	<b>Tule mosquito</b> <i>Culex erythrothorax</i>	Lakes and Ponds Associated with Tules	0 - 500 meters	≥ 1 per dip	High Pest Significance Vector of West Nile Virus
	<b>House mosquito</b> <i>Culex pipiens</i>	Storm Drain Systems, Septic Tanks, Roadside Ditches, Cemetery Urns, Flooded Basements, Utility Vaults	0 meters - 1 mile	≥ 1 per 10 dips	High Pest Significance Vector of West Nile Virus
	<b>Foul water mosquito</b> <i>Culex stigmatosoma</i>	Foul Water, Sewage, Temporary Pools	0 - 300 meters	≥ 1 per dip	Low Pest Significance Vector of West Nile Virus
	<b>Encephalitis mosquito</b> <i>Culex tarsalis</i>	Creeks, Marshes, Temporary Pools, Roadside Ditches, Fresh Water	0 meters - 2 miles	≥ 1 per 10 dips	Moderate Pest Significance Vector of Encephalitis
CULISETA	<b>Fish pond mosquito</b> <i>Culiseta incidens</i>	Fish Ponds, Temporary Pools, Catch Basins, Roadside Ditches	0 meters - 1 mile	≥ 1 per dip	High Pest Significance Possible Vector of Canine Heartworm
	<b>Winter salt marsh mosquito</b> <i>Culiseta inornata</i>	Marshes, Temporary Pools, Roadside Ditches	0 meters - 1 mile	≥ 1 per dip	High Pest Significance
	<i>Culiseta particeps</i>	Shaded Clean Pools, Streams	0 - 300 meters	≥ 1 per dip	Low Pest Significance

## Ellicott Slough NWR Compatibility Determination for Mosquito Management

**Availability of Resources:** The following funding/annual costs (based on FY 2010 costs) would be required to administer and manage activities as described above:

	ANNUAL COSTS
Administration (Evaluation of applications, permit compliance, and monitoring)	0.1 FTE
<b>TOTAL</b>	<b>\$8,276</b>

Refuge operational funds are currently available through the Service budget process to administer this program.

**Anticipated Impacts of Use:** One of the major objectives of the Refuge is to provide high quality habitat for amphibians and other wildlife. There is concern that mosquito control treatments may interfere with that objective by adversely affecting the federally threatened and endangered amphibians that the Refuge was established to protect. This concern is based on the lack of research and associated evidence regarding effects of pesticide use on amphibians and their habitat. Treatment also reduces the amphibian food base. Effects on non-target organisms (i.e., those other than mosquitoes) can be loss of biomass, loss of diversity, interference with normal ecological relationships, bioaccumulation, or other unknown effects.

Mosquito monitoring includes regular visits by SCMVCD personnel to sample mosquito larvae (dip counts) and adults (landing counts) in wetlands and adjacent areas. Mosquito monitoring will cause direct and indirect disturbance effects. Disturbance would include altering wildlife behavior and habitat use, by SCMVCD staff entering a number of wetland areas to collect mosquito samples. However, these effects would be short-term. The sampling interval would typically be once every two weeks from March thru November. Sufficient monitoring restrictions to reduce disturbance would be included as part of the SUP, and SCMVCD activities would be monitored by refuge staff. Additionally, SUP conditions would include conditions to further ensure that impacts to wildlife and habitats are avoided and minimized, including disinfection protocol to avoid spreading chytrid fungus and trematodes to amphibians.

The SCMVCD has used *Bacillus thuringiensis israelensis* (Bti) and methoprene in Refuge drainage ditches in the past. Since 1996, the Refuge has not permitted the use of methoprene in ponds used by SCLTS and CTS for breeding. As of 2010, the Refuge has stopped the use of methoprene in all waterbodies on the Refuge until a mosquito management plan and environmental compliance are completed. Bti is a microbial insect pathogen used to control larval stages of mosquitoes and black flies. It is a naturally occurring anaerobic spore forming bacteria that is mass produced using modern fermentation technology. Bti produces protein endotoxins that are activated in the alkaline mid-gut of insect species and subsequently binds to protein specific receptors of susceptible insect species resulting in the lethal response (Lacey and Mulla 1990). Bti

must therefore be ingested by the target insect to be effective. It is most effective on younger mosquito larval instars but does not affect pupae or adult mosquitoes. The SCMVCD prefers to use Bti because of the low impacts to the environment and non-target organisms and its effectiveness in reducing the numbers of target pests. .

### **Toxicity and Effects to Non-target Organisms**

The dominant impact of mosquito control will relate to the toxicity and effects of the treatments on non-target organisms.

#### **Bti**

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

In addition to mosquitoes (Family Culicidae), Bti affects some other members of the suborder Nematocera within the order Diptera. Also affected are members of the Family Simuliidae (black flies) and some chironomids (midge larvae) (Boisvert and Boisvert 2000, Garcia et al. 1980). The most commonly observed Bti effects to non-target organisms were to larvae of some chironomids in laboratory settings when exposed to relatively high doses (Boisvert and Boisvert 2000, Lacey and Mulla 1990, Miura et al. 1980). In field studies, effects to target and susceptible nontarget invertebrates have been variable and difficult to interpret. Field study results are apparently dependent on the number, frequency, rate and aerial extent of Bti applications; the Bti formulation used; the sample type (e.g. benthic, water column or drift); the sampling interval (e.g. from 48 hrs to one or more years after treatment); the habitat type (e.g. lentic or lotic); the biotic (e.g. aquatic communities), and abiotic factors (e.g. suspended organic matter or other suspended substrates, temperature, water depth); the mode of feeding (e.g. filter feeder, predator, scraper or gatherer); the larval development stage and larval density (Ali 1981, Boisvert and Boisvert 2000, Lacey and Mulla 1990). Bti activity against target and susceptible nontarget invertebrates is also related to Bti persistence and environmental fate which are in turn affected by the factors associated with field study results (Dupont and Boisvert 1986, Mulla 1992, Hershey et al, 1998). Simulated field studies resulted in the suppression of two unicellular algae species, *Closterium* sp. and *Chlorella* sp. resulting in secondary effects to turbidity and dissolved oxygen of aquatic habitats, with potential trophic effects (Su and Mulla, 1999). For these reasons, Bti effects to target and

susceptible nontarget organisms and potential indirect trophic impacts in the field are difficult to predict.

### **Threatened and Endangered Amphibians and Plants**

Few studies on the effects of Bti on amphibians are published, and the few that are seem to indicate mixed results (S. Raimondo et. al. 2003, A. Channing, 1998).

#### **California Red-legged frog** (*Rana aurora draytonii*)

The diet of the California red-legged frog consists of a wide variety of invertebrates, and occasionally small vertebrates such as fish, mice, frogs and salamander larvae. Typical of most frogs, prey items are located by vision, and a large sticky tongue is used to catch the prey and bring it into the mouth to eat. Tadpoles probably feed on algae, diatoms, and detritus by grazing the surface of rocks and plants

#### **Santa Cruz long-toed salamander** (*Ambystoma macrodactylum croceum*)

The diet of the Santa Cruz long-toed salamander is typically carnivorous. Transformed adults eat small invertebrates, including worms, mollusks, insects, and spiders. Larvae start by eating small crustaceans. As they increase in size, they gradually consume larger prey items, including crustaceans, worms, mollusks, and frog tadpoles. Larger larvae may cannibalize smaller larvae.

#### **California tiger salamander** (*Ambystoma californiense*)

Adults probably feed mainly on a variety of invertebrates. Hatchlings feed on zooplankton and older larvae feed on tadpoles (mostly *Pseudacris* tadpoles) and aquatic invertebrates.

#### **Santa Cruz tarplant** (*Holocarpha macradenia*)

The Santa Cruz tarplant attracts a diverse set of pollinators, including moths, as it is a pollination generalist (FWS 2007).

#### **Monterey spineflower** (*Chorizanthe pungens* var. *pungens*) and **Robust spineflower** (*Chorizanthe robusta* var. *robusta*)

Pollinators of the *Chorizanthe* genus likely include sweat bees (*Halictidae*), bumblebees (*Bromus* sp), wasps (*Sphecidae*), honeybees (*Aphis mellifera*), and soft-winged flower beetles (*Dasytidae*). Pollinator diversity was correlated with variation of microhabitat conditions, including exposure; proximity to the coast; and the structure, composition, and density of the surrounding vegetation (Murphy 2003).

**Table 4. Mosquito-Borne Disease Health Threat and Response Matrix (adapted from USFWS 2005).**

Current Conditions		Threat Level	Refuge Response
Health Threat Category <sup>1</sup>	Refuge Mosquito Populations <sup>2</sup>		
No documented existing or historical health threat/ emergency	No action threshold	1	Remove/manage artificial mosquito breeding sites such as tires, tanks, or similar debris/containers. Allow compatible monitoring by MVCDS.
Documented historical health threat/emergency	Below action threshold	2	Response as in threat level 1, plus: employ compatible non-pesticide management options (BMPs) to reduce mosquito production.
	Above action threshold	3	Response as in threat level 2, plus: allow increased monitoring and disease surveillance by MVCDS.
Documented existing health threat	Below action threshold	4	Response as in threat levels 3, plus: more readily allow compatible site-specific larviciding of infested areas by MVCDS as determined by monitoring data.
	Above action threshold	5	Response as in threat levels 4, plus: allow increased monitoring and disease surveillance by MVCDS.
Officially determined existing health emergency	Below action threshold	6	Response as in threat levels 5 plus: allow site-specific larviciding of infested areas by MVCDS as determined by monitoring.
	Above action threshold	7	Response as in threat levels 6 plus: allow site-specific larviciding of infested areas by MVCDS as determined by monitoring.

<sup>1</sup> **Health threat** - For the purposes of allowing mosquito control on a particular refuge, the threshold of a “documented existing health threat” will be met when a positive virus (WNV, Western Equine Encephalitis, St. Louis Encephalitis, etc.) detection is made in humans, dead birds, mosquito pools, sentinel chickens, or horses in the vicinity of the Refuge and within the same county and within the same annual mosquito season.

**Health emergency** - Indicates an imminent risk of serious human disease or death. A health emergency represents the highest level of mosquito-associated health threats. An “officially determined existing health emergency” will be determined by the appropriate Federal, State, or local public health authorities and documented with local and current mosquito population and

## Ellicott Slough NWR Compatibility Determination for Mosquito Management

disease monitoring data. Changes to these definitions may occur as a result of changes in national policies.

\*This table is subject to change based on current conditions or changes in USFWS national policy.

**Public Review and Comment:** Public review and comments will be solicited in conjunction with distribution of the Draft CCP/EA for the Ellicott Slough National Wildlife Refuge, released in 2010.

### **Determination:**

Use is Not Compatible

Use is Compatible with the Following Stipulations

### **Stipulations necessary to ensure compatibility:**

1. All mosquito control activities proposed by SCMVCD are evaluated and authorized through an annual SUP, supported by the risk-based, hierarchical approach.
2. The application of any mosquito control products are conducted in accordance with approved PUPs, which is referenced in the SUP.
3. Only Service-approved mosquito control agents will be applied. Currently this includes *Bacillus thuringiensis israelensis* liquid or granular formulations.
4. Applications should be made from the shoreline without entry into the ponds. To facilitate access to shoreline, some vegetation clearing may occur to provide a pathway to various points around the non-SCLTS breeding ponds.
5. Vegetation clearing will be limited to no lower than knee high length; no ground level vegetation clearing will occur; selective cutting avoiding oaks, sticky monkeyflower, coffeeberry and live limbs over 6" diameter.
6. When feasible, hand tools, such as machetes and pruning shears, will be used to clear herbaceous vegetation. Axe cuts are not permitted. Cut vegetation and limbs will be left in situ.
7. A FWS biologist will be notified for opportunity to be present for larval dip monitoring in sensitive sites, vegetation clearing and larvicide application activities to monitor SCLTS.
8. If any SCLTS or their eggs are found, they will not be moved, disturbed, or have their natural behavior altered in any way. Dipper samples will be returned to the pond.

## Ellicott Slough NWR Compatibility Determination for Mosquito Management

9. All SCMVCD staff sampling for mosquito larvae with a dipper shall be trained in amphibian identification and informed of the appropriate techniques for avoiding the capture of larvae and dislocating eggs and egg masses of the Santa Cruz long-toed salamander or threatened amphibians and for their release if they are inadvertently netted. Workers conducting monitoring activities shall not enter the water and shall take great care in approaching the water slowly to allow wildlife to escape.
10. To avoid transferring disease or pathogens between aquatic habitats, mosquito abatement technicians will follow the Declining Amphibian Population Task Force's Code of Practice.
11. An annual pesticide use report will be provided to USFWS at the beginning of the year.

**Justification:** Mosquito-borne disease issues are a threat in the Monterey Bay area. Mosquito management activities are controlled by a process that involves incorporating USFWS National Mosquito Guidance, annual PUPs and SUPs, which would contribute towards a compatible program consistent with purposes of the Refuges and Refuge System mission. Appropriate safeguards are incorporated into the planning efforts to ensure that the level of mosquito control is commensurate with the associated public health risk. In particular, the above stipulations and those within the PUPs and SUPs will help to avoid or minimize any impacts to fish, wildlife, plants and their habitats along with the Refuges' ability to maintain the biological integrity, diversity, and environmental health of the Refuges. Based upon impacts described in the Draft Comprehensive Conservation Plan and Environmental Assessment, (USFWS 2010), it is determined that mosquito management activities within the Ellicott Slough 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. In our opinion, these mosquito management activities will not conflict with the national policy to maintain the biological diversity, integrity, and environmental health of the Refuge.

This compatibility determination may need to be reevaluated in the event that a national policy for management of mosquitoes on National Wildlife Refuges is finalized.

### **Mandatory Re-Evaluation Date** (2020):

Mandatory 15-year Re-Evaluation, Date will be provided in Final CCP/EA (for priority public uses)

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

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

- \_\_\_\_\_ Categorical Exclusion without Environmental Action Statement
- \_\_\_\_\_ Categorical Exclusion and Environmental Action Statement
- X   Environmental Assessment and Finding of No Significant Impact
- \_\_\_\_\_ Environmental Impact Statement and Record of Decision

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**Refuge Determination**

Prepared by: \_\_\_\_\_  
(Signature) (Date)

Wildlife Refuge Manager/  
Project Leader  
Approval: \_\_\_\_\_  
(Signature) (Date)

**Concurrence**

Refuge Supervisor: \_\_\_\_\_  
(Signature) (Date)

Assistant Regional  
Director, Refuges: \_\_\_\_\_  
(Signature) (Date)

**COMPATIBILITY DETERMINATION**

**(April 27, 2010)**

**Use:** Research

**Refuge Name:** Ellicott Slough National Wildlife Refuge, Santa Cruz County, California.

**Establishing and Acquisition Authority:**

Ellicott Slough National Wildlife Refuge was established in 1975. Legal authority includes the Endangered Species Act of 1973 as amended (16 U.S.C. 1531-1543: 87 Statute 884).

**Refuge Purpose(s):**

The Refuge's purposes are defined as the following:

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)

... the conservation of the wetlands of the Nation in order to maintain the public benefits they provide and to help fulfill international obligations contained in various migratory bird treaties and conventions ... 16 U.S.C. 3901(b) (Emergency Wetlands Resources Act of 1986)

**National Wildlife Refuge System Mission:** "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-ee]).

**Description of Use:** Two provisions of the National Wildlife Refuge Improvement Act are to "maintain biological integrity, diversity and environmental health" and to conduct "inventory and monitoring." Research investigations are designed to address these provisions by answering specific management questions. These include, but are not limited to, evaluation of vegetation and wildlife response to habitat management techniques, wildlife and plant population monitoring, documentation of seasonal wildlife movements and habitat use, wildlife disease investigations, and development of invasive species management techniques. Pertinent results from research investigations are incorporated into management plans and actions, and help strengthen the decision-making process.

Ellicott Slough National Wildlife Refuge receives numerous requests each year to conduct scientific research. The Refuge proposes to give priority to studies that contribute to the enhancement, protection, preservation, and management of native Refuge plant and

## Ellicott Slough NWR Compatibility Determination for Research

wildlife populations and their habitats. Research applicants are required to submit a proposal that outlines: (1) objectives of the study; (2) justification for the study; (3) detailed methodology and schedule; (4) potential impacts on Refuge wildlife or habitat, including disturbance (short and long term), injury, or mortality (this includes a description of measures the researcher will take to reduce disturbance or impacts); (5) research personnel required; (6) status of necessary permits; (7) costs to Refuge, if any; and (8) progress reports and end products (i.e., reports, thesis, dissertations, publications). Research proposals are reviewed by refuge staff, and if approved, a Special Use Permit (SUP) is issued by the wildlife refuge manager or wildlife biologist to formally authorize any project. Each SUP will include case-specific stipulations (example disinfecting before and after entering ponds to prevent spread of chytrid) and will be reviewed annually.

Evaluation criteria will include, but not be limited to, the following:

- Research that will contribute to specific refuge management issues will be given higher priority over other research requests.
- Research that will conflict with other ongoing research, monitoring, or management programs will not be approved.
- Research projects that can be accomplished off-Refuge are less likely to be approved.
- Research, which causes undue disturbance or is intrusive will likely not be approved. Level and type of disturbance will be carefully evaluated when considering a request. Suggestions may be made to adjust the location, timing, scope, number of permittees, study methods, number of study sites, etc.
- If staffing or logistics make it impossible for the Refuge to monitor researcher activity in a sensitive area, the research request may be denied.
- The length of the project will be considered and agreed upon before approval. Projects 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, review of proposals, study plans, and reports and compliance monitoring of projects require an estimated .10 FTE annually for the Refuge manager and .10 FTE annually for the Refuge biologist. The cost per year is based on the fiscal year 2010 pay scale of a GS-11 Refuge manager and GS-9 Refuge biologist (with San Francisco locality pay adjustment). Other than staff time, no special equipment, facilities, or improvements are necessary to support this proposed use.

## Ellicott Slough NWR Compatibility Determination for Research

	<b>Annual Costs</b>
Refuge Biologist (0.1 FTE)	\$8,276
Refuge Manager (0.1 FTE)	\$9719
<b>TOTAL</b>	<b>\$17,995</b>

Refuge operational funds are currently available through the Service budget process to administer this program.

**Anticipated Impacts of Use:** Conducting management-oriented research will benefit Refuge fish, wildlife, plant populations, and their habitat. Monitoring and research investigations will be designed to answer habitat or population management questions, thereby contributing to adaptive management of the Refuge. Natural resources inventory, monitoring and research are necessary tools towards maintaining biological integrity, diversity and environmental health. Information gained from well-thought out research will improve habitat and wildlife populations.

Some negative direct and indirect effects would occur through disturbance, which is expected with some research activities, especially where researchers are entering sensitive habitat areas. Researcher disturbance would include actions like altering wildlife behavior and habitat, going off designated trails, collecting soil, plant and animal samples, trampling of plants and animals, entering sensitive ponds, introduction of invasive organisms (e.g., non-native weeds and chytrid), or trapping, handling and sometimes euthanizing wildlife. However, most of these effects would be short-term because only the minimum of samples (e.g., water, soils, vegetative litter, plants, macroinvertebrates) required for identification and/or experimentation and statistical analysis would be permitted and captured and marked wildlife would be released. Long-term effects would be negligible because Refuge evaluation of research proposals and conditions of SUPs would ensure that impacts, such as disturbance and introduction of invasive organisms, to wildlife and habitats are avoided or minimized. Refuge staff would ensure research projects contribute to the enhancement, protection, preservation, and management of native Refuge wildlife populations and their habitats thereby helping the Refuge fulfill the purposes for which it was established and the mission of the National Wildlife Refuge System.

Section 7 consultations were completed with the Service (20\_\_ ) on the Draft CCP/EA for the following species: Santa Cruz long-toed salamander, California tiger salamander, California red-legged frog, and the robust spineflower.

**Public Review and Comment:** Public review and comments were solicited in conjunction with distribution of the Draft CCP/EA for Ellicott Slough National Wildlife Refuge, released in 2010. All comments received will be addressed in the Public Involvement appendix to the CCP (Appendix J).

**Determination:** This program as described is determined to be compatible. Potential impacts of research activities on Refuge resources will be minimized because sufficient restrictions and safeguards would be included in the SUP, and research activities will be monitored by the Refuge manager and biologist. The Refuge manager and biologist would ensure that proposed monitoring and research investigations would contribute 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 ecological integrity, diversity, and environmental health.

Use is Not Compatible

Use is Compatible with the Following Stipulations

**Stipulations necessary to ensure compatibility:**

The criteria for evaluating a research proposal, outlined in the Description of Use section above, will be used when determining whether a proposed study will be approved on the Refuge. If proposed research methods are evaluated and determined to have potential adverse impacts on Refuge wildlife or habitat, then the Refuge staff would determine the utility and need of such research to conservation and management of Refuge wildlife and habitat. If the need was demonstrated by the research permittee and accepted by the Refuge, then measures to minimize potential impacts (e.g., reduce the numbers of researchers entering an area, restrict research in specified areas) would be developed and included as part of the study design and on the SUP. SUPs will contain specific terms and conditions that the researcher(s) must follow relative to activity, location, duration, seasonality, etc. to ensure continued compatibility. All Refuge rules and regulations must be followed unless otherwise accepted in writing by Refuge management.

Refuge staff will monitor researcher activities for potential impacts to the Refuge and for compliance with conditions on the SUPs. Research activities will be modified to avoid harm to sensitive wildlife and habitat when unforeseen impacts arise. The Refuge manager may determine that previously approved research and SUPs be terminated due to observed impacts. The Refuge manager will also have the ability to cancel a SUP if the researcher is out of compliance with the conditions of the SUP.

**Justification:** This program as described is determined to be compatible. 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 were established or the mission of the Refuge System. In fact, well-designed research investigations will directly benefit and support refuge goals, objectives and management plans and activities. Fish, wildlife, plants and their habitat will improve through the application of knowledge gained from monitoring and research.

Ellicott Slough NWR Compatibility Determination for Research

Biological integrity, diversity and environmental health would benefit from scientific research conducted on natural resources at the Refuge. The wildlife-dependent, priority public uses (wildlife viewing and photography, environmental education and interpretation, and fishing would also benefit.

**Mandatory Re-Evaluation Date (2020):**

\_\_\_\_\_ Mandatory 15-year Re-Evaluation, Date will be provided in Final CCP/EA (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 without Environmental Action Statement

\_\_\_\_\_ Categorical Exclusion and Environmental Action Statement

X  Environmental Assessment and Finding of No Significant Impact

\_\_\_\_\_ Environmental Impact Statement and Record of Decision

**References**

U.S. Fish and Wildlife Service. 2010. Ellicott Slough National Wildlife Refuge Draft Comprehensive Conservation Plan and Environmental Assessment. Region 8. Sacramento, CA.

**Refuge Determination**

Prepared by: \_\_\_\_\_  
(Signature) (Date)

Refuge Manager/  
Project Leader  
Approval: \_\_\_\_\_  
(Signature) (Date)

Ellicott Slough NWR Compatibility Determination for Research

**Concurrence**

Refuge Supervisor: \_\_\_\_\_  
(Signature)

\_\_\_\_\_  
(Date)

Assistant Regional  
Director, Refuges: \_\_\_\_\_  
(Signature)

\_\_\_\_\_  
(Date)

**COMPATIBILITY DETERMINATION**

(July 9, 2010)

**Use:** Wildlife Observation and Photography

**Refuge Name:** Ellicott Slough National Wildlife Refuge, Santa Cruz County, California.

**Establishing and Acquisition Authority:**

Ellicott Slough National Wildlife Refuge was established in 1975. Legal authority includes the Endangered Species Act of 1973 as amended (16 U.S.C. 1531-1543: 87 Statute 884).

**Refuge Purpose(s):**

The Refuge's purposes are defined as the following:

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)

... the conservation of the wetlands of the Nation in order to maintain the public benefits they provide and to help fulfill international obligations contained in various migratory bird treaties and conventions ... 16 U.S.C. 3901(b) (Emergency Wetlands Resources Act of 1986)

**National Wildlife Refuge System Mission:** "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-ee]).

**Description of Use:** The National Wildlife Refuge System Improvement Act of 1997 identifies wildlife observation and photography as well as hunting, fishing, interpretation, and environmental education as priority wildlife-dependent public uses for refuges. As two of the six priority public uses of the Refuge System, these uses are to be encouraged when compatible with the purposes of the refuges. Wildlife observation and photography are considered simultaneously in this compatibility determination. Many elements of the wildlife observation and photography programs are also similar to opportunities provided in the environmental education and interpretation programs. These uses are described in the Draft Comprehensive Conservation Plan (CCP) and Environmental Assessment (EA) (USFWS 2010) and are incorporated by reference.

## Ellicott Slough NWR Wildlife Observation and Photography Compatibility Determination

The guiding principles of the Refuge System's wildlife observation and wildlife photography programs (Service Manual 605 FW 4 and 5) are to:

- Provide safe, enjoyable, and accessible wildlife viewing opportunities and facilities.
- 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 Service Manual 605 FW 1.6.
- Minimize conflicts with visitors participating in other compatible wildlife-dependent recreation activities.

Currently, Ellicott Slough National Wildlife Refuge is closed to the public for wildlife observation and photography. The Refuge plans to develop and construct a self-guided interpretive trail system on the Harkins Slough Unit. Harkins Slough is ideal for wildlife observation and photography activities, as no federally-listed species are known to occur on the Unit. Several of the elements required to support these programs (e.g., construct parking area, trail system and general information kiosk on the Harkins Slough Unit) are the same as for environmental education and interpretation programs. Details for these elements are discussed in further detail and broken down by cost in the Environmental Education and Interpretation Compatibility Determination.

Wildlife observation and photography tours would be led on the Harkins Slough, Ellicott and Buena Vista (when memorandum of understanding is in place) Units at least once a year. Partner organizations, educated in Refuge rules and regulations would be sought to lead tours on the Harkins Slough Unit, and Refuge staff would lead tours on the remaining Units due to their sensitive habitat.

These two priority uses will provide opportunities for the public to observe wildlife habitats firsthand and learn about wildlife and wild lands in an unstructured environment. Photographers will gain opportunities to photograph wildlife and natural habitats. These opportunities can result in increased publicity and advocacy for Service programs.

**Availability of Resources:** Additional funds would be required to provide wildlife observation and photography opportunities. Funding will be sought through the Service budget process. Other sources may be sought through partnerships, grants, and additional refuge operations funding to support a safe and quality program as described above. Maintenance of the additional facilities will require a maintenance worker (position shared with Salinas River NWR) for mowing, trail, kiosk and sign repair, and trash collection throughout the year. An outdoor recreation planner (position shared with Salinas River NWRs) would be needed to develop materials and infrastructure to facilitate safe and informative visitor experiences. Refuge law enforcement (shared with Salinas River NWR) would be needed to protect of infrastructure and provide a safe visitor experience.

## Ellicott Slough NWR Wildlife Observation and Photography Compatibility Determination

The following funding/annual costs (based on FY 2010 costs) would be required to administer and manage wildlife observation and photography activities as described above:

Item	One-Time Cost	Annual Costs
Refuge Law Enforcement (0.1 FTE)	\$9,000	\$9,000
Maintenance Staff (0.1 FTE)	\$7,500	\$7,500
Park Ranger/Outdoor Recreation Planner (0.2 FTE)	\$20,000	\$20,000
<b>TOTAL</b>	<b>\$36,500</b>	<b>\$36,500</b>

**Anticipated Impacts of Use:** Once considered “non-consumptive”, it is now recognized that wildlife observation and wildlife photography can negatively impact wildlife by altering wildlife behavior, reproduction, distribution, and habitat (Purdy et al. 1987, Knight and Cole 1995).

Purdy et al. (1987) and Pomerantz et al. (1988) described six categories of impacts to wildlife as a result of visitor activities. They are:

- 1) Direct mortality: immediate, on-site death of an animal;
- 2) Indirect mortality: eventual, premature death of an animal caused by an event or agent that predisposed the animal to death;
- 3) Lowered productivity: reduced fecundity rate, nesting success, or reduced survival rate of young before dispersal from nest or birth site;
- 4) Reduced use of refuge: wildlife not using the refuge as frequently or in the manner they normally would in the absence of visitor activity;
- 5) Reduced use of preferred habitat on the refuge: wildlife use is relegated to less suitable habitat on the refuge due to visitor activity; and
- 6) Aberrant behavior/stress: wildlife demonstrating unusual behavior or signs of stress likely to result in reduced reproductive or survival rates.

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).

Heron 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).

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

People can be vectors for invasive plants by moving seeds or other propagules from one area to another. Once established, invasive plants can out-compete native plants, thereby altering habitats and indirectly impacting wildlife. The threat of invasive plant establishment will always be an issue requiring annual monitoring and treatment when necessary. Refuge staff will work at eradicating invasive plants and educating the visiting public.

Humans have also been known to introduce non-native species intentionally into water bodies. Non-native fish such as carp and bullfrogs have already been found in Harkins Slough. Adult, non-native bullfrogs (*Rana catesbeiana*) have also been sporadically observed on the Calabasas and Ellicott Slough Units.

Refuge staff, in collaboration with volunteers and researchers, will monitor and evaluate the effects of these priority uses to discern if adverse effects to wildlife or habitats result

from the uses. Temporary area closures and seasonal guidelines may be used to minimize impacts.

Section 7 consultations were completed with the Service (\_\_\_\_) on the Draft CCP/EA for the following species: Santa Cruz long-toed salamander, California tiger salamander, California red-legged frog, and the robust spineflower.

**Public Review and Comment:**

Public review and comments will be solicited in conjunction with distribution of the Draft CCP for Ellicott Slough 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

Use is Compatible with the Following Stipulations

**Stipulations necessary to ensure compatibility:**

1. Wildlife observation and photography would only be allowed between sunrise and sunset, unless they are part of a refuge-led activity.
2. Public access would be restricted to trails, other designated facilities/areas, and appropriate times of year where the least disruption to wildlife and their habitats would occur.
3. Refuge tours will have an established limit on number of participants.
4. Refuge tours will be led by Refuge staff on Units with sensitive habitat to prevent impacts, and partners/volunteers leading tours at Harkins Slough will be trained in Refuge rules and regulations.
5. Regulations and wildlife friendly behavior (e.g., requirements to stay on designated trails, no dogs, etc.) would be posted at the general information kiosk and described in brochures.
6. Maps and visitor use information would also be available at the Refuge Headquarters and the Complex website.
7. Collection of plants, animals and other specimens, debris or artifacts would be prohibited unless the collection is part of a refuge-led activity.
8. Regulations would be enforced to insure public safety and to prevent resource impacts.

**Justification:** After assessing the potential impacts from the uses proposed for the Refuge it was determined 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. Providing opportunities for wildlife observation and

photography would contribute toward fulfilling provisions of the National Wildlife Refuge System Administration Act, as amended in 1997. Wildlife observation and photography provide an excellent forum for allowing public access and increasing understanding of the Refuges' resources. These activities would allow visitors to experience and learn about native wildlife and plant species in the Monterey Bay area. The Refuge will provide opportunities for wildlife enjoyment not usually available on adjacent private land. Refuge visitors will better understand the challenges facing our wildlife and wild land resources, what effects the public can have on wildlife resources, and learn more about the Service's role in conservation. With the stipulations considered in this compatibility determination, wildlife observation and photography would be compatible with Refuge purposes and the System mission.

**Mandatory Re-Evaluation Date (2025):**

- Mandatory 15-year Re-Evaluation, Date will be provided in Final EA/CCP (for priority public uses)
- Mandatory 10-year Re-Evaluation (for all uses other than priority public uses)

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

- Categorical Exclusion without Environmental Action Statement
- Categorical Exclusion and Environmental Action Statement
- 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)

Ellicott Slough NWR Wildlife Observation and Photography Compatibility Determination

Wildlife Refuge Manager/  
Project Leader

Approval:

\_\_\_\_\_  
(Signature)

\_\_\_\_\_  
(Date)

**Concurrence**

Refuge Supervisor:

\_\_\_\_\_  
(Signature)

\_\_\_\_\_  
(Date)

Assistant Regional  
Director, Refuges:

\_\_\_\_\_  
(Signature)

\_\_\_\_\_  
(Date)

## **Appendix H.**

# **Wilderness Inventory**

## Appendix H.

### Wilderness Inventory for

### Ellicott Slough National Wildlife Refuge

#### ***Wilderness Review Process***

The purpose of a wilderness review is to identify and recommend for Congressional designation National Wildlife Refuge System (System) lands and waters that merit inclusion in the National Wilderness Preservation System (NWPS). Wilderness reviews are a required element of CCPs and are conducted in accordance with the refuge planning process outlined in 602 FW 1 and 3, including interagency and tribal coordination, public involvement and National Environmental Policy Act (NEPA) compliance.

There are three phases to a wilderness review: inventory, study, and recommendation. The wilderness inventory identifies those lands within the refuge that might have wilderness character and satisfy the definition of wilderness. Each unit must be roadless and be either greater than 5,000 acres; a roadless island of any size; or less than 5,000 acres but of sufficient size to be practicably managed as wilderness. The inventory preliminarily classifies each unit of land that meets these requirements as a wilderness study area (WSA).

The wilderness study further evaluates each WSA for values, resources, and uses to determine if each one merits recommendation from the Service to the Secretary of the Interior as wilderness. The recommendation phase consists of forwarding or reporting recommendations for wilderness designation from the Director through the Secretary and the President to Congress in a wilderness study report.

This appendix summarizes the wilderness inventory for Ellicott Slough National Wildlife Refuge.

#### **Inventory Criteria**

The wilderness inventory is a broad look at the planning area to identify WSAs. These are roadless areas that meet the minimum criteria for wilderness identified in Section 2(c) of the Wilderness Act.

*“A wilderness, in contrast with those areas where man and his works dominate the landscape, is hereby recognized as an area where the earth and its community of life are untrammelled by man, where man himself is a visitor who does not remain. An area of wilderness is further defined to mean in this Act an area of undeveloped Federal land retaining its primeval character and influence, without permanent improvements or human habitation, which is protected and managed so as to preserve its natural conditions, and which: (1) generally appears to have been affected primarily by the forces of nature, with the imprint of man’s work substantially unnoticeable; (2) has outstanding opportunities for solitude or a primitive and unconfined type of recreation; (3) has at least five thousand acres of land or is of sufficient size as to make practicable its preservation and use in an unimpaired condition; and (4) may also contain ecological, geological or other features of scientific, educational, scenic, or historical value.”*

A WSA must appear natural, provide outstanding opportunities for solitude or primitive recreation, meet the size criteria, and may provide other supplemental values. The process for identification of roadless areas at the Refuge and application of the wilderness criteria are described in the following sections.

## **Identification of Roadless Areas and Roadless Islands**

Identification of roadless areas and roadless islands required gathering and evaluating land status maps, land uses, road inventory data, and aerial photographs for the Refuge. “Roadless” refers to the absence of improved roads suitable and maintained for public travel by means of motorized vehicles primarily intended for highway use. Only lands currently owned by the Service in fee title are discussed in this inventory.

## **Evaluation of the Naturalness Criteria**

In addition to being roadless, a WSA must meet the naturalness criteria. Section 2(c) defines wilderness as an area that “... generally appears to have been affected primarily by the forces of nature with the imprint of man’s work substantially unnoticeable.” The area must appear natural to the average visitor rather than “pristine.” 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 WSA 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 the Size Criteria**

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

- 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 than 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 managing agency such as the Forest Service, National Park Service, or Bureau of Land Management.

### **Evaluation of Supplemental Values**

Supplemental values are defined by the Wilderness Act as “...ecological, geological, or other features of scientific, educational, scenic, or historic value.” These values are not required for wilderness but their presence should be documented.

### **Ellicott Slough National Wildlife Refuge**

Ellicott Slough National Wildlife Refuge (Ellicott Slough NWR) contains a total of 200 discontinuous acres, owned in fee title by the Service. The largest Service-owned segment of contiguous land at Ellicott Slough NWR consists of 121 acres. The Refuge is largely surrounded by roads and rural residential and agricultural lands. The Ellicott Unit is bisected by a public access road running from San Andreas Road to the east. Ellicott Slough NWR does contain features of scientific, educational, scenic, and historical value. However, Ellicott Slough NWR does not meet the overall criteria for recommendation as a wilderness area because:

- much of the Ellicott Slough NWR has been impacted by man;
- it does not offer outstanding opportunities for primitive or unconfined recreation or solitude; and;
- it does not encompass 5,000 contiguous acres.

## **Appendix I.**

# Appendix I.

## List of Preparers

### Planning Team Members and Persons Responsible for Preparing this Document

#### CCP Core Team

Diane Kodama, Refuge Manager, Ellicott Slough NWR, USFWS  
Rachel (Hurt) Tertes, Biologist, Ellicott Slough NWR, USFWS  
Winnie Chan, Refuge Planner, San Francisco Bay NWR Complex, USFWS  
Tia Glagolev, Environmental Education Specialist, San Francisco Bay NWR Complex, USFWS  
Karla Tanner, Chief, Visitor Use Program, previously with San Francisco Bay NWR Complex, USFWS  
Mendel Stewart, Project Leader, San Francisco Bay NWR Complex, USFWS  
Sandy Osborn, Refuge Planner, Pacific Southwest Region, USFWS

#### CCP Expanded Team

Diane Kodama, Refuge Manager; Ellicott Slough NWR, USFWS  
Rachel (Hurt) Tertes, Biologist; Ellicott Slough NWR, USFWS  
Winnie Chan, Refuge Planner; San Francisco Bay NWR Complex, USFWS  
Tia Glagolev, Environmental Education Specialist, San Francisco Bay NWR Complex, USFWS  
Karla Tanner, Chief, Visitor Use Program, previously with San Francisco Bay NWR Complex, USFWS  
Sandy Osborn, Refuge Planner; Region 8, Pacific Southwest Region, USFWS  
Mendel Stewart, Project Leader, San Francisco Bay NWR Complex, USFWS  
Richard Smith, Land Protection Planner; Region 8, Pacific Southwest Region, USFWS  
Sallie Hejl, Regional Biologist, Region 8, Pacific Southwest Region, USFWS  
Debra Schlafmann, Pacific Southwest Region, USFWS  
Cathy Johnson, Sacramento Fish and Wildlife Office, USFWS  
Chad Mitcham, Fish & Wildlife Biologist, Ventura Fish and Wildlife Office, USFWS  
Connie Rutherford, Ventura Fish and Wildlife Office, USFWS  
Denise Steurer, Ventura Fish and Wildlife Office, USFWS  
Mary Root, Conservation Partnerships Program Coordinator, USFWS  
Jamie Bettaso, Arcata Fish and Wildlife Office, USFWS  
Nick Valentine, Cultural Resources, Region 1, Pacific Region, USFWS  
Peter Kelly, Fire Management Officer, San Luis NWR Complex, USFWS  
Miriam Morrill, Wildland Fire Management Branch, USFWS

Michelle Leicester, California Department of Fish and Game  
Suzanne DeLeon, Environmental Scientist, California Department of Fish and Game  
Jeannine DeWald, Associate Biologist (Wildlife), California Department of Fish and Game  
Becky Suarez, California Department of Fish and Game  
Dave Johnston, California Department of Fish and Game  
Angela Berheisel, Cal Fire

Dana Bland, private consultant  
David Laabs, Biosearch Associates  
Mark Allaback, Biosearch Associates  
Steve Miller, volunteer  
Steve Ruth, volunteer

Wes Savage, Ph.D.; researcher, UC Davis  
Brad Shaffer, UC Davis  
Norman Scott  
Galen Rathbun  
Sandy Baron  
Bernadette Ramer, Santa Cruz Bird Club  
Rob Ramer, Santa Cruz Bird Club  
Brian Popper  
Paul Binding, County of Santa Cruz Mosquito and Vector Control  
Kim Hayes, Elkhorn Slough Foundation  
Grey Hayes, Elkhorn Slough National Estuarine Research Reserve  
Laura Kummerer, High Ground Organics  
Jonathan Pilch, Watsonville Wetlands Watch  
Chris Hauser, Santa Lucia Conservancy  
Bree Candiloro, Elkhorn Slough National Estuarine Research Reserve  
Kris Beall, Watsonville Wetlands Watch  
Donna Bradford, County of Santa Cruz  
Bob Geyer, City of Watsonville  
Steve Palmisano, City of Watsonville  
Jonathan Pritchard, consultant  
Tom Crosser, Aptos La Selva Fire District  
Kris Beall, Watsonville Wetlands Watch  
Shoshana Coplan, Renaissance High School  
Monterey Peninsula Audubon Society (Monterey County)  
Sequoia Audubon Society (San Mateo County)

## **Appendix J.**

# **Public Involvement**

## **Appendix J.**

# **Public Involvement**

The responses to comments on the Draft CCP/EA will be provided in the public Final CCP/Final EA.