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## 6.0 CONSERVATION STRATEGY

### 6.1 OVERVIEW

This section, in combination with Sections 5.0 and 7.0 comprise the Solano HCP Conservation Program. The Conservation Strategy contains specific conservation measures designed to achieve biological goals and objectives for each Natural Community and Covered Species and to result in the development of a system of reserves. The Conservation Strategy is consistent with the U.S. Fish and Wildlife Service's "5-Point Policy" for Habitat Conservation Plans (USFWS 2000) and the overall purpose of the Solano HCP:

*"...to promote conservation of biological diversity consistent with the recognition of private property rights, providing for a healthy economic environment for the citizens, agriculture, and industries, and on-going maintenance and operation of public and private facilities in Solano County."*

Based on the Conservation Analysis (Section 4.0), biological goals and objectives for each Natural Community and Covered Species were developed to fully mitigate planned take and impacts associated with Covered Activities. In combination, these biological goals and objectives are designed to achieve the overarching conservation goal of the Solano HCP, to preserve contiguous functional landscapes that encompass the full suite of ecological diversity, maintain connectivity among natural communities, and functionally buffer natural communities from direct and indirect impacts from anthropogenic pressures.

Goals are broad, guiding principles based on the conservation needs of each Natural Community and Covered Species and describe the desired future condition of these communities and species with full implementation of the HCP. Each goal correlates to an essential ecological process or function identified in the conceptual models in Appendix B and to the reserve design principles described in Section 4.2.

Objectives are then provided to achieve the biological goals. Objectives are expressed as conservation targets and specific actions and clearly state a desired result. Objectives are the measurable components of the Conservation Program and are intended to be achieved within a given time-frame. The determination of conservation measures, adaptive management and biological effectiveness monitoring (see Section 7.0) derive from the objectives.

The conservation measures specify actions that will collectively achieve the objectives and thus the biological goals of the Conservation Strategy. The monitoring approach, adaptive management framework, and implementation of the HCP are based on the conservation measures.

### 6.1.1 Mitigation Standards

The Conservation Analysis in Section 4.0 addresses the conservation standards for the Covered Species and Natural Communities and estimates the acreage of each habitat type needed to conserve and recover the applicable Covered Species and associated Natural Communities. The intent of this analysis was to: evaluate and identify broad recovery requirements for Solano County resources, allow the Plan Participants to determine additional commitments required to meet the State NCCPA conservation and recovery standards, and to assist USFWS in assessing any adverse modification of designated critical habitats in the Plan Area. The Plan Participants determined that the additional State NCCPA recovery commitments could not be met and decided to pursue incidental take permits under FESA (Section 10(a) permit) and CESA (Section 2081 permit). The standards for issuance of incidental take permits under these regulations focus primarily on the ability to mitigate adverse effects of Covered Activities versus the higher, recovery standard required to meet NCCP Act requirements.

Under Federal ESA incidental take standards, an HCP must: 1) *“to the maximum extent practicable, minimize and mitigate the impacts of such taking”* (animals); 2) *“...not jeopardize the continued existence of any species”* (plants and animals), and 3) *“...not appreciably diminish the value of the critical habitat for the survival and recovery of the species”* (critical habitat). Under Section 2081 of the California Fish and Game Code, a mitigation plan must *“minimize and fully mitigate the effects of the authorized taking.”*

The measures developed for the Solano HCP Conservation Program achieve these regulatory requirements. The Conservation Program follows the standard hierarchical strategy of avoidance and minimization as a first priority<sup>1</sup> (see Section 5.0), followed by compensatory mitigation as outlined in the Conservation Strategy. Section 5.3 describes the mandatory avoidance and minimization measures to be implemented prior to initiating the compensatory Conservation Measures specified in Section 6.0. To determine the level of required conservation/mitigation, regulatory standards (i.e., “maximum extent practicable” and “fully mitigate”) were considered and defined. The term “maximum extent practicable,” or MEP, is the basic performance standard for numerous state and federal regulations, including the FESA and Section 404 of the Federal Clean Water Act. The MEP standard does not involve the same criteria in each application; rather it considers the specific circumstances and purpose of each individual project.

For the purposes of the Solano HCP, the working definition of “maximum extent practicable” combines primary elements from the EPA’s 404(b)(1) guidelines assessing the feasibility of alternatives to minimize impacts to aquatic resources and from the USFWS HCP Handbook (USFWS 1996) evaluating the maximum conservation program reasonably required of an HCP applicant.

The EPA defines “practicable” as: *“available and capable of being done after taking into consideration cost, existing technology and logistics in light of overall project purposes (40 CFR 230.10(a)(2)).”*

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<sup>1</sup> Note: The Solano HCP deviates from the standard maximum or full avoidance in all cases as being the highest priority. The Solano HCP conservation strategy recognizes that avoidance that results in the creation of small, isolated, patches of habitat is not ecologically defensible or desirable in most cases. Generally, the Solano HCP only requires avoidance where avoided habitats contribute significantly to the value of adjacent open space lands or reserves or where “specialty” reserves are necessary to protect certain, high value resources.

The USFWS HCP Handbook (USFWS 1996, Section 7.B.2) states that a conservation program may be evaluated against the MEP standard by: “*Weighing the benefits and costs of implementing additional mitigation, the amount of mitigation provided by other applicants in similar situations, and the abilities of that particular applicant.*”

The Handbook also recommends consistency in mitigation standards among offices and regions (Section 3.B.3.f.). This guidance provides an “equity” standard to for considering the MEP. To assess equity, conservation/mitigation measures were evaluated with respect to accepted mitigation standards and levels of mitigation required by other applicants in similar situations.

Comparison with typical or “standard” mitigation requirements were based on a number of examples such as:

#### Standards

- The Corps and RWQCB typically require 2:1 mitigation replacement ratios for wetlands in compliance with State and federal “no net loss” wetland policies.
- For less than 1 acre of impact, the USFWS Vernal Pool Programmatic (1999) mitigation ratio for low value vernal pools is 2:1 preservation and 1:1 construction.
- The USFWS Vernal Pool Species Recovery Plan (2005a).
- CDFG Statewide Guidelines for Impacts to Swainson’s Hawks (1994b).
- CDFG Statewide Guidelines (1995) and Burrowing Owl Consortium Guidelines (1997).

#### Comparables

- Existing HCPs such as San Joaquin County, East Contra Costa County, and Natomas Basin.
- Draft HCPs or other regional conservation plans in progress such as Yolo County, Placer County and southern Sacramento County.
- Biological Opinions for large-scale projects within northern California.

In summary, the conservation and mitigation measures required in the Solano HCP were derived by balancing the regional biological and conservation needs of Covered Species and Natural Communities (see Appendix B and Section 4.0) with considerations of cost (when available), logistics, technology, and equity, as defined for the Solano HCP. The effects of the Conservation Program on the economic viability of individual projects may vary; however, compliance with the Conservation Measures is mandatory. Individual projects may not reduce the required conservation requirements.

### **6.1.2 Conservation Strategy Summary**

Implementation of the Solano HCP Conservation Strategy will result in the establishment of a reserve system that will:

- preserve and manage an additional 10,500 to 11,500 acres of valley floor/vernal pool grassland habitat;

- preserve and manage approximately 5,700 acres of agricultural habitat and 1,000 acres of grassland/oak savanna habitat for Swainson’s hawks and burrowing owls and provide for increased long-term nesting opportunities through the establishment of a tree planting program and installation and maintenance of artificial burrow complexes;
- preserve and manage approximately 3,300 acres of upland habitat for California red-legged frogs and callippe silverspot butterfly and promote the expansion and recovery of California red-legged frog and callippe silverspot butterfly populations;
- provide additional sources of funding for management and restoration of Suisun Marsh and Delta waterways within the Plan Area to improve water quality and control invasive species on 5,000 to 8,500 acres of coastal marsh habitat;
- improve regional water quality to the maximum extent possible by implementing best management practices on future development projects to minimize construction and post construction water quality impacts;
- restore and manage an additional 175 acres of aquatic habitat and approximately 120 acres of associated upland habitat for giant garter snakes; and
- provide long-term commitment for future acquisition, including seeking grant funding for additional acquisitions of high priority conservation areas that will contribute to the recovery of Covered Species within the Plan Area.

## **6.2 LANDSCAPE LEVEL CONSERVATION STRATEGY**

The landscape level goals, objectives and conservation measures presented in this section apply to all of the Natural Communities and Covered Species. General landscape issues include corridors, invasive species control and public education.

### **6.2.1 Landscape Level Goals and Objectives**

**Goal LAN 1.** Maintain connectivity among natural communities.

**Objective LAN 1.1.** Protect and maintain important landscape corridors between representative Natural Communities within the Plan Area. These include:

- North Vacaville
- Vacaville-Fairfield Green Belt
- West Hills – Vaca Mountains Corridor
- Vallejo Lakes and Rockville Hills
- Suisun Valley
- Jepson Prairie-Suisun Marsh Corridor

**Goal LAN 2.** Maximize values, productivity, and carrying capacity of natural lands and contribute to the recovery of Covered Species.

**Objective LAN 2.1.** Develop and implement invasive species control programs within 5 years of adopting the Solano HCP.

**Objective LAN 2.2.** Within 5 years of adopting the Solano HCP, implement programs to educate the public on the progress of conservation efforts conducted as part of the HCP and coordinate with the Resource Agencies.

**Objective LAN 2.3.** Plan Participants shall seek grants and funds from third party government and non-government sources to acquire and manage additional high priority conservation lands through fee title and/or conservation easements as part of ongoing open space acquisition and farmland protection activities.

### 6.2.2 Landscape Level Conservation Measures

The following measures are designed to contribute to the conservation of Covered Species throughout the Plan Area and to achieve the Landscape Goals and Objectives above.

**Conservation Measure LAN 1: Establish Greenbelts and Corridors.** Plan Participants shall, within their regulatory authority and through cooperative agreements with other jurisdictions, use zoning and other applicable regulatory mechanisms to maintain green belts between urban areas and to limit incompatible land uses in corridors within existing urban boundaries that provide habitat connectivity between various eco-regions of Solano County (Figure 4-3). Important corridors within the County include:

- **The Tri City/County Planning Area** provides a link from San Pablo Bay environments through Suisun Marsh to the Montezuma Hills, the Delta, Jepson Prairie, and into agricultural areas of the north County.
- **The Vacaville-Fairfield Greenbelt** provides connectivity between the lowlands of the Jepson Prairie region and the Vaca Mountains.
- **Suisun Valley** provides a corridor from the West Hills to Suisun Marsh.
- **The Vaca-Dixon Greenbelt** establishes a block of continuous Swainson's hawk foraging and nesting habitat between the urban areas of Vacaville and Dixon and links Swainson's hawk habitat in the northern Jepson Prairie region with the north County area.
- **The Dixon-Davis Greenbelt** establishes a block of continuous Swainson's hawk foraging and nesting habitat between the urban areas of Davis and Dixon and links Swainson's hawk habitat in the northern Jepson Prairie region with the north County area.
- **The Jepson Prairie-Suisun Marsh** provides the only significant broad transitional band from tidal marsh into valley floor and vernal pool grasslands remaining in the San Francisco Bay Region.

This Conservation Measure is designed to achieve Goal LAN 1 and Objective LAN 1.1.

**Rationale.** This Conservation Measure is designed to meet Reserve Design Principle 6 described in Section 4.2.

**Conservation Measure LAN 2: Invasive Species Control Programs.** Plan Participants shall develop and implement invasive species control programs to control aggressive invasive species along public rights-of-way, roads, drainage facilities, utility rights-of-way, and other public lands. Invasive species control measures shall be adopted as part of ongoing operation and maintenance activities associated with these public facilities (e.g., flood control channels, parks, bike paths and linear parks, etc.). Within 5 years of adopting the HCP, invasive species control programs shall be in place and control efforts shall conform to the restoration guidelines of the HCP.

This Conservation Measure is designed to achieve Goal LAN 2 and Objective LAN 2.1.

**Rationale.** Non-native species can significantly alter ecosystems, upset the ecological balance, and cause significant economic harm. Chaplin et al. (2000) concluded that invasive species contribute directly to the decline of 49 percent of the threatened and endangered species in the United States, with only habitat loss posing a greater threat to native species and biodiversity. Without invasive species control, populations of Covered Species may continue to decline towards extinction despite existing protection measures. Conservation Measure LAN 2 is designed to control invasive species along known dispersal routes, and therefore, potentially eliminating dispersing individuals before they reach core reserve areas. Common dispersal routes for exotic invasive species include roads, drainage facilities, utility rights-of-way, bike paths and other linear features that provide public access and rights-of-way.

**Conservation Measure LAN 3: Public Education.** Within 2 years of HCP adoption, Plan Participants shall develop a community outreach program to educate the public on the progress of conservation efforts conducted as part of the HCP and shall coordinate with the Resource Agencies to help meet recovery criteria for Covered Species and Natural Communities within the Plan Area. As part of this community outreach program, compatible passive recreational and agricultural practices that contribute to public outreach and education shall be allowed within preserve areas under the condition that these activities do not significantly affect habitat quality for Covered Species or Natural Communities. In addition, public education programs shall address the effects of non-native predators and domestic and feral pets on native wildlife species, particularly salt marsh wildlife.

This Conservation Measure is designed to achieve Goal LAN 2 and Objective LAN 2.2.

**Rationale.** Active public participation is an essential element in successfully coordinating large-scale conservation efforts. Community outreach and educational programs are one way to engage and involve the public in regional conservation planning efforts.

**Conservation Measure LAN 4: Grant Funding.** The Plan Participants shall implement programs to obtain grants and funds from government and non-government sources to acquire and manage lands in the following high value conservation areas:

Vernal Pool Ecosystem/Lowland Grassland/Burrowing Owl

- Locate and establish reserve/preserves and implement restoration within High Value Vernal Pool Conservation Sub-areas 1A (Jepson Prairie), 1I (Montezuma Hills) and 1K (Collinsville Core Recovery Area) (Figure 4-8).

- Locate and establish specialty reserves to preserve, restore and enhance core Contra Costa goldfields populations, within High Value Vernal Pool Conservation Sub-areas 1B (McCoy Creek Watershed), 1C (Lower Ledgewood Creek), 1D (Cordelia population), 1E (Upper Union Creek), and 1F (Potrero Hills/Lower Union Creek).
- Locate and establish a reserve/preserve within High Value Vernal Pool Conservation Sub-area 1L (Hardpan Pools/Corning series soils), the southern extent of this soil and associated vernal pool type in California. Its unique position on the periphery of the range of this vernal pool type contributes to the diversity of vernal pool habitats in Solano County.

#### Swainson's Hawk

- Encourage compatible irrigated agricultural land uses and crops in Swainson's hawk Irrigated Agricultural Potential Reserve Areas in the Elmira, Dixon Ridge, and Maine Prairie regions of Solano County (Section 4.3.9 and Figure 4-28).

#### Grasslands and Oak Woodlands

- Acquire land and establish additional reserves within the Tri-City/County Planning Area to expand the existing reserve system and protect and manage important California red-legged frog and Callippe silverspot butterfly habitats (Figures 4-14 and 4-13).
- Encourage preservation in northeast Fairfield (Rancho Solano Master Plan Area) consistent with the City of Fairfield's 2002 General Plan to expand and connect existing grassland and woodland open spaces and to provide a large, contiguous regional grassland and woodland open space reserve.
- Encourage the establishment of smaller grassland reserves to protect existing woodland stands and promote connectivity through corridors and "stepping stone" reserves.

#### Riparian

- Widen and restore riparian corridors and functional flood plains where possible such as in eastern Vacaville and eastern Fairfield.

This Conservation Measure is designed to achieve Goal LAN 2 and Objective LAN 2.3.

**Rationale.** During development of the Solano HCP, actions required to achieve the recovery standards under the California NCCPA were considered. Although this alternative was not selected as the preferred alternative (see Section 9.5), Plan Participants are committed to preserving the legacy of conservation in Solano County (see Section 3.5) and encouraging future recovery actions through available land use/regulatory programs and efforts to obtain outside funding for land acquisition and protection.

### **6.3 VALLEY FLOOR GRASSLAND AND VERNAL POOL CONSERVATION STRATEGY**

The Valley Floor Grassland and Vernal Pool Natural Community goals, objectives and conservation measures are applicable to grassland habitat within the historical alluvial terraces or valley floor portions of Solano County as well as the larger grasslands in the Montezuma Hills and Potrero Hills

(Figure 4-2). Significant portions of these grassland areas currently support or historically supported, and are reasonably capable of being restored to, vernal pool habitats. The Conservation Strategy applies to the wetlands and surrounding grasslands within these areas that provide habitat for vernal pool and grassland associated Covered Species and Special Management Species.

The Valley Floor Grassland and Vernal Pool Natural Community Conservation Strategy focuses on establishing and maintaining a reserve system that enhances the essential ecological processes, functions, and values; maintains species diversity; and supports adaptation and evolutionary changes of valley floor grassland and vernal pool ecosystems. Primary conservation actions include preservation, restoration, reintroduction of Covered Species and their habitat, and maintaining connectivity between vernal pool regions.

In Section 4.3.2.3, High, Medium and Low Value Conservation Areas were identified based on specific conservation criteria (Figure 4-9). The High and Medium Value Conservation Areas were further divided into subareas based on geographic areas and species-specific conservation requirements. Conservation goals and objectives were developed for each conservation subarea. The conservation measures pertain to these conservation areas and subareas and establish appropriate mitigation for Covered Activities and acceptable levels of development within the Plan Area compatible with the regional conservation goals and objectives.

The conservation measures are designed to offset impacts from Covered Activities and achieve the biological goals and objectives of the HCP. Implementation of the Solano HCP Conservation Strategy will result in the preservation of 10,500 to 11,500 acres of Valley Floor and Vernal Pool Grassland habitat within High and Medium Value Vernal Pool Conservation Areas, contributing to the conservation target established in Section 4.5.2 and identified in the Vernal Pool Recovery Plan (USFWS 2005a).

### **6.3.1 Valley Floor Grassland and Vernal Pool Goals and Objectives**

**Goal VPG 1.** Establish and maintain a reserve system that enhances the essential ecological processes, functions, and values, and maintains species diversity and the potential for adaptation and evolutionary change of Valley Floor Grassland and Vernal Pool Ecosystems<sup>2</sup>.

**Objective VPG 1.1.** Preserve 10,500 to 11,500 acres of Valley Floor Grassland and Vernal Pool habitat within High Value Vernal Pool Conservation Areas (Figure 4-9) and/or future protection priority areas identified in Figure 4-27. More specifically, preserve approximately:

- 380 - 400 acres in Subarea 1B,
- 700 - 760 acres in Subarea 1C,
- 60 acres in Subarea 1D,
- 170 acres in Subarea 1E,
- 120 acres in Subarea 1G,

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<sup>2</sup> The reserve design principles outlined in Section 4.2 and the criteria used to identify High Value Conservation Areas in Section 4.3.2.3 set additional criteria necessary to achieve this goal.

- at least 350 acres in Subarea 1F, and
- 8,700 acres to 9,700 acres in Subarea 1A or other potential vernal pool reserve areas delineated in Figures 4-8 and 4-26.

**Rationale.** Subarea preservation objectives establish minimum reserves in all High Value Conservation Areas. Establishment of reserves in Subareas 1B through 1G is particularly important for conserving the genetic range of Contra Costa goldfields.

**Objective VPG 1.2.** Restore 270 to 400 acres of vernal pool wetlands within High and Medium Value Vernal Pool Conservation Areas.

**Rationale.** Historical land use practices have altered much of the remaining vernal pool and associated valley floor grassland habitat (see Figure 4-6). While significant resources still exist, active management and restoration is needed to restore historical levels of productivity and value for native vernal pool and associated grassland species. Restoration will be conducted within moderately to highly disturbed habitats within and adjacent to moderate/high quality vernal pool complexes identified in Figure 4-9. The success of restoration efforts will be measured by the diversity of species (i.e., native versus nonnative) and the distribution and relative abundance of covered vernal pool species present in restored habitats (see Section 7.0 for specific monitoring criteria).

**Goal VPG 2.** Maintain and where possible through restoration, increase population levels and distribution of covered vernal pool species.

**Objective VPG 2.1.** Conserve 90 percent of the existing occurrences of Contra Costa goldfields within the Plan Area.

**Objective VPG 2.2.** Establish 100 acres of new, self-reproducing Contra Costa goldfield populations<sup>3</sup> within known or potential habitat areas (Figure 4-7).

**Objective VPG 2.3.** Preserve one occurrence<sup>4</sup> of Ferris's Milk-vetch within the Plan Area.

**Objective VPG 2.4.** Preserve eight occurrences of alkali milk vetch within the Plan Area.

**Objective VPG 2.5.** Preserve one occurrence of vernal pool small scale within the Plan Area.

**Objective VPG 2.6.** Preserve two occurrences of Boggs lake hedge-hyssop within the Plan Area.

**Objective VPG 2.7.** Preserve three occurrences of Legenere within the Plan Area.

**Objective VPG 2.8.** Preserve one occurrence of Colusa grass within the Plan Area.

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<sup>3</sup> Self reproducing population is defined as having plants that reestablish annually for a minimum of 5 years with no human intervention such as supplemental seeding.

<sup>4</sup> One occurrence corresponds to an occupied area at least 0.4 kilometers (¼ mile) away from the next occupied area (UFWS 2006).

**Objective VPG 2.9.** Preserve one occurrence of San Joaquin Valley Orcutt grass within the Plan Area.

**Objective VPG 2.10.** Preserve one newly established/reintroduced occurrence of Solano grass within the Plan Area.

**Objective VPG 2.11.** Preserve 2,500 acres of natural vernal pool grassland encompassing known occurrences of Delta green ground beetles within the Jepson Prairie region of the Plan Area.

**Objective VPG 2.12.** Preserve five occurrences of Conservancy fairy shrimp within the Plan Area.

**Objective VPG 2.13.** Preserve ten occurrences of Vernal pool fairy shrimp within the Plan Area.

**Objective VPG 2.14.** Preserve four occurrences of Vernal pool tadpole shrimp within the Plan Area.

**Objective VPG 2.15.** Preserve four occurrences of Mid-valley fairy shrimp within the Plan Area.

**Rationale.** The Recovery Plan for Vernal Pool Ecosystems of California and Southern Oregon (USFWS 2005a) establishes recovery criteria that require protection of 100 percent of all species populations with fewer than 20 occurrences and that occur in 3 or fewer vernal pool regions, unless new populations are discovered or established (i.e., replacements for current occurrences). The recovery criteria require protection of less than 100 percent of all species with more than 20 known occurrences throughout their geographic and ecological range. The USFWS defines one occurrence as an occupied area at least 0.4 kilometers (¼ mile) away from the next occupied area (USFWS 2005a). Implementation of the Solano HCP Conservation Strategy will protect approximately 50 percent of the habitat identified in the Recovery Plan. Therefore, species-level objectives for the HCP were also established at 50 percent of the recovery criteria. The objectives identify the number of occurrences to be preserved based on the percentage of known occurrences identified in the recovery plan. Preservation of these occurrences will be achieved by preserving known, new or restored occurrences on preserve land.

**Objective VPG 2.16.** Preserve at least four multiple breeding populations of California tiger salamanders<sup>5</sup> and 350 to 500 acres of associated upland habitat per breeding population. The reserves shall be distributed throughout the range of the species within Solano County, and include one preserve in Vernal Pool Conservation Area 1F (the Potrero Hills/Highway 12 region), two preserves in Vernal Pool Conservation Area 1A (the Greater Jepson Prairie region), and one preserve in Vernal Pool Conservation Areas 1C and 1D (northeast Fairfield region).

**Objective VPG 2.17.** Create 30 acres of new breeding habitat for California tiger salamanders within the known range of the species (Figure 4-8).

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<sup>5</sup> A breeding population includes a minimum of 2 or more breeding sites located within 0.7 mile of each other and connected by continuous associated upland habitat.

**Rationale.** Trenham and Schaffer (2005) in their study at Olcott Lake on the Jepson Prairie documented the need to preserve a minimum of 350 acres of upland surrounding a breeding site in order to maintain a viable population. Habitat preservation, by itself, is an important tool for species recovery; however, providing additional breeding habitat, as required under Objective VPG 2.17, is necessary to increase California tiger salamander numbers in order to offset reduced population levels associated with Covered Activities.

### **6.3.2 Valley Floor Grassland and Vernal Pool Conservation Measures**

The following conservation measures contribute to the conservation of Valley Floor Grasslands and Vernal Pools and achieve the goals and objectives for this Natural Community. Conservation measures are divided into the following categories: Natural Community Conservation Measures and Species-Specific Conservation Measures.

**6.3.2.1 Natural Community Conservation Measures.** The following conservation measures apply to Valley Floor Grassland and Vernal Pool habitat and relate primarily to corridors and connectivity and habitat mitigation.

**Conservation Measure VPG 1: Landscape Mosaic Corridors.** Plan Participants shall preserve and manage landscape mosaic corridors linking High Value Vernal Pool Conservation Areas. Landscape mosaic corridors are large corridors designed to connect major vernal pool areas, such as, the greater Jepson Prairie (High Priority Conservation Area Subarea 1A) and the Potrero Hills (Subareas 1F and 1E). Landscape mosaic corridors must be large enough to provide sufficient habitat for daily or seasonal movements of Covered Species such that all of a species' life history requirements are met within the corridor environment (Noss 1991).

Landscape mosaic corridors that retain existing links between the vernal pool complexes in the upper Union Creek and northeastern McCoy Creek watersheds (Subareas 1C, 1D and 1B) and the Jepson Prairie (Subarea 1A)(Figure 4-9) shall be incorporated into new development projects in northeast Fairfield (east of Peabody Road, within Conservation Areas 1B, 1C, and 1D). Landscape mosaic corridors shall be at least 1,320 feet wide and shall provide for animal movement, seed dispersal, long-term genetic interchange, and be of sufficient size to provide habitat components for all life stages of Covered Species occupying the corridor.

This Conservation Measure meets Objective VPG 1.1.

**Conservation Measure VPG 2: Maintain Connectivity.** New roads or the expansion of existing roads that meet the following criteria shall incorporate design measures to facilitate the movement of small animals and maintain hydrological connectivity:

1. It is within a High Value Vernal Pool Conservation Areas or bisect a designated corridor; and
2. Will have a projected night-time traffic volume of 20 cars per hour or greater at maximum capacity.

Design measures may include culverts, underpasses, and roadside barriers to prevent animals from accessing the roads. Crossings between open space areas shall be provided in areas where concentrated movement is likely (along swales, significant slope breaks, near wetlands and breeding sites, etc). An assessment of potential movement corridors and specific measures to facilitate safe crossings shall be provided to and approved by SCWA in consultation with the Regulatory Agencies (see Section 10.2.6).

This Conservation Measure meets Objective VPG 1.1 and 2.16.

**Conservation Measure VPG 3: Habitat Mitigation.** Compensatory mitigation for the conversion/loss of vernal pool habitats shall be provided by preserving high quality vernal pool habitat (i.e., habitat within High Value Conservation Areas), restoring vernal pool habitat within high priority restoration areas, and restoring/expanding existing populations of Covered Species within established reserves and preserves. Mitigation criteria are based on the geographic location and the conservation priority of the impacted area identified in the Conservation Approach (Section 4.0). Habitat restoration and associated management activities conducted in compliance with the Solano HCP are exempt from these requirements. All mitigation areas established as part of the HCP shall meet the minimum reserve design requirements described in Section 10.5, including establishment of a management plan and an adequate endowment for managing the mitigation site in perpetuity. As defined in Section 10.5.4, all wetland creation shall occur on soil types typically associated with vernal pool communities and in areas that have historically supported vernal pool communities or currently support highly degraded seasonal wetlands as a result of past land uses (e.g., agriculture). Creation of vernal pools and associated seasonal wetlands on other soil types or in areas where the basic soil structure has been lost will not meet restoration objectives. Mitigation requirements for High, Medium and Low Value Vernal Pool Conservation Areas (Figure 4-9) are described below. Additional conservation measures are also required for Contra Costa Goldfield Core Population Areas (Subareas 1B, 1C, 1D, 1E, 1F in part, 1G, and 1H) and California tiger salamander habitats (Subareas 1A, 1C, 1D, 1E, 1F, 1I, 1J, 2A, 2C, 2E, 2F, and 2I).

#### **High Value Conservation Areas.**

##### **Wetland Component Direct Impacts:**

- **Subareas 1A – 1F and 1I – 1L:** Preserve vernal pool and swale habitats at a ratio of 9:1 (mitigation: impact) and restore vernal pool and swale habitats at a ratio of 1:1.
- **Subareas 1G and 1H:** Preserve vernal pool and swale habitats at a ratio of 6:1 and restore vernal pool and swale habitats at a ratio of 1:1.

##### **Wetland Component Indirect Impacts:**

- **Subareas 1A – 1F and 1I – 1L:** Preserve vernal pool and swale habitats at a ratio of 3:1 for avoided wetlands within 250 feet of proposed development.
- **Subareas 1G and 1H:** Preserve vernal pool and swale habitats at a ratio of 2:1 for avoided wetlands within 250 feet of proposed development

##### **Upland Component Direct Impact:**

- **Subareas 1A – 1F and 1I – 1L:** Preserve upland habitat at a ratio of 3:1.
- **Subareas 1G and 1H:** Preserve upland habitat at a ratio of 2:1.

**Upland Component Indirect Impact (all subareas):** Preserve avoided uplands at a ratio of 1:1 within 250 feet of proposed development.

Preservation and restoration for impacts to High Value Conservation Areas shall occur within High Value Conservation Areas. Indirect impacts will be calculated based on the location/conservation value of impacted habitat and not the location of project activity. Preservation and restoration for impacts to occupied Contra Costa goldfield habitat within Core Population Areas (Subareas 1B, 1C, 1D, 1E, 1F, 1G and 1H; Figure 4-7) must occur in areas with extant Contra Costa goldfield populations (e.g., occupied habitat).

**Medium Value Conservation Areas (Subareas 2A – 2N).**

**Wetland Component Direct Impacts:** Preserve vernal pool and swale habitats at a ratio of 2:1 and restore vernal pool and swale habitats at a ratio of 1:1.

**Wetland Component Indirect Impacts:** Preserve vernal pool and swale habitats at a ratio of 1:1 for avoided wetlands within 250 feet of proposed development.

**Upland Component Direct:** In Subareas 2C, 2F, and 2I, preserve upland habitat at a ratio of 3:1. In the remaining subareas, preserve upland habitat at a ratio of 2:1.

**Upland Component Indirect Impact:** Preserve avoided upland habitat at a ratio of 1:1 within 250 feet of proposed development.

Preservation and restoration for impacts to Medium Value Conservation Areas shall occur within Medium to High Value Conservation Areas. Impacts to occupied Contra Costa goldfield habitat within potential habitat areas (Figure 4-7) must be mitigated for by preserving extant Contra Costa goldfield populations (e.g., occupied existing or established habitat).

**Low Value Conservation Areas (Area 3)<sup>6</sup> and Seasonal Wetlands within Agricultural Areas of the County outside of a Medium Value Conservation Area.**

**Wetland Component Direct Impacts:** Preserve of vernal pool and swale habitats at a ratio of 1:1 and restore vernal pool and swale habitats at a ratio of 1:1.

**Wetland Component Indirect Impacts:** Preserve vernal pool and swale habitats at ratio of 1:1 within 100 feet of proposed development.

Preservation and restoration for impacts to Low Value Conservation Areas shall occur within Medium to High Value Conservation Areas.

**Note:** The above mitigation ratios are applicable to all seasonal wetlands (saturated, seasonally flooded, and temporarily flooded water regimes). Conservation actions for streams and semi-permanently to permanently flooded wetlands within the Valley Floor and Vernal Pool Grassland

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<sup>6</sup> There are additional avoidance requirements for impacts to upland habitat for Swainson's hawk and burrowing owl (See Sections 5.3.8 and 5.3.9).

Natural Community are addressed under the Riparian, Stream, and Freshwater Marsh Natural Community (Section 6.6).

Conservation Measures VPG 3 is designed to contribute to all of the valley floor grassland and vernal pool objectives.

**Conservation Measure VPG 4: Habitat Mitigation Similarity.** Seasonal wetlands preserved under Conservation Measure VPG 3 shall be similar in character to those impacted within the following categories:

- Pools: Greater than one inch of standing water for more than 10 continuous days with short (less than three weeks) to long (more than three weeks) durations of standing water, clear to moderate turbidity, and exhibiting significant vegetation cover.
- Pools: Greater than one inch of standing water for more than 10 continuous days with long (more than three weeks) to very long durations of standing water, moderate to high turbidity, and exhibiting sparse vegetation cover (typically found in association with Pescadero Series Soils; often referred to as playa-type pools).
- Swales or Mesic Grassland: Shallow, standing water (generally less than one inch) present for fewer than 10 continuous days.
- Highly Alkaline Flats and Meadows: Shallow, standing water (generally less than one inch) present for fewer than 10 continuous days and exhibits indicators of high alkalinity.

Minor deviations, not to exceed 10 percent of the required mitigation acreage by type or category, may be permitted by SCWA, in consultation with the Regulatory Agencies, if adequate acreage of the appropriate seasonal wetland type is not available for preservation or sale within approved commercial or institutional mitigation banks or other reserve system lands. This measure is designed to ensure that conservation habitats are proportional to impacts to Covered Species and Special Management Species associations (see Table 4-2) (e.g., impacts to long duration, playa type pool species are not being mitigated by preservation of more abundant swale or mesic grasslands which do not support the species).

Conservation Measure VPG 4 is designed to contribute to all of the valley floor grassland and vernal pool objectives.

**Rationale for VPG 3 and 4.** Mitigation required for unavoidable impacts associated with Covered Activities in compliance with HCP goals and objectives will result in the establishment of the Solano HCP reserve system. To achieve Goals 1 and 2, and Objectives 1.1 and 1.2, Plan Participants will provide for a net increase in the quantity and quality of aquatic vernal pool habitats and the quality of associated uplands based on the mitigation ratios outlined above. Conservation measures address specific, community-based requirements for aquatic/wetland and upland habitats and may be modified to address species-specific conservation requirements. Mitigation for Covered Activities within this Natural Community are based on the prioritization of Valley Floor Grassland and Vernal Pool habitat into High, Medium and Low Value Conservation Areas, as described in Section 4.3.2.3. Therefore, impacts shall be determined based on the quality and type of directly impacted habitats and indirect impacts to adjacent, avoided wetland and upland habitats on or adjacent to the project and within established mitigation sites,

existing reserves/preserves, designated open space areas and in areas outside of designated urban boundaries. For examples of potential indirect impacts, refer to the Valley Floor Grassland and Vernal Pool Natural Communities narrative conceptual model in Appendix B.

Mitigation ratios are based on the Solano HCP Conservation Analysis (Section 4.3.2) and the Recovery Plan for Vernal Pool Ecosystems (USFWS 2005a) that identify the need to maintain 85 to 95 percent of existing vernal pool and associated upland habitats (e.g., vernal pool complexes) to conserve vernal pool resources. The Recovery Plan for Vernal Pool Ecosystems establishes preservation objective of 95 percent of the Jepson and Collinsville Core Areas (Solano HCP Subareas 1A – 1F and 1I – 1L) and 85 percent of the Suisun Marsh Core Area (Solano HCP Subareas 1G and 1H) to conserve species in these areas. Conservation actions in the Suisun Marsh Core Area are largely directed toward single species while multiple species are present in the Jepson Core Area. The Medium and High Value Vernal Pool Conservation Areas (Figure 4-9) encompass most of the existing high quality valley floor grassland and vernal pool habitat and areas that have the greatest potential for restoration. Conversion of the Recovery Plan for Vernal Pool Ecosystems preservation criteria to mitigation ratios results in a 19:1 ratio for the 95 percent criteria and a 6:1 ratio for the 85 percent criteria. The 19:1 ratio (95 percent preservation) was reduced to 9:1 for the Solano HCP due, in part, to equity considerations (see Section 6.1.1) with the 6:1 ratio for Subareas 1G and 1H and several biological-based considerations. Biological considerations include the added conservation benefits associated with: 1) comprehensive management and monitoring required for individual reserves and the HCP adaptive management program; 2) wetland and Covered Species restoration requirements; 3) preservation requirements for indirect impacts; and 4) mitigation ratios commensurate with or greater than project impacts.

The Solano HCP mitigation ratios are designed to fulfill Objectives 1.1 and 1.2 through the mitigation of direct and indirect impacts to uplands and wetlands (e.g., the preservation of 90 to 95 percent of remaining vernal pool habitat). Upland conservation requirements ensure preservation of adequate uplands associated with preserved and restored/constructed wetlands and provide compensation for impacts to upland habitat and associated species such as California tiger salamander and burrowing owl. Wetland habitats may be substituted for uplands if adequate uplands are provided to ensure retention of normal hydrological functions. Wetland restoration requirements fulfill state and federal “no net loss” wetland policies and provide additional habitat for expansion of Covered Species populations.

**6.3.2.2 Species-Specific Conservation Measures.** The following conservation measures apply to Valley Floor Grassland and Vernal Pool species, specifically Contra Costa goldfields and California tiger salamanders.

**Conservation Measure VPG 5: Development Criteria for Contra Costa Goldfield Core Population Areas.** The following performance criteria/design guidelines shall be implemented as part of urban development within Plan Participant jurisdictions in Subareas 1B, 1C, 1D, 1E, 1F, 1G and 1H (Figure 4-7):

1. Development shall conform to the site design standards outlined in Avoidance and Minimization Measure VPG 2 (Section 5.3.2).

2. No more than 10 percent of suitable wetland habitat for Contra Costa goldfields<sup>7</sup> shall be directly impacted per project.
3. The project shall not directly impact more than 50 percent of the current or historically occupied habitat on the site.
4. The extent of occupied habitat shall be determined based on at least two years of field surveys/mapping at the site (Occupied habitat area shall be based on the total area of the occupied wetland, not just Contra Costa goldfield cover).
5. The reserves area shall encompass at least 100 acres of suitable/contributing habitats and may include other parcels protected by conservation easements and managed consistent with the Solano HCP Reserve Criteria (Section 10.5). Some existing preserved areas/mitigation sites may require extension of management agreements and endowments to these sites.

This Conservation Measure meets Objectives VPG 1.1, 1.2, and 2.1.

**Conservation Measure VPG 6: Contra Costa Goldfield Mitigation Requirements for Impacts to Occupied Habitat.** All direct impacts to extant stands of Contra Costa goldfields within identified Core Areas and Potential Habitat Areas (Figure 4-7) shall be mitigated by establishing new, self-reproducing population at a ratio of 4:1 within protected habitat areas.

Re-establishment Criteria:

1. Contra Costa goldfield populations and other Covered Species shall be established in constructed, restored and enhanced wetlands within the known range of Contra Costa goldfields in Solano County (Figure 4-7). If unoccupied habitat is available or can be restored, restoration shall occur within the same Core Area as the impacts. Restoration may occur within existing preserved pools currently lacking Contra Costa goldfields or in restored pools and swales within other Core Areas (Figure 4-7). Seed used to establish new populations shall be taken within a Core Area only, until further genetic data is available. New populations must be established in currently unoccupied habitat at least 2,500 feet from an extant Contra Costa goldfield population.
2. Re-establishment shall be accomplished through collection of seed from extant populations with similar genetics as determined by genetic analysis of existing populations. Until such genetic data is available, seed used to establish new populations shall be taken from the Core Area in which they are to be established. Seed collection shall not affect more than 10 percent of an individual preserved population. Seed and top soils shall be salvaged from occupied vernal pools and other wetlands within an impacted area.
3. Habitat area shall be based on occupied pool/swale area, not just Contra Costa goldfield cover. The extent of the occupied area and the flower density in re-established pools shall be equal to or greater than the impacted occupied habitat areas.
4. Re-established populations will be considered self reproducing when:

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<sup>7</sup> All wetlands within core areas shall be initially considered suitable habitat for Contra Costa goldfields. Applicants may appeal this assumption to SCWA, USFWS, and CDFG pursuant to the Appeals Process described in Section 10.4.2. Appeals will require additional field surveys for species occurrences, habitat characterizations, and hydrological analysis of all wetlands on the site.

- a. plants re-establish annually for a minimum of 5 years with no human intervention such as supplemental seeding; and
- b. habitat areas contain an occupied area and flower density comparable to existing occupied habitat areas in similar pool types and Core Areas (see Conservation Measure VPG 4).

If these criteria are not achieved within 10 years of project implementation, the applicant shall increase the preserved wetland restoration acreage by 50 percent<sup>8</sup>. The applicant shall provide bonds or other financial assurances, subject to approval by SCWA, to ensure implementation of such measures (see Section 10.5). Once population and genetic studies are complete, SCWA will develop more detailed restoration criteria in consultation with the Resource Agencies.

This Conservation Measure meets Goal VPG 2 and Objective VPG 2.2.

**Rationale.** Contra Costa Goldfields have an extremely limited distribution and remaining populations in Solano County are isolated by development. Recent genetic studies suggest that a high level of genetic variability exists within each population and an apparent level of distinctness occurs between populations (Ramp 2004: three populations were sampled in Solano County, at least six additional populations still need to be assessed). Given Ramp's 2004 findings and general concerns about potential genetic differences among the extant populations in Solano County, the Solano HCP assumes that each contiguous block of occupied Contra Costa goldfield habitat represents a genetically distinct population. Based on this assumption and Ramp's findings that each population contributes substantially to the overall genetic diversity of the species, development criteria and mitigation requirements would result in the preservation of 90 percent of available habitat and 100 percent of intact populations (i.e., 100 percent of occurrences). The development criteria exceeds the 90 percent occurrence preservation criteria for Contra Costa goldfields recommended in the Recovery Plan for Vernal Pool Ecosystems; however, it is slightly less than the 95 percent habitat criteria outlined in the Recovery Plan (USFWS 2005a).

The Contra Costa Goldfield Core Population Areas comprise a substantial portion of the remaining undeveloped lands within the urban boundaries of the cities of Fairfield and Suisun. While previous environmental documents recognize significant constraints on these parcels related to wetlands and endangered species, some level of development is expected in these areas based on current zoning. These expectations pre-date the listing of Contra Costa goldfields. Design/project performance standards are specified to provide flexibility in designing projects and to allow some development to occur in these areas while ensuring the conservation of each Core Population Area consistent with the HCP Steering Committee goals (i.e., respect of private property rights, conservation of Covered Species; see Section 1.2.2.1).

The Solano HCP Science Advisory Committee (Noss et al. 2002) did not specify a minimum reserve size and insufficient knowledge about Contra Costa goldfields exists to allow for a mathematical determination of the minimum viable population or reserve area. The primary guidance for reserve size is that "bigger is better." The Solano HCP establishes a minimum reserve size of 100 acres for these urban, Contra Costa goldfield reserves. Populations of Contra

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<sup>8</sup> If Contra Costa goldfields are not established successfully in this 10 year period and the increased restoration acreage requirement is invoked, the Contra Costa goldfield establishment requirement will be eliminated.

Costa goldfields are currently subject to indirect pressures from surrounding land uses and will be increasingly subject to such pressures as lands within and adjacent to the Core Population Areas are developed. Small reserves are almost entirely affected by adjacent land uses rendering them difficult and costly to manage. A 100-acre preserve allows areas to be buffered from adjacent land uses. In addition, areas less than 100 acres are difficult to manage with livestock, which provide the most efficient and reliable tool for reducing introduced grass thatch (see Natural Community Conceptual Model in Appendix B).

Within the Contra Costa Goldfield Core Population Areas, plant distribution (i.e., occupied habitat) is often patchy, a trend that has been observed for several of these populations over a period of years. As an annual plant, population numbers of Contra Costa goldfields can fluctuate dramatically between years and over time. As a result, the Solano HCP requires two years of population mapping and surveying to address this issue. Two years of data showing plant distribution is available for many of the core populations and can easily be obtained prior to projects being brought forward for coverage and approval under the HCP.

While preservation of existing populations and high quality habitat is the major emphasis of the HCP conservation program for vernal pool associated species, restoration and population expansion is an important component of the conservation of Contra Costa goldfields. The largest contiguous potential habitat area for Contra Costa goldfields is the Potrero Hills/Lower Union Creek/Denverton Creek region and Upper Union Creek; however the plant has not been documented in many of these habitat areas (Figure 4-7), leaving the majority of the known occurrences within the current and potential urban development areas of Suisun City and Fairfield. Collinge (2003) successfully established Contra Costa goldfield populations in constructed pools on Travis Air Force Base. Re-establishment of populations within the larger unoccupied habitat areas would provide larger preserve areas and viable populations.

**Conservation Measure VPG 7: Salvage and Recovery of Contra Costa Goldfields and Group 2 and 3 Vernal Pool Plant Species (Table 4-2).** Covered Activities that will impact extant stands of Contra Costa goldfields (in Core and Potential Habitat Areas) or Group 2 and 3 Covered Species (see Section 4.3.2.1) (in High Value Conservation Areas) shall implement a salvage program. The salvage program shall include measures to collect seed from impacted populations for at least one season prior to loss. Collected seeds shall be made available for habitat restoration efforts and samples shall be stored consistent with criteria defined by the Center for Plant Conservation (CPC 1991). Collected seed shall be stored at a minimum of two locations, including the National Center for Genetic Resources in Fort Collins, Colorado and a facility certified by the Center for Plant Conservation.

This Conservation Measure meets Goal VPG 2 and Objectives VPG 2.2, 2.5 and 2.6.

**Rationale.** Ex-situ conservation in seed and germplasm banks is a viable alternative and/or supplement to in-situ conservation to prevent the immediate extinction of a species by preserving a large representation of its genetic diversity (Walters 2004). Ramp et al. (2008) recommended ex-situ conservation and restoration as an important part of the Conservation Strategy for Contra Costa goldfields. In addition, because considerable genetic variability is present within that species and the variation is broadly distributed among the populations, Ramp et al. (2008) also recommended that efforts should be made to obtain samples from all remaining populations.

**Conservation Measure VPG 8: California Tiger Salamander.** Mitigation shall be required for any Covered Activity within the known or potential range of the species (see Figure 4-8). Mitigation shall include preservation and enhancement of suitable upland habitat and preservation and construction of new breeding habitat consistent with the mitigation requirements specified in Conservation Measure VPG 3, subject to the following additional requirements.

**Breeding Habitat Mitigation:** Impacts to all suitable California tiger salamander breeding habitat (see notes below for definition) within the known or potential range of the species (Figure 4-8) will be mitigated for by preserving known breeding habitat at a 3:1 ratio and creating breeding habitat at a ratio of 2:1 (approximately 0.35 acres), whichever is greater. All preserved and created breeding habitat shall be contiguous to at least 300 acres of preserved upland habitat and created breeding habitat shall be located within 2,100 feet of known breeding habitat (see item 2 in the notes below).

**Upland Habitat Mitigation:** Impacts to uplands and other movement habitats (i.e., seasonal wetland swales, meadows) within the known or potential range of the California tiger salamander (Figure 4-8) shall be mitigated for as follows:

- Impacts to upland habitat within Subareas 1A through 1F and 1I through 1L shall be mitigated for by preserving upland habitat at a 3:1 ratio, consistent with Conservation Measure VPG 3, and creating 0.01 acres of breeding habitat per acre of upland habitat impacted.
- Impacts to upland habitat within Subareas 2C, 2F, and 2I shall be mitigated for by preserving upland habitat at a 3:1 ratio, consistent with Conservation Measure VPG 3, and creating 0.01 acres of breeding habitat per acre of upland habitat impacted.
- Impacts to upland habitat within Subareas 1G, 1H, 2A, 2D, 2E, 2H, 2K, and 2N shall be mitigated for by preserving upland habitat at a 2:1 ratio, consistent with Conservation Measure VPG 3, and creating 0.01 acres of breeding habitat per acre of upland habitat impacted.
- Impacts to upland habitat within the Inner Coast Range, within the potential range of the species (Figure 4-8), connecting Subareas 1B, 2B and 2C to 2N, shall be mitigated for by preserving upland habitat at a 2:1 ratio and creating 0.01 acres of breeding habitat per acre of upland habitat impacted.

**Notes:**

1. Suitable breeding habitat is defined as all natural vernal pool and man-made ponds that maintain standing water in most years for a minimum of 10 weeks.
2. Known breeding habitat shall include all known sites where breeding has been documented to occur at least once within the last 10 years.
3. Upland preservation shall be within 2,600 feet of known breeding habitat or within 1,300 feet of constructed breeding habitat if the constructed habitat is within 2,100 feet of known breeding habitat.
4. All new breeding habitat shall be located within 2,100 feet of a known breeding site and be situated within a contiguous reserve/preserve area of 330 acres or more of suitable/contributing

habitats. This may include other parcels if the lands are protected by conservation easements and are managed consistent with the Solano HCP Reserve Criteria in Section 10.5. For some existing preserved areas/mitigation sites, this may require that management agreements and endowments be extended to these sites.

5. New breeding habitat can consist of multiple sites within 1,300 feet of each other. All new created breeding habitats shall be a minimum size of 0.2 acres.

This Conservation Measure meets Objectives VPG 1.1, 1.2 and VPG 2.16.

**Rationale.** California tiger salamanders are dependent on upland and aquatic habitats. Populations reduced through loss of upland or breeding habitat can only be replaced by increasing reproductive output through an expansion of breeding habitat availability within secured upland habitats. The movement distances and potential juvenile salamander productivity incorporated in the above conservation measures are derived from studies at Olcott Lake in Solano County by Trenham and Schaffer (2005).

#### 6.4 CALIFORNIA RED-LEGGED FROG CONSERVATION STRATEGY

The California red-legged frog goals, objectives and conservation measures apply to all freshwater, aquatic, marsh and riparian habitats within the Inner Coast Range and upland habitat within the designated California Red-legged Frog Conservation Area (Figure 4-2 and 4-15). The Recovery Plan for the California red-legged frog (UFWS 2002a) identifies five criteria and seven general actions needed for recovery. The overall recovery strategy involves:

- protecting existing populations by reducing threats;
- restoring and creating habitat that will be protected and managed in perpetuity;
- surveying and monitoring populations and conducting research on the biology and threats of the subspecies; and
- re-establishing populations of the subspecies within its historic range.

The Conservation Strategy for California red-legged frog encompasses the elements of the Recovery Plan identified above. Protecting existing populations will be accomplished primarily through the preservation and/or active management of approximately 3,300 acres of Inner Coast Range upland, riparian and aquatic habitats within the California Red-legged Frog Conservation Area.

Implementation of the Conservation Measures will result in the construction and restoration of additional breeding habitat within the Conservation Area that will be managed for the benefit of California red-legged frogs. The control of invasive species includes measures to prevent the creation of new permanent water features and the “perennialization” of intermittent creeks and to implement control programs established as part of the resource management plans of the reserves.

Re-establishing or augmenting existing populations will occur through salvage of individuals from impacted sites (see Section 5.0 Avoidance and Minimization) and release at recently constructed or existing aquatic breeding habitats (e.g., those not yet supporting an existing population at “carrying capacity”) or other reserves with applicable management requirements (see California red-legged frog Conservation Measures below). The movement/relocation of California red-legged frogs is also

considered important for maintaining the metapopulation structure of California red-legged frogs in this region. The California Red-legged Frog Conservation Area is divided into three discrete and largely isolated units by Interstate 80 between Vallejo and Fairfield and by Highway 12 between Fairfield and Napa County. The barriers formed by these highways severely restrict or eliminate the natural dispersal and migratory movements of individuals between these three blocks of habitat, reducing the resiliency of populations and limiting genetic diversity.

Section 7.0, Monitoring and Adaptive Management provides information on monitoring and research for these species goals, objectives, and conservation measures.

Section 4.5.4 identifies a conservation target of 20 percent of the historic range within Solano County or roughly 31,160 acres for this species, equating to 97 percent of the Solano HCP California Red-legged Frog Conservation Area. A large network of reserves is currently being developed by the Tri-City County Open Space JPA in conjunction with the Solano Land Trust. This reserve network preserves approximately 8,500 acres and provides an excellent foundation upon which to build a reserve system and achieve the overall conservation target (see Section 4.2 for details). The California Red-legged Frog Conservation Strategy will contribute to this reserve system through protection and management of additional habitat (up to 3,300 acres), and funding for management of California red-legged frog and associated species on existing open space lands.

The Solano HCP Conservation Strategy is designed to add to the overall quality and value of the existing reserve network by addressing the following reserve design principles: preserve large blocks of habitat (1), conserve target species throughout the Plan Area (2), prioritize habitat with high conservation value at high risk of being developed (3), incorporate a range of environmental gradients (4), protect regional water quality (5), maintain connectivity (6), preserve blocks of habitat close together (7), incorporate sufficient buffer zones between reserves and new development (8), minimize edge effects (9), preserve ecotone and transition areas (11), minimize human disturbance (13), incorporate adaptive management and monitoring (14), and restore and create additional habitat within preserve areas (15). In doing so, the Solano HCP Conservation Strategy will contribute to the achievement of the conservation targets identified in Section 4.5.4 and in the Recovery Plan.

However, the Solano HCP is not intended to fully achieve the conservation targets or recovery criteria. The objectives outlined in this section are not direct equivalents of the conservation targets or recovery criteria. The goals, objectives, and conservation measures in the HCP are designed to fully mitigate impacts from Covered Activities and contribute to the recovery of California red-legged frog within the Plan Area commensurate with the anticipated level of impact.

#### **6.4.1 California Red-Legged Frog Goals and Objectives**

**Goal RLF 1.** Maintain or increase California red-legged frog populations through preservation and management of interconnected blocks of upland and aquatic habitats that support natural movement patterns, breeding, and metapopulations dynamics within the California Red-legged Frog Conservation Area.

**Objective RLF 1.1.** Preserve and/or actively manage a total of 3,300 acres of inner coast range upland, riparian and aquatic habitats in perpetuity for the benefit of California red-legged frogs within the California Red-legged Frog Conservation Area.

**Objective RLF 1.2.** Provide for a net increase in the quantity and quality of aquatic habitat for California red-legged frogs within the California Red-legged Frog Conservation Area through establishment of additional breeding habitat and control of nonnative predators.

**Objective RLF 1.3.** Maintain connectivity between existing habitat areas and periodically translocate frogs between the three disjunct units of the California Red-legged Frog Conservation Area.

**Goal RLF 2.** Re-establish or expand populations of California red-legged frogs within the California Red-legged Frog Conservation Area and other portions of its historic range within the Inner Coast Range Natural Community.

**Objective RLF 2.1.** Limit the expansion of nonnative predators and competitors of California red-legged frogs and other native amphibians (e.g., bullfrog, crayfish, and warm water fish) within the Inner Coast Range Natural Community.

**Objective RLF 2.2.** Control populations of nonnative predators and competitors of California red-legged frogs and other native amphibians (e.g., bullfrog, crayfish, and warm water fish) within the California Red-legged Frog Conservation Area.

**Objective RLF 2.3.**<sup>9</sup> Establish new or augment existing breeding populations in established preserves within the Inner Coast Range Natural Community by establishing new aquatic breeding habitat and transplanting California red-legged frogs from reserves or salvaged from habitats impacted by Covered Activities.

#### **6.4.2 California Red-Legged Frog Conservation Measures**

The following conservation measures shall be implemented for unavoidable impacts to California red-legged frog habitat.

**Conservation Measure RLF 1: Maintain Connectivity.** New roads or the expansion of existing roads with a projected night-time traffic volume of more 20 cars per hour within the California Red-legged Frog Conservation Area shall incorporate design measures to facilitate the movement of small animals and maintain hydrological connectivity. Design measures may include, culverts, underpasses, and roadside barriers to prevent animals from accessing the roads. Crossings between open space areas shall be provided in areas where concentrated movement is likely (along swales, significant slope breaks, near wetlands and breeding sites, etc). An assessment of potential movement corridors and specific measures to facilitate safe crossings shall be provided to and approved by SCWA in consultation with the Regulatory Agencies (see Section 10.2.6).

This Conservation Measure is designed to achieve Goal RLF 1 and Objective RLF 1.3.

**Conservation Measure RLF 2: Mitigation for Upland Habitat within the California Red-legged Frog Conservation Area.** As mitigation for conversion of upland habitats within the California Red-

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<sup>9</sup> This objective also contributes to maintaining the metapopulation dynamics of the California red-legged frog populations under Goal CRLF 1.

legged Frog Conservation Area, upland habitat shall be preserved and managed at a 3:1 ratio. All upland preservation shall occur within the California Red-legged Frog Conservation Area and be located within 0.7 mile of breeding habitat and nonbreeding aquatic habitats. All preserved lands shall meet the management and funding requirements identified in Sections 7.3 and 10.5.

If commercial or institutional mitigation banks or individual project mitigation lands are not practicably available, SCWA will establish and collect an impact fee based on the gross acreage of the impacted upland habitat. SCWA will pool and administer collected fees in consultation with the Resource Agencies to provide funding for land acquisition, aquatic predator control, habitat enhancement, and other activities benefiting California red-legged frog within the California Red-legged Frog Conservation Area. The fee shall be based on the cost of land at a 3:1 ratio and associated endowment that would be sufficient to implement management plans for the preserved lands. Management endowment funds shall be sufficient to restore and enhance aquatic and upland habitats for the California red-legged frog and control nonnative species such as bullfrog, warm water fish, and crayfish consistent with the HCP reserve management standards (Sections 7.3 and 10.5).

This Conservation Measure is to achieve Goal RLF 1 and 2 and Objectives RLF 1.1, 2.2 and 2.3.

**Conservation Measure RLF 3: Mitigation for Long Term Impacts to Riparian, In-Stream, Pond, and Freshwater Marsh Habitats Within California Red-legged Frog Conservation Area.**

Compensatory mitigation for unavoidable impacts to riparian, in-stream, pond, and freshwater marsh habitats within the California Red-legged Frog Conservation Area shall be provided through the preservation, construction, and/or restoration of similar habitats at a prescribed ratio (acres restored to acres impacted) consistent with Riparian and Freshwater Marsh Conservation Measure RSM 2, but subject to the following conditions:

**Conservation Measure RLF 3.1: Long Term Impacts to Aquatic Breeding Habitat.** Impacted breeding habitat shall be mitigated for by preserving existing occupied breeding habitat at a 2:1 ratio and constructing new breeding habitat at a minimum 2:1 ratio. If suitable breeding habitat is not available for preservation, construction of additional new breeding habitat at this same ratio may be substituted for this requirement. Suitable breeding habitat consists of all standing bodies of fresh water (with salinities less than 7.0 ppt), including: natural and manmade (e.g., stock) ponds, slow-moving streams or pools within streams, and other ephemeral or permanent water bodies that typically become inundated during winter rains and hold water for a minimum of 20 weeks in all but the driest of years (USFWS 2008b). All habitat preservation, restoration or creation shall also occur within the California Red-legged Frog Conservation Area. An endowment fund or other approved funding source shall be provided for long-term operation and maintenance of the features, including control of invasive plant and animal species (i.e., bullfrogs, pepperweed) (see Section 10.5).

**Conservation Measure RLF 3.2: Long Term Impacts to Non-breeding Aquatic and Riparian Habitats.** Impacts to other wetland/aquatic and riparian habitats will be mitigated at: a) a 2:1 ratio for created or restored aquatic habitats and b) a 3:1 ratio where enhancement measures for existing habitat areas are implemented and the affected habitat is replaced (constructed) at a minimum 1:1 ratio. Non-breeding aquatic habitat consists of any typically shallow (non-lacustrine) freshwater features not suitable as breeding habitat, such as streams, small seeps, and ponds that dry too quickly to support breeding (USFWS 2008b). Riparian habitat consists of

vegetation growing nearby, but not typically in, a body of water on which it depends. Typically riparian habitat extends from the bank of a pond or stream to the margins of the associated floodplain (USFWS 2008b). The restoration of suitable habitat or construction of new riparian and aquatic habitats shall occur within the California Red-legged Frog Conservation Area. An endowment fund or other approved funding source for long-term operation and maintenance of the features shall also be provided, including control of invasive plant and animal species (i.e., bullfrogs, pepperweed).

This Conservation Measure is to achieve Goal RLF 1 and 2 and Objectives RLF 1.2 and 2.2.

**Conservation Measure RLF 4: Temporary<sup>10</sup> Impacts to Marsh, Pond/Aquatic, and Riparian Habitats.** Temporary or short-term impacts associated with the removal of vegetation for ordinary channel operation and maintenance activities conducted by Plan Participants or with construction/installation of permanent features (e.g., outfalls, bridges, utility lines) within the California Red-legged Frog Conservation Area, shall not require direct compensation for the temporary loss of herbaceous vegetation or woody vegetation less than one inch in diameter provided activities comply with the following conditions:

1. Appropriate erosion control measures and BMPs are implemented for all disturbed areas above the waterbody's ordinary high water mark consistent with the Avoidance and Minimization Measures outlined in the California Red-legged Frog and Riparian and Freshwater Marsh sections (Sections 5.3.3 and 5.3.5).
2. All work is conducted in compliance with the avoidance and protection measures described in the Solano Operations and Maintenance Manual (Appendix D).
3. All native, woody riparian vegetation greater than one inch in diameter is replaced by new native riparian vegetation to achieve a 3:1 replacement ratio after 5 years. No compensation is required for removal of non-native trees and shrubs.

Although periodic, short-term reductions in value may occur as disturbed areas revegetate, the primary compensation for such impacts is the commitment by Plan Participants to develop and implement programs to control aggressive invasive species.

This Conservation Measure is designed to achieve Goal RLF 1 and 2 and Objectives RLF 1.2 and 2.2.

**Conservation Measure RLF 5: Mitigation for Breeding and Non-breeding Aquatic Habitat Outside of the California Red-legged Frog Conservation Area.** Compensatory mitigation for unavoidable impacts to suitable breeding and non-breeding aquatic habitat (e.g., riparian, in-stream, pond, and freshwater marsh habitats) outside of the California Red-legged Frog Conservation Area shall be provided through the construction and/or restoration of similar habitats at a prescribed ratio (acres restored to acres impacted) consistent with Riparian, Stream, and Freshwater Marsh Conservation Measure RSM 2, and provide an endowment fund or other approved funding source to implement management plans for preserved lands in perpetuity consistent with Sections 7.0 and 10.5.

This Conservation Measure is designed to contribute to Goal RLF 2 and Objective RLF 2. 3.

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<sup>10</sup> Temporary effects are defined as actions that can be restored to baseline values or higher within one season following disturbance.

**Rationale.** The above measures (RLF 2, 3, 4, and 5) provide standards for mitigating direct and indirect impacts to California red-legged frog habitat and providing funds to implement management actions that will contribute to the recovery of the species in a manner commensurate with the effects of Covered Activities.

**Conservation Measure RLF 6: Nonnative Predator Habitat.** Development activities within the Inner Coast Range Natural Community shall not establish new perennial ponds, small lakes, or other perennial water bodies that could provide habitat for nonnative species such as bullfrog, crayfish, and warm water fish that prey on California red-legged frog and other native amphibian species. In addition, storm water runoff and other associated discharges from Covered Activities shall be controlled to prevent “perennialization” of intermittent creeks. An endowment fund or other approved funding source for long-term operation and maintenance of storm water features shall also include sufficient contingency funds to control invasive species (e.g., bullfrogs) if, in the future, these features are found to support these invasive species.

This Conservation Measure is designed to contribute to Goal RLF 2 and Objective RLF 2. 1.

**Conservation Measure RLF 7: Nonnative Predator Control.** Reserves established in the California Red-legged Frog Conservation Area shall implement and fund, in perpetuity, programs designed to control nonnative species such as bullfrog, crayfish, and warm water fish.

This Conservation Measure is designed to achieve Goal RLF 2 and Objective RLF 2.2.

**Conservation Measure RLF 8: Establishing New Populations and Augmenting Existing California Red-legged Frog Populations.** SCWA shall coordinate, review and approve relocation plans for California red-legged frogs collected/salvaged from construction sites (see Avoidance and Minimization Measure RLF 3, Section 5.3.3). When collected frogs (any life stage) are not relocated onsite (i.e., aquatic habitat would be eliminated, remaining habitat would be isolated), frogs shall be relocated to established preserves with limited frog populations. SCWA shall coordinate with the Resource Agencies and managers of preserves and open space lands to translocate California red-legged frogs between the three disjunct units of the California Red-legged Frog Conservation Area or to establish new populations on preserves with suitable habitat in other portions of the Inner Coast Range Natural Community.

This Conservation Measure is designed to achieve Goals RLF 1 and 2 and Objectives RLF 1.3 and 2.3.

## **6.5 CALLIPPE SILVERSPOT BUTTERFLY CONSERVATION STRATEGY**

The goals, objectives and conservation measures outlined below are designed to protect and enhance Callippe silverspot butterfly habitat and populations throughout its range in portions of the Inner Coast Range Natural Community within the Callippe Silverspot Conservation Area (Figure 4-14).

The overall conservation goal for Callippe silverspot is to preserve multiple populations in secure core areas and to provide connectivity between these preserved core areas. The Callippe Silverspot Butterfly Conservation Program is largely based on avoiding habitat impacts and maintaining connectivity between existing stands of viola within the Conservation Area (Avoidance Measures are

detailed in Section 5.3.4). However, some direct and indirect impacts are anticipated. Mitigation for these impacts will provide additional protection for core breeding habitat within the Conservation Area as well as additional habitat restoration to expand breeding habitat and adult nectar plants.

An existing network of reserves within the Tri City/County Planning Area meet the following Solano HCP Reserve Design Principles (Section 4.2): preserve large blocks of habitat (1), prioritize habitat with high conservation value at high risk of being developed (3), incorporate a range of environmental gradients (4), preserve blocks of habitat close together (7), preserve ecotone and transition areas (11), and minimize human disturbance (13). Therefore, the Solano HCP Conservation Program addresses the remaining Reserve Design Principles. The principles include: conserve target species (i.e., the Callippe silverspot butterfly) throughout the Plan Area (2), maintain connectivity (6), incorporate sufficient buffer zones between reserves and new development (8), minimize edge effects (9), incorporate adaptive management and monitoring (14), and restore and create additional habitat within preserve areas (15).

### **6.5.1 Callippe Silverspot Butterfly Goals and Objectives**

**Goal CSB 1.** Maintain or increase Callippe silverspot butterfly populations through preservation and management of interconnected blocks of upland habitat that support natural movement patterns, breeding, and metapopulation dynamics within the Callippe Silverspot Butterfly Conservation Area.

**Objective CSB 1.1.** Preserve and actively manage 3,300 acres of inner coast range habitats in perpetuity for the benefit of Callippe silverspot butterfly within the Callippe Silverspot Butterfly Conservation Area. (Note: This objective is addressed concurrently with Objective RLF 1.1).

**Objective CSB 1.2.** Increase the quantity and quality of breeding habitat and adult nectar sources for Callippe silverspot butterfly within the Callippe Silverspot Butterfly Conservation Area.

**Objective CSB 1.3.** Maintain connectivity between core breeding sites and existing subpopulations within the Callippe Silverspot Butterfly Conservation Area by preserving corridors with a minimum width of 300 feet, oriented along hill tops and ridgelines.

### **6.5.2 Callippe Silverspot Butterfly Conservation Measures**

The following conservation measures shall be implemented for unavoidable impacts to callippe silverspot butterfly habitat.

**Conservation Measure CSB 1: Non-breeding Habitat within the Callippe Silverspot Conservation Area.** To mitigate for conversion of non-breeding habitats within the Callippe Silverspot Butterfly Conservation Area, suitable habitat shall be preserved and managed at a 3:1 ratio. All habitat preservation shall occur within the Callippe Silverspot Butterfly Conservation Area. All preserved lands shall meet the management and funding requirements identified in Sections 7.3 and 10.5. This measure shall be implemented concurrently with Conservation Measure RLF 2.

If commercial or institutional mitigation banks or individual project mitigation lands are not practicably available, SCWA will collect an impact fee based on the gross acreage of the impacted

habitat. SCWA will pool and administer collected fees in consultation with the Resource Agencies to provide funding for land acquisition, habitat enhancement, and other activities benefiting Callippe silverspot butterfly within the Callippe Silverspot Butterfly Conservation Area. The fee shall be based on the cost of land at a 3:1 ratio. An endowment fund or other approved funding source shall be established to implement management plans for preserved lands to restore and enhance habitats for the species consistent with the HCP reserve management standards (Sections 7.3 and 10.5).

This Conservation Measure is designed to achieve Goal CSB 1 and Objective CSB 1.1.

**Conservation Measure CSB 2: Development Criteria for Callippe Silverspot Butterfly Core Breeding Habitat Areas.** The following design guidelines shall be implemented for urban development within the Callippe Silverspot Butterfly Conservation Area where core breeding habitat is present (Figure 4-14):

1. Development shall conform to the site design standards outlined in Avoidance and Minimization Measure CSB 1 (Section 5.3.4).
2. Project activities shall directly impact no more than 20 percent of any breeding habitat area. Breeding habitat is defined as a block of habitat at least one acre in size with *Viola pedunculata* density of at least 10 percent. The breeding area also includes the outer edge of viola stands where the viola density is at least one plant per square meter or one percent of the total cover.
3. Occupied habitat shall be determined based on a minimum of one year of field surveys/mapping at the site.
4. All preserves established with core breeding habitat shall have a minimum 300-foot buffer, consisting of upland grassland or other natural vegetation (i.e., oak savanna/woodland or riparian habitats if applicable), between the outer edge of the core breeding habitat area and incompatible uses.
5. All avoided or retained breeding habitat shall have natural open space corridors at least 300 feet wide, oriented along hill tops and ridgelines, connecting core viola larval host plant stands and adult nectar sources to allow for dispersal of adults between core breeding areas. All corridor areas shall be preserved in perpetuity and managed consistent with the reserve criteria described in Sections 7.3 and 10.5.
6. All avoided areas, including buffer and corridor areas, shall be preserved and managed consistent with the requirements outlined in Sections 7.3 and 10.5.

This Conservation Measure is designed to achieve Goal CSB 1 and Objectives CSB 1.1 and 1.3.

**Conservation Measure CSB 3: Mitigation for the Conversion of Breeding Habitat.** Impacts to core viola larval host plant stands, adult nectar sources and associated buffer habitats within the Callippe Silverspot Butterfly Conservation Area shall meet the following mitigation requirements:

**Preservation Component:** Mitigation for direct and indirect impacts to known or potential breeding habitat shall be provided as described below.

**Direct Impacts -** Compensatory mitigation for the conversion/loss of known or potential breeding habitat (i.e., a core breeding area) within the Callippe Silverspot Butterfly

Conservation Area shall provide an additional 3:1 ratio (6:1 total) with preservation of known occupied habitat within the Callippe Silverspot Butterfly Conservation Area. Permanent loss of core breeding habitat shall be limited to no more than 20 percent of any breeding habitat.

**Indirect Impacts** - Indirect impacts resulting from new development within 300 feet of known or potential breeding habitat within the Callippe Silverspot Butterfly Conservation Area shall provide an additional 1.5:1 ratio (4.5:1 total) with preservation of known occupied habitat within the Callippe Silverspot Butterfly Conservation Area.

**Note:** Habitat mitigation for temporary impacts within 300 feet of breeding habitat is not required if Covered Activities are conducted consistent with Avoidance and Minimization Measure CSB 2, all impacted habitat is successfully revegetated within one growing season, and restored habitat is preserved and managed consistent with the requirements provided in Sections 7.3 and 10.5.

**Restoration Component:** Both direct and indirect (within 300 feet) impacts to core viola larval host plant stands and direct impacts to adult nectar sources within the Callippe Silverspot Butterfly Conservation Area shall develop and fund additional restoration/enhancement of host plant (*Viola pedunculata*) and nectar plant habitat at a minimum 3:1 ratio. An endowment fund or other approved funding source shall be provided to implement management plans for restored lands into perpetuity.

Unlike impacts to non-breeding habitat, mitigation requirements for impacts to breeding habitat can not be achieved through payment of fees and may only be achieved through the direct dedication of land containing known occupied breeding habitat within the Callippe Silverspot Butterfly Conservation Area. All land dedication shall include an endowment fund or other approved funding source to implement management plans for preserved lands into perpetuity.

This Conservation Measure is designed to achieve Goal CSB 1 and Objective CSB 1.1 and 1.2.

## **6.6 RIPARIAN, STREAM, AND FRESHWATER MARSH CONSERVATION STRATEGY**

The Riparian, Stream and Freshwater Marsh Natural Community goals, objectives and conservation measures apply to all freshwater, aquatic, marsh and riparian habitats within the Plan Area, excluding vernal pools and seasonal wetlands associated with the Valley Floor Grassland and Vernal Pool Natural Community (Figure 4-2). The Riparian, Stream, and Freshwater Marsh Natural Community Conservation Strategy is designed to maintain the natural hydro-geomorphic and ecological functions of the Natural Community, conserve and restore natural stream behavior and flood regimes, contribute to the conservation and recovery of associated Covered Species, promote habitat connectivity, and maintain water quality standards. Primary conservation actions include preservation, restoration, invasive species control, and maintenance of water quality and hydro-geomorphic processes. The goals and objectives of the Riparian, Stream and Freshwater Marsh Conservation Strategy are achieved in conjunction with the Avoidance and Minimization Measures for this Natural Community outlined in Section 5.0.

In Section 4.3.6.3, Priority Drainages and Watersheds were identified based on specific conservation criteria (Figure 4-11). Priority Drainages were further subdivided into specific conservation areas based on site-specific conservation actions (Section 4.3.6.3). The designated actions for each conservation area outline the overall conservation approach for the Riparian, Stream and Freshwater Marsh Natural Community (see Section 4.6.5 for a detailed discussion of the reserve design and conservation approach). The conservation measures establish appropriate mitigation for Covered Activities and acceptable levels of development within the Plan Area compatible with the regional conservation goals and objectives.

The goals, objectives, and conservation measures in the HCP are designed to fully mitigate impacts resulting from Covered Activities and to contribute to the recovery of riparian, stream and freshwater marsh ecosystems within the Plan Area commensurate with the anticipated level of impact. The following sections detail the goals, objectives and conservation measures for the Riparian, Stream and Freshwater Marsh Natural Community.

### **6.6.1 Riparian, Stream and Freshwater Marsh Goals and Objectives**

**Goal RSM 1.** Maintain and enhance the natural hydro-geomorphic processes; essential ecological processes, functions, and values; species diversity; and habitat heterogeneity of riparian, stream, and freshwater marsh habitats within the Plan Area.

**Objective RSM 1.1.** Increase the quantity and quality of riparian, stream and freshwater marsh habitat in the Plan Area.

**Objective RSM 1.2.** Preserve, restore and enhance 50 acres of riparian vegetation within Priority Watersheds and Drainages.

**Objective RSM 1.3.** Control invasive exotic plant and animal species within at least 30 miles of stream habitat within Solano County, particularly within Conservation Area RSM 2 stream reaches.

**Objective RSM 1.4.** Restore and expand riparian and flood plain habitat within at least 2.5 miles of existing stream and flood channels within Conservation Area RSM 3 to allow naturalized channel processes to occur and riparian vegetation to establish.

**Objective RSM 1.5.** Implement stormwater management practices to control peak flows of storm water discharge and maintain natural hydrological processes to protect stream channels from degradation.

**Objective RSM 1.6.** Minimize non-point source pollution derived from storm water runoff that could degrade local water quality and adversely affect Covered Species inhabiting receiving waters within and downstream of the Plan Area.

**Goal RSM 2.** Contribute to the recovery of Covered Species associated with the Riparian, Stream and Freshwater Marsh Natural Community within the Plan Area through the preservation and expansion of existing populations, and future population expansion and re-colonization in restored areas.

**Objective RSM 2.1.** Remove all existing in-stream barriers, to the maximum extent practicable, within Plan Participant right-of-ways along important steelhead streams within 10 years of the adoption of the HCP. Prevent the creation of in-stream barriers associated with new development along Jameson Canyon, American Canyon, Ledge wood, Suisun, and Green Valley creeks and their tributaries that contain suitable breeding and rearing habitat for steelhead.

**Objective RSM 2.2.** Increase available habitat for the valley elderberry longhorn beetle within the riparian areas of Alamo, Ulatis and Putah creeks by replacing impacted elderberry plants at a minimum ratio of 2:1.

**Objective RSM 2.3.** Establish at least 28 acres of new, suitable nesting habitat for tricolored blackbird within agricultural reserves established as Swainson's Hawk foraging and nesting habitat mitigation.

## **6.6.2 Riparian, Stream and Freshwater Marsh Conservation Measures**

**6.6.2.1 Natural Community Conservation Measures.** The Riparian, Stream and Freshwater Marsh Conservation Measures focus on establishing and restoring riparian and/or in-stream habitat, controlling nonnative invasive plant species, protecting water quality and maintaining natural hydrological cycles. Habitat mitigation will vary depending on the duration of the impact (permanent or temporary) and the conservation value of the impacted area. Mitigation for temporary impacts associated with routine operation and maintenance activities shall include implementation of invasive species control programs and direct replacement of native vegetation. Restoration programs shall include measures to control and remove invasive species, replant native vegetation within existing riparian corridors and marshes and, where possible, restore riparian corridor widths to historic margins to provide for natural stream behavior and flood regimes. Sufficient funding shall also be provided to ensure implementation of restoration programs.

**Conservation Measure RSM 1: Controlling Invasive Species.** Plan Participants shall develop and adopt invasive species control programs as part of ongoing operation and maintenance activities associated with public facilities (e.g., flood control channels, parks, bike paths and linear parks). Invasive species control programs shall be in place within 5 years of adopting the HCP, and will conform to the requirements outlined in Riparian, Stream, and Freshwater Marsh Avoidance and Minimization Measure RSM 3 (Section 5.3.5.1) and the HCP restoration guidelines (Section 10.5.4).

This Conservation Measure is designed to achieve Goal RSM 1 and Objective RSM 1.3.

**Rationale.** Conservation Measure RSM 1 promotes opportunities for riparian restoration within existing public right-of-ways where it would not conflict with flood control or safety considerations. Riparian habitats are one of the natural communities most affected by invasive exotic species. Conservation Measure RSM 1 is designed to increase Plan Participant and public awareness of invasive species and to incorporate control measures into the routine vegetation management programs conducted by Plan Participants.

**Conservation Measure RSM 2: Permanent Impacts to Riparian, Stream and Freshwater Marsh Habitat.** Mitigation for permanent impacts to riparian, stream and freshwater marsh habitat associated with riverine systems within the Plan Area shall be provided through preservation and

restoration of in-kind habitat. Restoration of riparian habitat or creation of new marsh habitat must occur either onsite, at an approved mitigation bank, or at another high quality site, and must be of similar quality and support similar species as the impacted site. Plan Participants shall direct restoration and enhancement activities toward severely degraded stream segments within Priority Watersheds and Drainages (Figure 4-11). Basic mitigation requirements are based on the stream order<sup>11</sup> and designated conservation values of the riparian, stream and freshwater marsh habitat as assessed in Section 4.3.6.3. The mitigation requirements are:

**Priority Watersheds and Drainages.** Mitigation for unavoidable project impacts to riparian, stream, and freshwater marsh habitats within the Priority Drainages and Watersheds shall be provided as follows:

- Enhance existing streams or marsh habitats at a ratio of 4:1 ratio (based on acreage impacted) through additional riparian plantings and protection measures or create/restore new in-kind habitats at a ratio of 3:1 within the same drainage.
- Loss or fill of intermittent to perennial streams and their immediate tributaries (generally third, fourth, or higher order streams, but may include second order streams supporting riparian vegetation) shall require construction of a relocated stream segment to maintain hydrologic and biological connections between downstream and upstream areas.

**Non-Priority Watersheds and Drainages.** Mitigation for permanent impacts to riparian and stream habitat within non-priority drainages and watersheds shall be subject to the following conditions:

- Mitigation for permanent impacts to ephemeral to intermittent first order and second order streams lacking a defined woody riparian community shall be provided at a 2:1 ratio (based on acreage impacted) if existing streams or marsh habitats are enhanced through additional restoration and protection measures or 1:1 if new in-kind habitats are constructed.
- Mitigation for permanent impacts to third and higher order streams and second order streams with riparian vegetation shall be provided as follows: 1) maintain the hydrologic and biological connection between downstream and upstream areas by constructing a by-pass or rerouted channel and 2) enhance existing stream or marsh habitats at a 3:1 ratio (based on acreage impacted) through additional riparian plantings and protection measures or create/restore new in-kind habitats at a ratio of 1.5:1 .

This Conservation Measure is designed to achieve Goal RSM 1 and Objectives RSM 1.1, 1.2, and 1.4.

**Conservation Measure RSM 3: Mitigation for the Loss or Fill of Ponds and Freshwater Marsh Habitat Not Associated with Streams.** Mitigation for direct impacts to pond or freshwater marsh habitat not associated with streams shall be provided at a 2:1 ratio. This mitigation may be achieved by creating/restoring onsite open space areas with a minimum 100-foot wide buffer, establishing an

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<sup>11</sup> Stream order is a classification based on the branching pattern of river systems. A first order stream is defined as the smallest un-branched tributary. As streams of equal order join, they result in a stream of the next higher order (i.e., when two first order streams join, they form a second order stream; when two second order streams join they form a third order stream). See Figure 5-1.

endowment or other suitable funding source for long-term management of the mitigation habitat, or purchasing credits at an approved mitigation bank.

This Conservation Measure is designed to achieve Goal RSM 1 and Objectives RSM 1.1.

**Conservation Measure RSM 4: Mitigation for the Loss or Fill of Seasonal Wetlands within the Inner Coast Range.** Mitigation for direct impacts to seasonal wetlands within the Inner Coast Range shall be provided at a 2:1 ratio. This mitigation may be achieved by creating/restoring onsite open space areas with a minimum 100-foot wide buffer, establishing an endowment or other suitable funding source for long-term management of the mitigation habitat, or purchasing credits at an approved mitigation bank.

**Note:** Additional mitigation may be required from the US Army Corp of Engineers and RWQCB to comply with Sections 404 and 401 of the Clean Water Act and the Porter-Cologne Water Quality Act.

This Conservation Measure is designed to meet Objectives RSM 1.1.

**Rationale.** In addition to priority drainages, the Solano HCP Conservation Strategy establishes variable standards for stream order that are designed to minimize impacts on riparian habitats. Stream order is a classification based on the branching pattern of river systems. A first order stream is defined as the smallest un-branched tributary. Streams of equal order join to form a stream of the next higher order (i.e., two first order streams join to form a second order stream; two second order streams join to form a third order stream) (see Figure 5-1). Generally, first and many second order streams lack woody riparian vegetation, but may have a distinct herbaceous community.

**Conservation Measure RSM 5: Temporary Impacts to Riparian and Freshwater Marsh Habitat.** Temporary or short-term impacts (i.e., impacts that result in the removal of vegetation lasting less than one growing season) associated with ordinary channel operation and maintenance activities conducted by Plan Participants (see Appendix D for typical requirements), or construction/installation of permanent features (e.g., outfalls, bridges, utility lines), except in designated giant garter snake habitat areas (see Section 4.3.7), shall comply with the following conditions:

1. Implement appropriate erosion control measures for all disturbed areas above the waterbody's ordinary high water mark consistent with Avoidance and Minimization Measure RSM 5.
2. Conduct all work associated with ordinary channel operations and maintenance activities in compliance with the Operations and Maintenance Manual (Appendix D).
3. Implement BMPs consistent with Avoidance and Minimization Measure RSM 3 (Section 5.3.5.1) for all work associated with new development projects.
4. Replace all native, woody riparian vegetation greater than one-inch in diameter with sufficient new native riparian vegetation to achieve a 3:1 replacement ratio after 5 years. No compensation is required for removal of non-native trees and shrubs.
5. Restore channel or bank disturbance to original conditions at a 1:1 ratio.

**Note:** The above measures do not apply to maintenance and operation of constructed irrigation ditches associated with ongoing agricultural activities, including the undergrounding or lining of supply ditches for water conservation purposes. However, conversion or loss of surface water ditches subject to Section 404 of the Clean Water Act for urban development or other Zone 1 Covered Activities would be subject to the mitigation requirements.

This Conservation Measure meets Goal RSM 1 and Objective RSM 1.1.

**Rationale.** Although periodic, short-term reductions in value may occur as disturbed areas revegetate over time, the primary compensation temporary impacts associated with ordinary channel operation and maintenance activities is commitment by Plan Participants to develop and implement programs to control aggressive invasive species as required in Conservation Measures RSM 1.

**Conservation Measure RSM 6: Base Flow.** New developments shall not result in any increase in the base flood elevation. “Base flood” means a flood with a one percent chance of being equaled or exceeded in any given year (also called the “100-Year Flood”).

This Conservation Measure meets Objective RSM 1.5.

**Conservation Measure RSM 7: Development within Watersheds of Priority Drainages.** Within Priority Drainages and Watersheds (Figure 4-1), new urban development projects more than 10 acres in size shall detain water for a minimum of 12 to 24 hours for discharges that exceed pre-project level, two-year recurrence, 24-hour storm event discharges.

**Note:** All flood control and water quality basins within Priority Drainages and Watersheds shall be designed to minimize establishment and expansion of non-native species such as bullfrog and warm water fish consistent with Conservation Measure RSM 9.

This Conservation Measure meets Objectives RSM 1.5 and 1.6.

**Conservation Measure RSM 8: Restoring Naturalized Channel Processes.** New urban development projects in Vacaville east of Leisure Town Road (old Alamo Creek and old Ulatis Creek channels), and future development along Priority Drainages (Figure 4-11), shall restore and expand riparian habitat along existing stream and flood channels to allow more naturalized channel processes to occur and riparian vegetation to establish. Channel design standards shall include, but not be limited to, establishing a two-stage floodplain corridor that allows natural channel meander patterns to develop while still providing for riparian habitat restoration and protection, and adequate capacity to handle predicted storm flows.

This Conservation Measure meets Objective RSM 1.4.

**Conservation Measure RSM 9: Prevent the “Perennialization” of Ponds and Intermittent Creeks.** Minimize activities associated with urban and agricultural land uses that could lead to expansion of predator (bullfrog, crayfish, and warm water fish) populations (range and numbers) into undeveloped areas in western Solano County. Development activities shall avoid establishing

perennial ponds and small lakes, and urban runoff shall be controlled to prevent “perennialization” of intermittent creeks.

This Conservation Measure meets Objectives RSM 1.5.

**Rationale.** Increases in impervious surfaces associated with urban development alter downstream hydrology, typically resulting in down-cutting and/or erosion of existing banks to accommodate increased flow regimes. Studies have shown that development in as little as 10 percent of a watershed can have significant effects on water quality and downstream habitats (BASMAA 1999). Predation by introduced species such as bullfrogs, crayfish and warm water fish exert significant adverse pressure on native amphibian and reptile populations. Native species have adapted their life history and/or behavior to survive the dry summer climate of California, whereas introduced species typically rely on altered aquatic habitat conditions that provide perennial water where it previously did not occur. Elimination of unnatural perennial water sources limits the spread and establishment of these invasive species.

**Conservation Measure RSM 10: Stormwater Discharge.** Municipal Plan Participants shall require all new development and redevelopment projects that will increase directly connected impervious area (DCIA) to filter, retain, detain, or infiltrate storm water prior to discharge consistent with NPDES permit requirements established by the RWQCB. Such developments shall be required to implement storm water management plans to adequately treat urban runoff prior to discharge into wetlands, streams, rivers, ponds, or other local waterbodies or into municipal storm systems that discharge to aquatic habitats. Minimum design standards for structural or treatment control storm water runoff shall be determined by one of the following methods<sup>12</sup>:

Volumetric Treatment Control BMPs (e.g., water quality ponds, treatment wetlands.)

- Treat runoff up to and including the 85<sup>th</sup> percentile 24-hour runoff event determined as the maximum capture of storm water volume for a specific jurisdiction, according to the formula recommended in *Urban Runoff Quality Management, WEF Manual of Practice No. 23/ ASCE Manual of Practice No. 87* (or most current update); or
- Treat runoff up to and including the annual runoff volume based on a unit basin storage water quality volume, by the method recommended in *California Stormwater Best Management Practices Handbook – Industrial Commercial (CASQA 2004)* to achieve 80 percent or more volume treatment; or
- Treat runoff up to and including the runoff volume produced from a 0.75 inch storm event, prior to its discharge to a storm water conveyance system; or
- Treat runoff up to and including the runoff volume produced from a historical record-based reference 24-hour criterion for “treatment” that achieves approximately the same reduction in pollutant loads achieved by the 85<sup>th</sup> percentile 24-hour runoff event.

Flow Based Treatment BMPs (e.g., inlet filters, biofilters, swales.)

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<sup>12</sup> Design standards for all stormwater-related conservation measures shall conform to NPDES permits requirements in place at the time of the project approvals when such permit requirements exceed the minimum standards presented in the HCP.

- Treat runoff up to and including the flow of runoff produced by a rain event of at least 0.2 inches per hour; or
- Treat runoff up to and including the flow of runoff produced by a rain event of at least twice the 85<sup>th</sup> percentile hourly rainfall intensity for the applicable Plan Participant jurisdiction; or
- Treat runoff up to and including the flow of runoff produced by a rain event resulting in the treatment of an equivalent portion of runoff as treated by the volumetric standards above.

This Conservation Measure meets Goal RSM 1 and Objectives RSM 1.5 and 1.6.

**Rationale.** The water quality protection measures are adapted from the State Water Resources Control Board Phase II NPDES general storm water permit standards and contribute to maintaining and improving the chemical, physical and biological integrity of waters within the Plan Area. These minimum design standards are anticipated to be revised over time and for all stormwater-related conservation measures shall conform to NPDES permits requirements in place at the time of a project's approval when such permit requirements exceed the minimum standards presented in the HCP (e.g., the more protective standards shall apply).

**6.6.2.2 Species Specific Conservation Measures.** The following conservation measures apply to Riparian, Stream and Freshwater Marsh species, specifically steelhead, Valley elderberry longhorn beetle, and tri-colored blackbird.

**Conservation Measure RSM 11 New Stream Crossings.** New crossings in streams that are known to, or have the potential to support salmonids (i.e., the main stems and tributaries to American Canyon, Jameson Canyon, Ledgewood, Green Valley, and Suisun Valley Creeks and the Napa River) shall adhere to the guidelines developed by NOAA NMFS for safe passage of salmonids. The following alternatives and structure types shall be considered in order of preference:

1. *Nothing* – Realign the road to avoid crossing the stream;
2. *Bridge* - Span the stream to allow for long-term dynamic channel stability;
3. *Streambed simulation strategies* – Implement a bottomless arch, embedded culvert design, or ford;
4. *Non-embedded culvert* – Utilize a non-embedded culvert or hydraulic design for limited to low slopes; and
5. *Baffled culver or structure designed with a fishway* – Utilize a baffled culvert or similar facility for steeper slopes.

If a crossing is proposed in an active salmonid spawning area, only full span bridges or streambed simulations are acceptable.

This Conservation Measure meets Goal RSM 2 and Objective RSM 2.1.

**Conservation Measure RSM 12: Removal of In-Stream Barriers.** Plan Participants shall develop and implement programs to remove or minimize existing barriers and to prevent creation of barriers as new development occurs along the creeks. All barriers within Plan Participants' right-of-ways along important steelhead streams shall be removed or corrected within 10 years of adopting the

HCP. Plan Participants shall also work with, and provide technical assistance to, landowners to remove or minimize barriers on private lands.

This Conservation Measure meets Goal RSM 2 and Objective RSM 2.1.

**Conservation Measure RSM 13: Elderberry Shrub Mitigation for Valley Elderberry Longhorn Beetles.** Where removal of elderberry shrubs or their stems measuring one-inch or greater in diameter is unavoidable, these impacts shall be mitigated. Mitigation will include salvaging and planting affected elderberry shrubs and planting additional elderberry shrubs and associated native riparian plants according to the following criteria:

1. Transplant removed elderberry shrubs to an approved, secure site (an approved mitigation bank location within Solano County or non-bank site to be approved by SCWA). All non-bank relocation sites shall meet the minimum reserve standards identified in Section 10.5 (e.g., site shall be protected by a conservation easement or other applicable protection measure, funding shall be provided for long-term monitoring and maintenance). Transplanting shall occur between June 15 and March 15 (November through February is the optimal period for transplanting). Elderberry may not be transplanted between March 16 and June 14 except where isolated bushes are located more than 0.5 mile from other suitable valley elderberry longhorn beetle habitat and no signs of use (exit holes) have been identified.
2. Plant a minimum of 5 elderberry seedlings or rooted cuttings and 5 associated native, woody riparian plants for each removed elderberry bush within the mitigation area or purchase applicable credits from a mitigation bank approved under the Solano HCP to sell valley elderberry longhorn beetle credits.
3. Plant 2 elderberry seedlings and 2 native, associated woody riparian plant seedlings for every 10 elderberry stems one-inch or greater in diameter trimmed/removed.

Mitigation planting shall occur, to the maximum extent practicable, in areas adjacent to the impact area and/or within existing gaps in riparian corridors. Priority areas for riparian revegetation and planting of elderberry include Alamo, Ulati and Putah creeks in order to expand suitable habitat for the valley elderberry longhorn beetle within the Plan Area.

This Conservation Measure meets Goal RSM 2 and Objective RSM 2.2.

**Conservation Measure RSM 14: Tricolored Blackbird Habitat Establishment.** Tricolored blackbirds usually nest in large flocks in dense vegetation near open water, in emergent wetland vegetation, especially cattails and tules, or in thickets of willow, blackberry, wild rose, tall herbs, and willow thickets, and in silage or other grain fields such as sorghum. Plan Participants shall establish at least 28 acres of new, suitable nesting cover within agricultural reserves established for Swainson's hawk foraging and nesting habitat mitigation.

Plan Participants shall establish dense stand of suitable nesting cover (e.g., California blackberry, wild rose) within the 285 acres of reserved land required under Conservation Measure SH 3. Areas where suitable nesting cover should be established shall be determined on a reserve specific basis (see Section 10.5 and Figure 6-1 for an example). In general, nesting habitat should be established in proximity to aquatic habitats, in areas that will not interfere with ongoing agricultural operations and

away from the nest trees/groves. Mitigation for loss of suitable freshwater marsh and nesting cover will also be provided through Conservation Measures RSM 2 and RSM 3.

**Note:** In addition, 175 acres of aquatic habitat shall be restored and enhanced for giant garter snakes (Objective GGS 1.2) and will also contribute to the conservation of tricolored black birds by providing additional breeding habitat.

This Conservation Measure meets Goal RSM 2 and Objective RSM 2.3.

## **6.7 GIANT GARTER SNAKE CONSERVATION STRATEGY**

The Giant Garter Snake Conservation Strategy is limited to the eastern portion of the Plan Area within the historic and current range of this species (Figure 4-19). Suitable habitat for this species, with the exception of a few areas in Rio Vista, fall outside the anticipated urban expansion areas; therefore, primary concerns for this species are indirect effects of increased urban runoff in downstream receiving waters and flood control channels and direct impacts from operations and maintenance activities within Plan Participant facilities.

The Giant Garter Snake Conservation Strategy will result in the conservation and restoration of approximately 175 acres of aquatic habitat and 121 acres of associated upland habitat within the Giant Garter Snake Conservation Area (Figure 4-19). Reserves established for this species will be designed to maintain interconnected blocks of habitat that support natural movement patterns, provide opportunities for reestablishing populations within the Plan Area, and will be appropriately restored and managed to achieve historical levels of productivity and value for giant garter snakes. The following sections describe the goals, objectives and conservation measures designed to promote the potential recovery of giant garter snakes within the Plan Area.

### **6.7.1 Giant Garter Snake Goals and Objectives**

**Goal GGS 1.** Promote the continued existence of a viable population of giant garter snakes in the Plan Area and contribute to their recovery through protection, management, restoration, and enhancement of suitable habitat within the Yolo Basin-Liberty Farms population area.

**Objective GGS 1.1.** Improve habitat quality within the Giant Garter Snake Conservation Area and Yolo Basin-Liberty Farms population area by enhancing water quality discharged from urban and agricultural sources and controlling invasive exotic plants and animals.

**Objective GGS 1.2.** Acquire, enhance, and manage 175 acres of aquatic and 121 acres of associated upland habitat for giant garter snake.

### **6.7.2 Giant Garter Snake Conservation Measures**

**Conservation Measure GGS 1: Urban Runoff Water Quality Control.** Municipal Plan Participants shall comply with the storm water quality control measures identified in Conservation Measure RSM 10 to filter, retain, detain, or infiltrate storm water from new development prior to

discharge into wetlands, streams, rivers, ponds, or other local waterbodies or into municipal storm systems that discharge to such aquatic habitats.

This Conservation Measure meets Goal GGS 1 and Objective GGS 1.1.

**Conservation Measure GGS 2: Agricultural Runoff Water Quality Improvements and Invasive Species Control.** Plan Participants shall implement programs to control invasive exotic plants and animals and improve water quality throughout the Plan Area. Plan Participants shall provide funding for invasive species control and cost-sharing of water quality improvement measures for agricultural runoff. This measure shall be implemented in conjunction with Conservation Measures RSM 10 and CM 4.

This Conservation Measure meets Goal GGS 1 and Objective GGS 1.1.

**Rationale.** Minimizing the adverse effects of urban storm water runoff and improving the quality of water discharged from agricultural operations is important for maintaining and improving habitat for giant garter snake and other species in the region.

**Conservation Measure GGS 3: Short Term Impact Habitat Mitigation.** Plan Participants (SCWA, MPWD, Dixon RCD and RD 2068) shall acquire through direct purchase or conservation easement and restore 85 acres of aquatic habitat and at least 22 acres of associated upland habitat within the Giant Garter Snake High Value Conservation Area (Figure 4-19). This acreage shall be managed to promote giant garter snake habitat and shall be established within five years of adopting the HCP.

This Conservation Measure meets Goal GGS 1 and Objective GGS 1.2 and addresses habitat mitigation for Zone 2, channel maintenance and associated covered activities within Plan Participant features within the Giant Garter Snake Conservation Area.

**Rationale.** An estimated 170 acres of perennial marsh and aquatic habitat and 220 acres of associated uplands are present within Plan Participant facilities in the Giant Garter Snake Conservation Area. Operation and maintenance activities within these areas involve periodic clearing of vegetation and sediment. Typically, clearing of these waterways cannot be practicably accomplished during the desired time frames for avoidance and minimization (Avoidance and Minimization Measure GGS 1). Clearing schedules vary by feature, but only limited areas of channel are cleared in any given year and clearing cycles range from once every few years in smaller channels to more than once every 10 years in larger channels. The effects of channel vegetation removal tend to be temporary, lasting only one to two years. Plan Participants shall provide a one-time mitigation for temporary impacts associated with channel clearing of core habitat areas. Mitigation shall entail creation of new aquatic habitat at a ratio of 0.5:1 and restoration of upland habitat at a ratio of 0.1:1. Creation of 85 acres of aquatic habitat will mitigate for impacts to 170 acres of perennial marsh and aquatic habitat and restoration of 22 acres of upland represents 10 percent of the 220 acres of associated upland habitat.

Although USGS conducted extensive field studies in 2004 and 2005 in Solano County and found no evidence of this species in waterways owned and operated by Plan Participants, giant garter

snakes may be present within the Plan Area or may expand into Solano County waterways in the future.

**Conservation Measure GGS 4: Long Term Impact Habitat Mitigation.** Compensatory mitigation for unavoidable, long-term (longer than two years) and permanent direct and indirect impacts to suitable aquatic and associated upland habitat (i.e., 200 feet from the edge of aquatic habitat) within the Giant Garter Snake Conservation Area (Figure 4-19) shall be provided as follows:

**Aquatic Component Direct Impacts.** Restore aquatic habitat at a ratio of 3:1 (mitigation: impact) and restore upland habitat adjacent to restored aquatic habitat at a ratio of 2:1 restored upland acres to restored aquatic acres.

**Aquatic Component Indirect Impacts<sup>13</sup>.** Restore aquatic habitat at a ratio of 3:1 for avoided wetlands within 200 feet of proposed development and restore upland habitat adjacent to restored aquatic habitat at a ratio of 2:1 restored upland acres to restored aquatic acres.

This measure will provide preservation for approximately 100 acres of additional aquatic habitat (based on a projected urban direct and indirect impact to 30 acres of aquatic habitat) and 99 acres of upland habitat (based on an anticipated 33 acres of associated upland impacts). Upland mitigation requirements may be substituted by providing additional giant garter snake aquatic habitat at a ratio of 0.5:1 (additional aquatic habitat: required upland mitigation), if a sufficient portion (generally 20 to 25 percent) of the reserve is composed of associated upland habitat.

**Note:** Upland mitigation requirements are based on required aquatic habitat mitigation. Mitigation requirements for direct impacts to upland within 200 feet of giant garter snake aquatic habitat are specified as part of the broader Valley Floor Grassland and Vernal Pool Natural Community or Swainson's Hawk/Agricultural Community conservation requirements. The 175 acres of restored and enhanced aquatic habitat for giant garter snakes (Objective GGS 1.2) will also contribute to the conservation of tricolored black bird (a Covered Species), song sparrow, and yellow-headed blackbird (Special Management Species).

This Conservation Measure meets Goal GGS 1 and Objective GGS 1.2.

## 6.8 COASTAL MARSH CONSERVATION STRATEGY

The Coastal Marsh Natural Community goals, objectives and conservation measures apply to all marsh habitats within the historic influence of tidal action, including areas that are currently influenced by tidal action or are diked and no longer affected by tides. These marshes exhibit a broad range of characteristics and include the current and historic estuarine-influenced marshes of San Pablo Bay/Lower Napa River, Southampton Marsh in the Carquinez Straits, Suisun Marsh, and tidally influenced freshwater marshes in the upper regions of the sloughs and creeks in the Delta Region of Solano County (Figure 4-2). The Coastal Marsh Natural Community Conservation Strategy is designed to maintain the water and sediment quality standards, hydrology and ecological functions of the Natural Community; contribute to the restoration of tidally-influenced coastal marsh habitat; contribute to the conservation and recovery of associated Covered Species and Special Management

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<sup>13</sup> Indirect impacts are based on the location/conservation value of impacted habitat; not the location of project activity.

Species; and promote habitat connectivity. Primary conservation actions include preservation (primarily through avoidance, Section 5.3.7), restoration, invasive species control, and improvement of water quality.

Impacts to Coastal Marsh from Covered Activities are anticipated to result from changes in hydrology and water quality associated with development within the watershed rather than direct take of habitat. Coastal marsh habitats do not often occur within urban boundaries or when they do, the marshes are managed or incorporated into open space areas that have been established to protect and enhance existing values (e.g., White Slough, River Park, and Mare Island). In addition, all of the California Fully Protected Species—salt marsh harvest mouse, California black rail and California clapper rail—occur within the Coastal Marsh Natural Community and direct take is prohibited. The presence of fully protected species within coastal marsh habitat precludes large-scale development. Some minor direct impacts are anticipated as a result of road projects (widening of Cordelia Road in Fairfield), utility crossings, high-flow flood control, bypass channels and storm water outfalls, and flood control channel maintenance.

In addition to mitigating impacts, the Coastal Marsh Conservation Strategy contains additional commitments, to be undertaken by the Plan Participants, to conserve marsh habitat through the invasive species control and water quality improvement conservation measures. Plan Participants intend to work with State, federal, and private agencies and organizations to obtain additional funding and/or land to contribute to the restoration goals set by CALFED and the Suisun Marsh Conservation Plan.

The following sections detail the goals, objectives and conservation measures for the Coastal Marsh Natural Community.

### **6.8.1 Coastal Marsh Goals and Objectives**

**Goal CM 1.** Maintain and enhance the essential ecological processes, functions, and values; species diversity; and habitat heterogeneity of coastal marsh habitat within the Plan Area.

**Objective CM 1.1.** Increase the quality of coastal marsh habitat in the Plan Area by implementing programs to control invasive exotic plants and animals and improve water quality. Funding for these programs shall be sufficient to control invasive species on 100 to 170 acres of coastal marsh habitat annually (or 5,000 to 8,500 acres over the life of the HCP) and to fund cost-sharing of water quality improvement measures for agricultural water discharges.

**Objective CM 1.2.** Plan Participants shall prevent increases in dry season (May 1 through October 15) discharge from storm water systems into tributaries that drain into Suisun Marsh, Southampton Marsh, and the marshes bordering the Napa River and San Pablo Bay.

**Goal CM 2.** Plan Participants shall maintain and where possible, through restoration, increase population levels and distribution of coastal marsh associated species in order to contribute to their recovery.

**Objective CM 2.1.** Preserve, manage, and restore 80 acres of coastal marsh habitats.

**Objective CM 2.2.** Increase the quantity and quality of suitable coastal marsh habitat for populations of coastal marsh-associated Covered Species.

## **6.8.2 Coastal Marsh Conservation Measures**

The following conservation measures are designed to mitigate future direct impacts as well as existing and potential future indirect effects associated with urban development and other Covered Activities.

**6.8.2.1 Natural Community Conservation Measures.** The following conservation measures apply to all Coastal Marsh habitats within the Plan Area.

**Conservation Measure CM 1: Mitigation for Direct, Permanent Habitat Loss.** Compensatory mitigation for unavoidable direct, permanent impacts to coastal marsh habitats shall be provided through the creation and/or restoration of tidally-influenced coastal marsh at a 3:1 ratio of acres restored to acres impacted. Required ratios shall be applied and implemented to establish marsh communities (e.g., deep water, shallow water/mudflat, low marsh, mid marsh, high marsh, and upland) commensurate with impacted habitat.

This Conservation Measure is designed to contribute Goal CM 2 and Objectives CM 2.1, and 2.2.

**Rationale.** Coastal marsh habitat occurs within the Urban Limit Lines/Municipal Service Areas (MSAs) of Vallejo, Suisun City, Fairfield and Rio Vista, along areas bordering existing development. However, the potential for direct impacts to coastal marsh communities and associated species is limited. All of the California Fully Protected Species—salt marsh harvest mouse, California black rail, and California clapper rail—occur within the Coastal Marsh Natural Community. Fully protected species may not be taken or possessed at any time and no licenses or permits may be issued for their take except for scientific research collection, species recovery/habitat restoration, and relocation of bird species for livestock protection. The presence of fully protected species within substantial portions of the coastal marsh habitat, precludes its development and fill. Some minor direct impacts are anticipated as a result of road projects (widening of Cordelia Road in Fairfield), utility crossings, high-flow flood control, bypass channels and storm water outfalls and flood control channel maintenance.

### **Conservation Measure CM 2: Permanent Loss of Shallow Water Habitat from Shading.**

Mitigation for the shading of shallow water habitat shall be provided through the preservation, creation or restoration of shallow water habitat at a 3:1 ratio (e.g., for every one acre of shallow water habitat shaded, three acres will be preserved, created or restored). Shallow water habitat is defined as waters between Mean High Water and three meters below Mean Lower Low Water Mark. The footprint of the structure shall be used to calculate the shadow zone and to offset all adverse effects resulting from the project. For example, a boat dock with a surface area of 400 square-feet (40 feet by 10 feet) will need to preserve, create or restore 1,200-square-feet (a 3:1 ratio) of shallow water habitat.

This Conservation Measures is designed to achieve Goal CM 1 and Objectives CM 2.1 and 2.2.

**Rationale.** All waters with depths less than three meters at any given time are within the photic zone and are highly productive. These areas provide suitable habitat for delta smelt, are both vegetated and unvegetated, and include areas where rock riprap may have been applied. Structures placed over or in the waterways adjacent to shallow water habitat create shadows, called the shadow zone. This shading reduces productivity and contributes to the loss or thinning of aquatic vegetation that is important habitat for Covered Species.

**Conservation Measure CM 3: Dry Season Nuisance Flows.** All new and redevelopment projects within watercourses that drain to Suisun Marsh, Southampton Marsh, Napa River and San Pablo Bay shall incorporate source control and treatment measures to evaporate or infiltrate dry season runoff. This Conservation Measure is designed to achieve Goal CM 1 and Objective CM 1.2.

**Rationale.** The primary concern for Coastal Marsh communities and species within Solano County is the potential for indirect effects resulting from increased urban runoff and wastewater discharge, primarily increases in dry season discharge associated with urban development. Increased dry season freshwater flows into salt and brackish marshes can significantly change the natural marsh communities in protected areas and reserves. Urban discharge into upper Southampton Marsh in the Benicia State Recreation Area have resulted in the conversion of pickleweed-dominated salt marsh to cattail-dominated emergent marsh and a corresponding loss of salt marsh habitat previously inhabited by the endangered salt marsh harvest mouse. Similar changes occur in marsh communities located at storm water outfalls downstream of the Cordelia Villages and in the Hill Slough area adjacent to Suisun City. Conservation Measure CM 3 is designed to minimize urban runoff and wastewater discharge, which contribute to dry season nuisance flows. In addition, a portion of the development fee will fund invasive species control and public education grant programs, as mitigation for indirect impacts to coastal marsh habitat that will result in the permanent loss of upland habitat (see Conservation Measures CM 4 and LAN 3).

**Conservation Measure CM 4: Agricultural Runoff Water Quality Improvements and Invasive Species Control.** Within five years of adopting the HCP, Plan Participants shall implement a grant program to control invasive exotic plants and animals and improve water quality affecting coastal marsh habitat throughout the Plan Area. Plan Participants shall provide funding for invasive species control and cost-sharing of water quality improvements for agricultural runoff. This Conservation Measure shall be implemented in conjunction with Conservation Measures RSM 10 and GGS 2.

This Conservation Measure is designed to achieve Goals CM 1 and 2 and Objectives 1.1 and 2.2.

**6.8.2.2 Species Specific Conservation Measures.** The following conservation measures apply to Coastal Marsh species, specifically soft bird's beak, Suisun thistle, Mason's lilaeopsis, and Delta smelt.

**Conservation Measure CM 5: Covered Plant Species Salvage and Recovery.** Covered Activities that will impact populations of soft bird's beak, Suisun thistle, and Mason's lilaeopsis shall be required to implement salvage and recovery programs. Salvage and recovery plans shall include measures to transplant plants or collect seed from impacted populations for at least one season prior to loss. Collected seeds shall be made available for habitat restoration efforts; however, seed shall

only be introduced to areas within the same local genetic population complex. If sites are not available, collected seeds shall be banked/stored consistent with the criteria defined by the Center for Plant Conservation (CPC 1991). Collected seed shall be stored at a minimum of two locations, including the National Center for Genetic Resources in Fort Collins, Colorado and a facility certified by the Center for Plant Conservation.

This Conservation Measure meets Goal CM 2 and Objective CM 2.2.

**Conservation Measure CM 6: Delta Smelt Habitat Restoration.** Plan Participants shall restore and manage 175 acres of shallow water aquatic breeding and rearing habitat within the lower Delta area of Solano County. This measure shall be implemented in conjunction with Conservation Measures GGS 3 and GGS 4.

This Conservation Measure implements Goal CM 2 and Objective CM 2.2 and

## **6.9 SWAINSON'S HAWK CONSERVATION STRATEGY**

The goals, objectives and conservation measures for Swainson's hawk apply to all potential habitats within the Plan Area (Figure 4-22). The Swainson's Hawk Conservation Strategy is designed to maintain suitable foraging habitat and nesting habitat in proximity to suitable foraging habitat to support Swainson's hawk populations within the Plan Area and contribute to the range-wide recovery of the species. Primary conservation actions include preservation of suitable foraging habitat and planting of new nest trees.

Section 4.3.9.3 identifies Swainson's Hawk Conservation Areas based on the distribution of Swainson's hawk records and foraging habitat quality (Figure 4-22). Not all potential habitats within the Plan Area contribute equally to the conservation of Swainson's hawks; therefore, specific conservation areas were defined to direct conservation efforts. Based on the value of different foraging habitat and the distribution of Swainson's hawk records within the Plan Area, three Swainson's Hawk Conservation Areas were identified: the Irrigated Agriculture Conservation Area, Valley Floor Grassland Conservation Area, and the Inner Coast Range Conservation Area. Section 4.6.8 further refines these areas to identify potential areas in which reserves could be established as compensatory mitigation for impacts to foraging habitat. The Irrigated Agriculture, Valley Floor Grassland, and Inner Coast Range Potential Reserve Areas are depicted in Figure 4-28. These potential reserve areas are designed to avoid establishing reserves in areas that may be indirectly affected by future development. Areas excluded from reserve establishment include land within any City limits and areas zoned under the Solano County General Plan (2008) for rural residential, commercial, and industrial uses.

The Irrigated Agriculture Potential Reserve Area includes all irrigated agricultural land beyond the Plan Participants' Urban Limit Lines/MSAs and land above sea level. The Valley Floor Grassland Potential Reserve Area encompasses portions of the Valley Floor Grassland Conservation Area (Figure 4-28), minus the wind resource area in the Montezuma Hills. The Inner Coast Range Potential Reserve Area encompass key corridors between the valley floor and the Coast Range, the North Vacaville Corridor and the Vacaville-Fairfield Green Belt (see Section 4.3.1.1) and grassland habitat within the California Red-legged Frog Conservation Area (Figure 4-28). The Inner Coast Range

Potential Reserve Area captures the higher value and higher risk habitats within this region of the Plan Area.

Section 4.5 does not delineate a quantitative conservation target for Swainson's hawks because sufficient data was not available. Instead, a qualitative assessment was conducted based on expert opinion and the known needs of the species. Members of the Swainson's Hawk Technical Advisory Committee (SHTAC) and the Solano HCP Science Advisors argue that long-term viability of the Solano County population of Swainson's hawk will require conservation of existing agricultural lands in appropriate crop types (alfalfa, tomatoes, other specific row crops) in reasonable proximity to nest sites (Michael Bradbury, pers. comm.). If this is achieved, the Swainson's hawk population will likely remain at its current level, and may increase to a level that meets recovery standards in accordance with recent observations that the Swainson's hawk population in Solano County appears to be stable and/or expanding (Steve Foreman, LSA Associates, pers. obs.).

Implementation of the Solano HCP Conservation Strategy will result in the preservation of 11,000 acres of Swainson's hawk foraging habitat: 5,700 acres within the Irrigated Agriculture Potential Reserve Area, 4,300 acres within the Valley Floor Grassland Potential Reserve Area, and up to 1,000 acres of oak savannah/grassland within the Inner Coast Range Conservation Area. Additional foraging habitat (approximately 2,300 acres) will also be protected or enhanced through implementation of the California Red-legged Frog and Callippe Silverspot Butterfly Conservation Strategies. The following sections detail the goals, objectives and conservation measures for Swainson's hawk.

### **6.9.1 Swainson's Hawk Goals and Objectives**

**Goal SH 1.** Maintain the existing population of Swainson's hawk (estimated to be between 120 and 130 pairs) within the Plan Area.

**Objective SH 1.1.** Preserve and manage in perpetuity 5,700 acres of agricultural foraging habitat within the Swainson's Hawk Irrigated Agriculture Potential Reserve Areas.

**Objective SH 1.2.** Maintain at least 50 percent (or 2,850 acres) of cultivated reserve lands in alfalfa or other irrigated hay crops with similar irrigation and harvest requirements (e.g., multiple irrigations and cuttings per season) and the remaining 50 percent in any annual or biennial crop type that provides an acceptable crop rotation typical of or suitable for alfalfa production in this region.

**Objective SH 1.3.** Minimize the conversion of suitable foraging habitat within the Swainson's Hawk Conservation Areas to incompatible crop types or land uses when lands are annexed to SID, MPWD, RD2068, or Dixon RCD.

**Objective SH 1.4.** Preserve and manage 4,300 acres of valley floor grassland habitat to promote Swainson's hawk foraging and nesting opportunities within Swainson's Hawk Valley Floor Grassland Potential Reserve Areas.

**Objective SH 1.5.** Preserve and manage 1,000 acres of foraging habitat to promote Swainson's hawk foraging and nesting opportunities within the Swainson's Hawk Irrigated Agriculture, Valley Floor Grassland, or Inner Coast Range Potential Reserve Areas.

**Goal SH 2.** Provide sufficient nesting habitat in proximity to suitable foraging habitat to support the current Swainson's hawk population within the Plan Area.

**Objective SH 2.1.** Provide a minimum average density of one suitable nest tree or grove of trees<sup>14</sup> per 40 acres of reserve (minimum 143 trees/groves) in perpetuity within the Swainson's Hawk Irrigated Agriculture Potential Reserve Area.

**Objective SH 2.2.** Increase nesting opportunities for Swainson's hawk in Valley Floor Grassland and Vernal Pool Natural Community reserves by preserving and replacing existing nest trees within current and historic homesteads and restoring riparian habitats.

**Objective SH 2.3.** Maintain a minimum of 17 known Swainson's hawk nest trees in the Swainson's hawk Irrigated Agriculture and Valley Floor Grassland Potential Reserve Areas.

**Rationale.** The Swainson's hawk goals and objectives provide conservation actions for the Swainson's Hawk Conservation Areas (Figure 4-22) and the Swainson's Hawk Potential Reserve Areas (Figure 4-28). The goals and objectives focus on maximizing Swainson's hawk foraging habitat values while providing necessary flexibility for ongoing agricultural production and preserving near-term and long-term suitable nesting habitat. Objective SH 2.3 aims to preserve at least one known nest site for the each known nest site expected to be lost as a result of Zone 1 Covered Activities.

## 6.9.2 Swainson's Hawk Conservation Measures

**6.9.2.1 Foraging Habitat.** Mitigation requirements for loss of Swainson's hawk foraging habitat shall be provided through the preservation and management of suitable habitat and are based on the type, location, and duration of impacts and the conservation priority assigned to the impacted area.

**Conservation Measure SH 1: Irrigated Agriculture Foraging Habitat Conservation.** Long-term impacts<sup>15</sup> to Swainson's hawk foraging habitat within the Irrigated Agriculture Conservation Area (Figure 4-22) shall be mitigated through the preservation and management of foraging habitat at a ratio of 1:1 (mitigation: impact). Mitigation shall be provided within the Irrigated Agriculture Potential Reserve Area (Figure 4-28).

This Conservation Measure is designed to meet the foraging habitat objectives under Objective SH 1.1.

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<sup>14</sup> Nest tree sites ideally will include a small grove or row of trees, with fewer than 10 individuals per site. Each grove should include several species and age groups.

<sup>15</sup> Long-term impacts are defined as those Covered Activities resulting in the loss of more than one year of foraging habitat.

**Conservation Measure SH 2: Irrigation District Annexations Foraging Habitat (Zone 2 Covered Activity).** Irrigation district annexations will be required to preserve Swainson's hawk foraging habitat as described below.

- Annexations of existing irrigated lands with suitable foraging crops<sup>16</sup> where the property owner accepts and places a standard Swainson's Hawk Conservation Easement on the annexed lands (see Section 10.5 for standard crop and other use restrictions) will not require additional conservation actions.
- Annexations of existing irrigated lands with suitable foraging crops where the property owner does not accept standard Swainson's hawk conservation easement restrictions shall permanently protect suitable foraging habitat consistent with Conservation Measure SH 1.

This Conservation Measure is designed to meet the foraging habitat objectives identified under Objective SH 1.3.

**Rationale.** Annexations to irrigation districts could result in conversion of agricultural lands to incompatible crops types that do not provide suitable foraging habitat (e.g., orchards, vineyards, rice, etc.) for Swainson's hawks. While such crop conversions may not be permanent (e.g., the land would remain in some form of agriculture), crop conversions could result in a net, long-term loss of foraging habitat. Placement of a standard Swainson's Hawk Conservation Easement on the annexed lands would preserve existing foraging habitat values. Annexation of lands that do not support suitable foraging crops at the time the HCP is adopted, are not required to provide mitigation as no foraging habitat would be lost.

**Conservation Measure SH 3: Irrigated Agricultural Reserve Management Requirements.**

Reserves established for Swainson's hawk mitigation within the Irrigated Agriculture Potential Reserve Area (Figure 4-28) shall incorporate the minimum reserve standards described in Section 10.5 and shall meet the following additional management requirements:

1. Five percent of the reserve system shall be set aside and established in permanent, naturalized herbaceous and woody/shrub cover. The locations of these areas shall be determined on a reserve-specific basis to maximize distribution through the reserve and minimize interference to agricultural operations. These areas may also be used for preserving/planting nest trees (Conservation Measure SH 6); establishing burrowing owl artificial nest burrows (Conservation Measure BO 3), tricolored blackbird nesting habitat (Conservation Measure RSM 14), nesting habitat for other Special Management Species (Section 6.11); and providing vegetated filter strips for water quality enhancement (See Figure 6-1 for a reserve design example).
2. At least 50 percent of cultivated lands in the reserve system shall be planted and managed in any given year for alfalfa or other irrigated hay crops with similar management requirements (e.g., regular irrigation and harvesting through the Swainson's hawk nesting season). The remaining 50 percent of cultivated lands may be planted in any annual or biennial crop type that provides an acceptable crop rotation typical of or suitable for alfalfa production in this region (see Figure 6-1).

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<sup>16</sup> Crop types and impacts shall be based on baseline vegetation/habitat conditions at the time the HCP is adopted.

For long-term flexibility, SCWA will establish a program for trading crop type credits between individual reserves if the minimum 50 percent criteria for alfalfa (or other irrigated hay crops with similar management requirements) is achieved throughout the Irrigated Agriculture reserve system in any given year (see Section 10.5 for further information).

This Conservation Measure is designed to meet Goal SH 1 and Objective SH 1.2.

**Conservation Measure SH 4: Valley Floor Grassland Foraging Habitat Conservation.** Long-term impacts to Swainson's hawk foraging habitat within the Valley Floor Grassland Conservation Area (Figure 4-22) shall be mitigated through the preservation and management of foraging habitat at a ratio of 1:1 (mitigation: impact). Mitigation shall be provided within the Irrigated Agriculture or Valley Floor Grassland Potential Reserve Areas (Figure 4-28). Preservation of valley floor grassland habitat may be satisfied through Conservation Measure VPG 3 if the minimum 1:1 ratio for foraging habitat is achieved.

This Conservation Measure is designed to meet Goal SH 1 and Objective SH 1.3.

**Conservation Measure SH 5: Inner Coast Range Foraging Habitat Conservation.** Long-term impacts to grassland and oak savanna habitat within the Inner Coast Range Conservation Area (Figure 4-22) shall be mitigated through the preservation and management of foraging habitat at a ratio of 1:1 (mitigation: impact). Mitigation shall be provided within the Irrigated Agriculture, Valley Floor Grassland, or Inner Coast Range Potential Reserve Areas (Figure 4-28). Preservation of inner coast range habitat may be satisfied through Conservation Measures RLF 2 and CSB 1 if the minimum 1:1 ratio for foraging habitat is achieved.

**Exceptions:** Covered Activities that are likely to have minimal effects on the extent and quality of Swainson's hawk foraging habitat are exempt from Swainson's hawk foraging habitat mitigation requirements. Such activities include: projects affecting less than one year of forage production or resulting in the establishment of natural habitats (e.g., aquatic, riparian, and grassland habitats), construction of in-fill developments that are less than five acres in size and surrounded by urban development at the time the HCP is adopted, and other minor public and private facilities (e.g., pump stations, antennae sites, new irrigation canals, buried pipelines or utilities).

This Conservation Measure is designed to meet the foraging habitat objectives identified under Objective SH 1.4.

**Rationale.** Conservation measures for Swainson's hawks in the Central Valley have largely focused on the CDFG draft mitigation guidelines that provide specific mitigation ratios for impacts to foraging habitat within a 10-mile radius of an existing Swainson's hawk nest. The guidelines allow for losses of foraging habitat throughout the area populated by the species and do not consider additional habitat necessary for population recovery (Woodbridge 1998). The guidelines also fail to consider the cumulative effects of agricultural intensification and conversion to incompatible crop types, which occur independently of residential and commercial development. As a result, the SHTAC, an independent group of biologists with Swainson's hawk expertise, has judged the CDFG guidelines to be inadequate to conserve or recover the species in the Central Valley (Estep, pers. comm., cited in Woodbridge 1998).

The Swainson's Hawk Conservation Strategy improves upon the CDFG mitigation guidelines by requiring a 1:1 mitigation ratio for every acre of suitable foraging habitat lost to development within the Irrigated Agriculture Conservation Area. These preserved lands need to be intensively managed to support crop types that maximize foraging opportunities for Swainson's hawks, while allowing flexibility in crop selection to maintain profitable agricultural operations. This requirement is based on the premise that every acre of foraging habitat lost to development reduces the availability of habitat for future nesting pairs, thereby reducing the potential for recovery and expansion of the existing breeding population. Five percent of the reserve system shall be set aside and established with native cover to provide increased prey populations and locations for planting and preserving nest trees and areas to benefit associated species such as burrowing owl, tricolored blackbird and northern harrier. The 1:1 mitigation ratio will also apply to any projects in the Valley Floor Grassland or Inner Coast Range Conservation Areas.

Habitat preservation requirements also specify that all conserved habitat be of equal or greater value than the impacted habitat. The conservation measures recognize the dependency of Swainson's hawk on irrigated agriculture over native grassland communities in this region. Therefore, the conservation measures require Covered Activities to mitigate impacts in equal or higher value Swainson's Hawk Conservation Areas: impacts to habitat within the Irrigated Agriculture Conservation Area can only be mitigated for within the Irrigated Agriculture Potential Reserve Area; impacts to foraging habitat within the Valley Floor Grassland Conservation Area can only be mitigated for within the Irrigated Agriculture or Valley Floor Grassland Potential Reserve Areas; and finally, impacts to the Inner Coast Range Conservation Area can be mitigated for within the Irrigated Agriculture, Valley Floor Grassland or Inner Coast Range Potential Reserve Areas.

**6.9.2.2 Nesting Habitat.** The following measures are designed to meet Goal SH 2 by providing nesting habitat in proximity to suitable foraging habitat to support the current Swainson's hawk population within the Plan Area.

**Conservation Measure SH 6: Nesting Habitat Mitigation.** Each Swainson's hawk reserve within the Irrigated Agriculture Conservation Area shall provide at least one suitable nest tree/grove per 40 acres of reserve. In Valley Floor Grassland reserves, one suitable nest tree/grove per 320 acres of reserve shall be provided through riparian restoration and preservation/replacement of trees within existing and historic farmsteads. The exact quantity and location of nest trees or groves shall be determined on a reserve-specific basis as part of the reserve management plan approval and certification process described in Section 10.5.

Additional requirements associated with the establishment of reserves and the protection/planting of future nest trees include:

1. Conservation easements or other appropriate protection mechanism shall not be conveyed within one mile of a proposed urban expansion area boundary, unless prior approval is obtained from SCWA in consultation with the Resource Agencies.
2. Planted trees shall be limited to the following native species known to be used by Swainson's hawks for nesting: Fremont cottonwood (*Populus fremontii*), valley oak (*Quercus lobata*), box elder (*Acer negundo*), black willow (*Salix gooddingii*), red willow (*S. laevigata*), arroyo willow

(*S. lasiolepis*), California sycamore (*Platanus racemosa*), or California black walnut (*Juglans californica*). Species selection will ultimately depend on site-specific conditions and location (e.g., willows will not be planted in non-riparian habitats). Large trees (i.e., valley oaks, sycamore, and walnut) are preferred in all areas and shall be planted to the maximum extent practicable.

3. Single trees/groves shall not be planted within 0.25 mile of riparian habitat since the planting of one tree in an area that already has many trees will be of limited value to Swainson's hawks. In contrast, the establishment of a single large tree or small grove adjacent to suitable foraging habitat would be extremely attractive to Swainson's hawks and would encourage the establishment of new territories.
4. Trees shall be planted no more than one mile from suitable foraging habitat.
5. Nest trees must be planted within one year of adoption into the Solano HCP reserve system.
6. Reserve management plans shall incorporate monitoring and funding to maintain reserve-specific nest tree numbers and replace potential nest trees in perpetuity.

This Conservation Measure is designed to meet Goal SH 2 and Objective SH 2.1.

**Conservation Measure SH 7: Known Nest Trees.** Loss of known nest trees shall be mitigated through protection/preservation of other known nest sites at a 1:1 ratio. Protected trees/groves shall be located more than one mile from a proposed urban expansion area boundary, unless prior approval is obtained from SCWA in consultation with the Resource Agencies. Protection shall be provided through a defined term easement program (generally 5 to 10 years) or future nest tree planting program to be implemented by SCWA. Known nest tree easements will remain in place until: 1) the term of the easement expires; 2) the tree dies of natural causes and becomes a hazard to people or property; or 3) the tree is abandoned by nesting Swainson's hawks for at least three consecutive years. Upon termination of a known nest tree easement, an easement for another known nest tree shall be obtained. If no known sites can be practicably obtained, 10 future replacement nest trees shall be planted and established within protected lands, but outside of established Swainson's hawk reserves. This program shall remain in effect until the number of active nest trees on established reserves equals the number of known nests impacted by urban development in the Plan Area.

This Conservation Measure is designed to meet the Goal SH 2 and Objective SH 2.2.

**Rationale.** The establishment of potential nest trees as mitigation for the loss of known and/or potential nest trees is an important component of the Swainson's Hawk Conservation Strategy. Implementation of Conservation Measure SH 6 ensures that replacement nest trees for future Swainson's hawk populations are present within established preserves. Conservation Measure SH 7 is a short-term measure to provide additional protection of known nesting sites. It recognizes the transitory nature of nesting habitat and the possibility that conserving known nest sites from willing sellers may not be practicable. In such cases, applicants would provide replacement trees at a 10:1 ratio. This replacement tree program would occur outside of established Swainson's hawk reserves as requirements for future nest trees within the reserves are established under Conservation Measure SH 6. Additional details on implementation of this Conservation Measure are presented in Section 10.5.

In addition to tree preservation and replacement planting requirements, impacted nest trees within riparian zones (both native and nonnative species) shall be mitigated through implementation of Conservation Measure RSM 2.

## 6.10 BURROWING OWL CONSERVATION STRATEGY

The goals, objectives and conservation measures for burrowing owls apply to all potential habitats within the Plan Area (Figure 4-22). The Burrowing Owl Conservation Strategy is designed to preserve and manage suitable foraging and nesting habitat to support the current burrowing owl wintering and nesting population within the Plan Area. Primary conservation actions include preservation of large tracts of suitable habitat, protection of important nesting and wintering areas, and expansion of nesting habitat (e.g., increased burrow densities).

Burrowing owls are an open-country species, naturally inhabiting grasslands, open shrublands, and open woodlands, and have also adapted well to human-modified landscapes, using agricultural lands, disturbed fields, roadsides, and railroad right-of-ways. This pattern is evident in the distribution of existing burrowing owl records in Solano County, as most records are from agricultural areas (see Section 4.3.10 for more details). As a result, the Burrowing Owl Conservation Strategy, particularly the reserve system, is intricately tied to the Swainson's Hawk Conservation Strategy, the Valley Floor Grassland and Vernal Pool Conservation Strategy and the California Red-legged Frog and Callippe Silverspot Butterfly Conservation Strategies. Reserves and preserves established for these Natural Communities and Covered Species will also be managed to support and expand the burrowing owl population throughout the Plan Area.

Implementation of the Solano HCP Conservation Strategy will permanently protect 19,500 to 20,500 acres of foraging habitat for burrowing owl including 5,700 acres in the Irrigated Agriculture Potential Reserve Area, 10,500 to 11,500 acres in the Valley Floor Grassland Potential Reserve Area, and 3,300 acres in the Inner Coast Range Potential Reserve Area. The following sections detail the goals, objectives and conservation measures of the Burrowing Owl Conservation Strategy.

### 6.10.1 Burrowing Owl Goals and Objectives

**Goal BO 1.** Maintain suitable foraging and nesting habitat to support a self-sustaining burrowing owl population throughout the Plan Area.

**Objective BO 1.1.** Preserve and manage in perpetuity 5,700 acres of agricultural foraging habitat within the Irrigated Agriculture Potential Reserve Areas (a 1:1 ratio for anticipated loss of suitable irrigated agricultural habitat). This objective will be implemented concurrently with Objective SH 1.1.

**Objective BO 1.2.** Preserve and manage 10,500 to 11,500 acres of valley floor grassland habitat to promote foraging and nesting opportunities within the Valley Floor Grassland Potential Reserve Areas. This objective will be implemented concurrently with Objective VPG 1.1.

**Objective BO 1.3.** Preserve and manage 3,300 acres of foraging habitat to promote burrowing owl habitat within the Inner Coast Range Potential Reserve Area. This objective will be implemented concurrently with Objectives RLF 1 and CB 1.

**Rationale.** Burrowing owls inhabit open grasslands and agricultural lands throughout the Plan Area. Their basic habitat needs are similar to other Covered Species; therefore, preservation of burrowing owl habitat can be achieved through the protection and management of associated Natural Communities and Covered Species. To expand burrowing owl populations, conservation actions focus on increasing the number of nesting burrows and cover habitat (see Goal BO 2 and associated Objectives) as limits on these resources appear to be limiting the burrowing owl population in the Plan Area (see Appendix B).

**Goal BO 2.** Preserve existing nesting areas and promote expansion of nesting habitat/burrows within the Plan Area.

**Objective BO 2.1.** Protect one known active burrowing owl nest site within the Plan Area for each active nest site eliminated as a result of Covered Activities.

**Objective BO 2.2.** Preserve and manage a minimum of 140 acres of grassland habitat within the Swainson's Hawk Irrigated Agriculture Reserves (approximately 2 acres per 80 acres of agricultural preserve) to provide nesting opportunities and cover habitat for burrowing owls.

This preservation requirement equates to 50 percent of the fallow areas required in agricultural reserves; the other 50 percent can be used for tree plantings, taller grass or shrub cover (e.g., nesting habitat for tricolored blackbird, northern harrier)

**Objective BO 2.3.** Install, monitor, and maintain one burrow complex per 80 acres of agricultural preserve within grassland reserves established under Objective BO 2.2 to provide suitable burrowing owl nesting habitat.

**Objective BO 2.4.** Provide 28 suitable burrows per 280 acres of vernal pool/valley floor grassland preserves by expanding ground squirrel populations in grassland reserves and where necessary, installing and maintaining artificial burrows.

**Rationale.** Suitable subterranean burrowing owl nesting habitat is limited in the Plan Area. The California ground squirrel, the primary natural burrow excavator for burrowing owl, is classified as an agricultural pest species. As such, populations of California ground squirrel are intensively controlled by poison and trapping programs in irrigated agricultural areas and grasslands. Sparse populations of ground squirrels remain but are primarily limited to roadsides, utility corridors, urban edges/vacant lots, and railroad rights of ways. Increasing nesting opportunities is necessary for expanding burrowing owl populations in the Plan Area.

Expansion of ground squirrel populations in managed agricultural areas is not practicable or desirable as a Good Neighbor or to promote economically viable agriculture. In these intensively managed agricultural areas, artificial burrow complexes provide the only realistic opportunities for providing long term nest burrows.

In Valley Floor Grassland and Inner Coast Range reserves, ground squirrel management can be limited to edge areas abutting other uses. Ground squirrel populations colonize new areas relatively slowly and State pest control regulations preclude actively moving squirrels to establish new populations. In vernal pool/valley floor grassland reserves, burrow distribution will be

patchy and standard densities should be measured over larger areas. With implementation of Objective BO 2.4, 28 burrows (natural or artificial) would be located within the home range of burrowing owl.

### **6.10.2 Burrowing Owl Conservation Measures**

Conservation measures for this species have historically been minimal, focusing on avoiding the take of individual owls or breeding pairs without compensatory protection of suitable breeding and foraging habitat. As a result, the number of breeding owl colonies in California has declined nearly 60 percent from the 1980s to the early 1990s, and breeding owls have been extirpated from 8 percent of their historical home range in California over the last 10 years (CBD et al. 2003). Recent Habitat Conservation Plans in the Central Valley, such as those for San Joaquin County, have required mitigation for the destruction of burrowing owl habitat. The Conservation Strategy also includes mitigation requirements to compensate for habitat destruction as well as recommendations for land management and pest control BMPs to protect burrowing owls in Solano County.

**Conservation Measure BO 1: Permanent Loss or Conversion.** Mitigation for the permanent conversion (more than one breeding season) of burrowing owl habitat (valley floor/vernal pool grassland, grassland and oak savanna within the Inner Coast Range, pasture, grain/hay crops, row crops and other irrigated agriculture, vacant or fallow fields, and diked historic tidal wetlands within the Coastal Marsh Natural Community) for urban development or other permanent facilities shall be provided at a 1:1 ratio. Mitigation ratios specified in the conservation measures for applicable Natural Communities and/or Covered Species (i.e., Valley Floor Grassland and Vernal Pool [excluding the wetland restoration/construction component], Coastal Marsh, Swainson's Hawk, California Red-legged Frog and Callippe Silverspot Butterfly) can be used to satisfy burrowing owl conservation, if the reserve area meets the basic reserve management standards (Sections 7.3 and 10.5) and criteria specified in Conservation Measure BO 2.

**Exemptions.** In-fill projects less than five acres in size and surrounded by urban development (based on conditions at the time the HCP is adopted) would have minimal effects on the extent and quality of burrowing owl habitat and are exempt from burrowing owl foraging habitat mitigation requirements. Nonetheless, project proponents are obligated to avoid destruction of active burrowing owl nests and take of burrowing owls in compliance with the Migratory Bird Treaty Act and California Fish and Game Code Section 3503.5 and to meet the burrow mitigation requirements specified in Avoidance and Minimization Measures BO 1, 2 and 3 and Conservation Measure BO 4.

This Conservation Measure is designed to meet Goal BO 1 and Objectives BO 1.1, 1.2 and 1.3.

**Conservation Measure BO 2: Temporary Impacts.** If Covered Activities associated with construction of pump stations, antennae sites, new irrigation canals, buried pipelines or utilities (but excluding restoration and reserve management activities) will result in temporary impacts to occupied burrows (e.g., closure, collapse due to ground disturbance or disturbance within the exclusion zone), Covered Activities shall be mitigated according to the following criteria:

**Breeding Season.** Within the exclusion zone, mitigation for activities that will result in the destruction, closure or disturbance of burrows during the nesting season (February 15–August 31)

shall entail enhancement of existing unsuitable burrows (i.e., enlarge or clear of debris) or creation of new burrows by installing artificial burrows at the following ratios:

- Temporary impacts less than or equal to one acre in size: Install 5 burrows on contiguous lands 250 feet or more from the edge of the construction area if at least 6.5 acres of contiguous habitat remains. This condition may be waived if, a qualified burrowing owl biologist and SCWA, in consultation with the Resource Agencies, determine that the contiguous area already contains suitable donor burrows.
- Temporary impacts greater than one acre in size: Install 10 burrows/acre on contiguous lands 250 feet or more from the edge of the construction area (see Avoidance and Minimization Measure BO 3) if at least 6.5 acres of contiguous habitat remains. This condition may be waived if, a qualified biologist and SCWA, in consultation with the Resource Agencies, determine that the contiguous area already contains suitable donor burrows.
- Temporary impacts that will reduce the amount of suitable burrowing owl habitat to less than 6.5 acres on a parcel or contiguous ownership parcels shall be mitigated by preserving burrowing owl habitat off-site at a ratio of 0.5:1 (minimum impact is the construction area plus a 250-foot buffer for a minimum of 4.5 acres).

**Non-Breeding Season.** Activities that will result in the destruction (from ground disturbance, etc.), closure, or disturbance within the exclusion zone during the non-breeding season (September 1 – February 14) shall be required to enhance existing unsuitable burrows (enlarged or cleared of debris) or create new burrows by installing artificial burrows within 160 feet of the temporary construction area after construction at the following ratios:

- Temporary impacts less than or equal to one acre in size: Install 2 burrows on contiguous lands 160 feet or more from the edge of the construction area if at least 6.5 acres of contiguous habitat remains.
- Temporary impacts greater than one acre in size: Install 5 burrows/acre on contiguous lands 160 feet or more from the edge of the construction area if at least 6.5 acres of contiguous habitat remains.

These conditions may be waived if, a qualified biologist and SCWA, in consultation with the Resource Agencies, determine that the contiguous area already contains suitable donor burrows. Artificial burrows shall be maintained for a minimum of two years following installation.

Where these measures cannot be practicably implemented, the project proponent shall preserve one known nest (see Conservation Measure BO 4) and at least 6.5 acres of agricultural or grassland foraging habitat (based on temporarily impacted habitats) for each burrowing owl or breeding pair of owls. Compliance with this measure does not allow for the destruction or disturbance of an active nest site.

This Conservation Measure is designed to meet Goal BO 2 and Objective BO 2.2.

**Conservation Measure BO 3: Reserve Management Requirements.** Reserves established for burrowing owls shall be at least 80 acres in size, provide suitable foraging habitat, and meet the basic reserve management standards identified in Sections 7.3 and 10.5.3. Additional management requirements are described below.

**Grassland Reserve Criteria.** In valley floor grassland reserves, burrowing owl mitigation may be satisfied if the conservation area implements the following minimum criteria:

1. **Vegetation Height:** Management measures shall be implemented and adequately funded to maintain an average effective vegetation height<sup>17</sup> less than or equal to 6 inches over 80 percent of the reserve. This average effective vegetation height shall be sustained from February 1 to April 15, when owls typically select mates and nest burrows. To achieve this standard, the average effective height of residual vegetation at the end of the dry season (September to October) shall not exceed 4 inches. In addition, less than 30 percent tree and shrub canopy cover shall be maintained in perpetuity.
2. **Restrictions on Rodent Control:** Reserves in grassland habitats shall contain a large core area (at least 25 percent of the site) where ground squirrel control is prohibited. Ground squirrel control may only occur along existing irrigation canals/drains and along the perimeter (with 250 feet) of the reserve as necessary to prevent increased in ground squirrel populations on adjacent properties (see Sections 7.3 and 10.5.3),
3. **Burrow Density:** Valley floor grassland reserves shall provide at least 28 suitable burrows per 280 acres of valley floor and vernal pool grassland preserves. Where natural burrows do not occur in sufficient density, at least three artificial burrow complexes per 280 acres of reserves shall be installed monitored, and maintained until the sufficient burrow density is achieved. Artificial burrow complexes shall be provided at a rate of one multi-entrance, nest burrow/chamber and 9 temporary burrows per 280 acres of reserves until suitable, natural burrow densities reach a minimum 28 burrows per 280 acres.

**Agricultural Reserves Criteria.** In agricultural reserves established for Swainson's hawks, burrowing owl mitigation may also be satisfied if the reserve area meets the following additional criteria:

1. **Suitable Burrow and Cover Habitat:** At least 2 acres of habitat per 80 acres of reserve land shall be permanently taken out of production to provide suitable nesting and cover habitat for burrowing owls. These two acres shall consist of one continuous block of habitat and shall not be located adjacent to a County road or highway (See Figure 6-1 for an example).
2. **Artificial Burrows:** At least 2 burrow complexes (3 burrows per complex) shall be installed and maintained in perpetuity within the 2 acres of habitat set aside for burrowing owls.
3. **Vegetation Height:** Within the 2 acres of habitat set aside for burrowing owls, management measures shall be implemented and adequately funded to maintain an average effective vegetation height<sup>12</sup> less than or equal to 6 inches from February 1 to April 15, when owls typically select mates and nest burrows. In addition, the 2 acres of habitat must be kept free of tree and shrub canopy cover in perpetuity.

This Conservation Measure is designed to meet the Goals BO 1 and 2 and Objectives BO 1.1, 1.2 and 2.2.

**Conservation Measure BO 4: Protection of Known Nest Sites.** Loss of known nest burrows shall be mitigated through preservation of other known nest sites at a 1:1 ratio. Protected nests shall be

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<sup>17</sup> Effective vegetation height is the height at which 90 percent of a white board is obscured by vegetation when viewed one meter from the ground at a distance of 10 meters (Green and Anthony 1989).

located more than one mile from a proposed urban expansion area boundary, unless prior approval is obtained from SCWA in consultation with the Resource Agencies. Protection shall be provided through a defined term easement program (generally 5 to 10 years) or future nest burrow installation to be implemented by SCWA. Known nest easements will remain in place until: 1) the term of the contract easement expires, 2) the burrow is destroyed by natural causes; or 3) the burrow is abandoned by nesting burrowing owls for at least three consecutive years. Upon termination of a known nest site easement, an easement for another known nest site shall be obtained. If no known nest site can be practicably obtained, the following shall be implemented for each impacted nest: 1) at least 6.5 acres of land supporting ground squirrels shall be preserved and ground squirrel control shall be prohibited; or 2) 5 artificial nest burrows shall be established and maintained within protected lands. This program shall remain in effect until the number of active nest sites on established reserves equals the number of known nests impacted by urban development in the Plan Area.

The program will be administered by SCWA and funded through user fees (see Section 11.0). If willing participants are unavailable, SCWA will coordinate with the HCP Advisory Committee and the Resource Agencies to use available funds to purchase additional burrowing owl habitat.

**Rationale.** Most known burrowing owl nest sites in the agricultural areas and valley floor grasslands are located within utility corridors, irrigation and drainage ditches, and along railroad right-of-ways (active and abandoned). Such areas are generally unsuitable for long-term conservation due to their use and easement requirements. However, short-term protection of existing nest sites is important to allow new nesting habitat within the reserves to establish and become occupied.

## **6.11 SPECIAL MANAGEMENT SPECIES MANGEMENT REQUIREMENTS**

Special Management Species (Appendix C) will receive substantial conservation benefit from implementation of the habitat preservation and restoration, water quality protection, invasive species control, and reserve management associated with the Conservation Strategies for Natural Communities and Covered Species described above. However, several Special Management Species require additional reserve management to maximize conservation benefits. Reserve Managers shall evaluate the management actions described below for inclusion into the required Reserve Management Plans (Sections 7.3 and 10.5.3). Special management actions shall be implemented on each reserve, as appropriate, and to the extent they do not conflict with Covered Species management.

### **6.11.1 Northern Harrier and Short-eared Owl Special Management Requirements**

Both the northern harrier and short-eared owl are widespread in Solano County and are associated with several natural communities, including the Valley Floor Grassland and Vernal Pool, Agriculture, Coastal Marsh, and Inner Coast Range Natural Communities. Both species benefit from a habitat mosaic that includes agricultural crops with suitable prey species, lush ungrazed to lightly grazed grasslands, and weedy fields (Shuford and Gardali eds. 2008). Both species are ground nesters, typically nesting in fairly tall and dense grass, weeds, marshy vegetation, or shrubs. Meadow voles (*Microtus* sp.), which are a primary food source for these two raptors as well as Swainson's hawk, also thrive in wet, ungrazed to lightly grazed grasslands (Fehmi and Bartolome 2002). The establishment of 50 percent of the Swainson's hawk reserve system in alfalfa or similar crop (see

Conservation Measure SH 3) will greatly benefit northern harrier and short-eared owl. Management requirements for Covered Species associated with the Valley Floor Grassland and Vernal Pool Natural Community focus on maintaining moderate grazing levels to reduce the abundance of annual grasses and promote native vegetation growth (see Appendix B). In grassland and agricultural communities, the lack of available nesting cover is likely the primary factor limiting the populations of both species.

The following special management actions shall be incorporated into required Reserve Management Plans (see Sections 7.3 and 10.5.3) to increase habitat values for northern harrier and short-eared owl:

**Establish patches of tall and dense nesting cover.** Typical nest cover includes fairly tall (2 to 4 feet) and dense grass, weeds, marshy vegetation, or shrubs.

- In Valley Floor Grassland and Vernal Pool and California Red-legged Frog/Callippe Silverspot Conservation Areas, nesting cover will be allowed to establish in suitable areas within reserves. Suitable areas include: old homesteads, corrals, or barn areas; ditches, streams, stock ponds, or marshy areas; and other waste areas separated from high value vernal pools, Callippe silverspot larval host plant stands, or native grassland habitats. Potential nesting habitat should be fenced to exclude regular livestock access, but may be periodically grazed to promote new vegetation growth and control invasive exotic vegetation.
- In Irrigated Agricultural Reserves for Swainson's hawk, dense nesting cover should be allowed to establish in 10 percent of the reserve lands specified in Conservation Measure SH 3. Dense shrubby cover established as tricolored blackbird nesting habitat (see Conservation Measure RSM 14) may also satisfy this requirement (see Figure 6-1 for an example).

**Implement grazing schemes that result in a patchwork of ungrazed, lightly to moderately grazed pastures.** In most Valley Floor Grassland and Vernal Pool and California Red-legged Frog/Callippe Silverspot Butterfly reserves, moderate grazing levels are desired to maximize habitat values for Covered Species. On larger reserves, periodically ungrazed or lightly grazed pastures may be appropriate to promote vole populations where multiple pastures are present and where limited grazing would not degrade habitat conditions for Covered Species associated with vernal pools or Callippe silverspot butterfly breeding and larval habitat. Areas where reduced grazing could be implemented include riparian pastures, vernal pool and seasonal wetland restoration areas where Covered Species are not established/present, wet or alkali meadows, or pastures lacking significant presence of vernal pools. In general, no more than 20 percent of a reserve shall be ungrazed or lightly grazed in any given year.

### 6.11.2 Loggerhead Shrike Special Management Requirements

Loggerhead shrike may use grasslands and agricultural areas for foraging and breeding, but prefer microhabitats such as riparian corridors and other areas with trees and shrubs (i.e., along roads or fence lines in agricultural areas). Loggerhead shrike travel between habitat patches via these sheltered corridors. As a result, areas of open agricultural or grassland habitat without such corridors to experience reduced shrike use and dispersal (Haas 1995). The following special management requirement shall be implemented to establish shrubby nesting cover for loggerhead shrike:

**Establish shrub nest cover.** Typical nest cover includes small trees and shrubs.

- In Valley Floor Grassland and Vernal Pool and California Red-legged Frog/Callippe Silverspot Butterfly reserves, nesting cover for loggerhead shrikes will be established in suitable areas. Suitable areas for planting/establishing nesting cover include: old homesteads, corrals, or barn areas; edges of ditches, streams, stock ponds, or marshy areas; or other waste areas.
- In Irrigated Agricultural Reserves for Swainson's hawk, shrubs should be established in association with tree planting in portions of the reserve lands specified in Conservation Measures SH 3 and SH 6 (see Figure 6-1 for an example). Shrub plantings shall not occur in areas reserved for burrowing owl habitat (Conservation Measure BO 3). Dense shrubby cover established as tricolored blackbird nesting habitat (see Conservation Measure RSM 14) would also provide suitable nesting habitat for loggerhead shrike.

### **6.11.3 Grasshopper Sparrow Special Management Requirements**

Grasshopper sparrows prefer breeding habitat comprised of open, native bunch-grass grasslands (versus sod-type), although, throughout California, non-native annual grasslands and fallow agricultural fields are used in the absence of native bunch-grass ecosystems. Open grasslands allow the birds to forage and move freely, whereas sod-type grasses hinder these activities (Whitmore 1981). A negative correlation has been identified between proximity to woodland areas and grasshopper sparrow use, due to increased predation and nest parasitism (Thogmartin 2006). Grasshopper sparrows are also considered area-sensitive, meaning they prefer interior habitat areas with a high interior-to-edge ratio (Renfrew 2005; Davis, 2004).

Primary habitat for grasshopper sparrows occurs in the larger tracts of grassland within the Valley Floor Grassland and Vernal Pool and Inner Coast Range Natural Communities. Specific information on optimal grazing regimes is limited (Shuford and Gardali, eds. 2008); however, life history data indicates that light grazing resulting in a patchy environment that includes bare ground, scattered shrubs, and dense residual grass cover is desirable.

Grazing management that results in a patchwork of ungrazed, lightly, and moderately grazed pastures as recommended for northern harrier and short-eared owl would also apply to the grasshopper sparrow.

### **6.11.4 Native Perennial Grassland Special Management Requirements**

Native perennial grassland is limited to small stands of relict native perennial grasses. Generally, researchers have classified an area with 10 percent relative cover of native grasses as a sensitive natural community. Stands of native grasses are threatened by habitat loss and fragmentation, and invasion by non-native annual plants caused by urbanization, crop cultivation, disking and tilling, improper livestock grazing, rodent control, and climate change. However, moderate grazing can be used to control non-native annual grasses. Within proposed reserves in the Valley Floor Grassland and Vernal Pool and California Red-legged Frog/Callippe Silverspot Butterfly Conservation Areas, locations where native grasses and associated native forbs comprise at least 10 percent of the cover shall be identified. As part of the required Reserve Management Plan, realistic management objectives shall be established and management actions implemented to preserve and expand native grass and forb stands.

Figure 6-1 Alternative Configurations for Achieving Habitat Set-asides on Agricultural Reserves