

## 5.1 Summary of Conservation Strategy

This chapter describes the creation and management of the Preserve System. These actions include land acquisition, habitat enhancement, restoration, creation, and species population enhancement<sup>1</sup>. The conservation strategy is designed to create a fully functioning Preserve System that will accomplish the following.

- Preserve approximately 23,800 acres of land under the initial urban development area (range = 21,450–27,050 acres) or approximately 30,300 acres of land under the maximum urban development area (range = 26,050–34,350 acres) for the benefit of covered species, natural communities, biological diversity, and ecosystem function.
- Preserve major habitat connections linking existing and future protected private and public lands.
- Manage habitats to enhance populations of covered species and maintain ecosystem processes.
- Compensate for habitat loss by restoring or creating approximately 424–586 acres (under the initial or maximum urban development areas, respectively) of specific habitats and land cover types.

This conservation strategy will be implemented to protect and recover listed covered species in the inventory area and help avoid the listing of nonlisted covered species by protecting and, where appropriate, enhancing their populations. The conservation strategy is a program of conservation measures<sup>2</sup> that, when implemented in concert, will achieve the biological goals and objectives of this Plan (Table 5-1).

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<sup>1</sup> Habitat enhancement is defined as the improvement of an existing degraded community; habitat restoration is defined as the establishment of a vegetation community in an area that historically supported it, but no longer does because of the loss of one or more required ecological factors; habitat creation is defined as the creation of a habitat in an area that previously did not support it; see below for more detailed explanations. Population enhancement is defined as an improvement in the probability of long-term persistence of a population, through increases in population size, decreases in mortality, increases in reproduction, or other vital rates that affect population persistence.

<sup>2</sup> Conservation measures are defined broadly as specific actions taken to avoid or minimize take, compensate for loss of habitat, or provide for the conservation of covered species.

The heart of the conservation strategy is a system of new preserves linked to existing protected lands to form a network of protected areas outside the area where new urban growth will be covered under the HCP/NCCP. In addition to supporting ecosystem processes, habitat, and species, the preserves will also support other uses such as recreation, grazing, and crop production, as long as these uses are compatible with the biological goals and objectives of the HCP/NCCP.

The conservation strategy combines conservation measures at three ecological scales: landscape, natural community (or habitat), and species. Landscape-level conservation measures will be applied on a geographically broad scale (i.e., the inventory area) to achieve multiple goals and objectives. These measures relate to overall design and assembly of the Preserve System and are structured to benefit all natural communities and covered species, as well as to foster the conservation of biodiversity. Landscape-level measures address such parameters as preserve location, size, shape, composition, and connectivity; and ecological processes. These landscape-level measures are determined by the spatial needs of vegetation communities and associated species and the management activities necessary to maintain a well-functioning Preserve System.

Community-level measures apply to each natural community and include such parameters as vegetation management, habitat restoration, enhancement of ecosystem function, control of exotics, and increasing prey abundance. These community-level measures are determined by the habitat needs of covered species and by actions required to conserve vegetation communities. Measures at this level will conserve most covered species indirectly through conservation of their habitats.

However, some covered species will also require direct (i.e., not habitat-related) population management and population augmentation. Species-level measures employed in these cases will provide additional conservation tailored specifically to each covered species that requires it at the individual or population level. These actions augment the landscape-level and community-level measures.

## 5.2 Methods

### 5.2.1 Approach to the Conservation Strategy

The conservation strategy was designed using a multi-scale approach in accordance with principles of conservation biology. Landscape-level elements of the strategy (landscape-level conservation measures) were developed to encompass diverse vegetation communities and the spatial requirements of wide-ranging covered species. Community-level measures address, primarily, the enhancement, restoration and management of vegetation and species habitat. Species-level measures address the remaining needs of covered species for protection of individuals and populations. Species-level measures were developed only when landscape- and community-level measures were not

sufficient to address the conservation needs of the species. In other words, if full protection was achieved through the preservation and management of landscape and natural-community attributes, species-level conservation measures were not needed.

The conservation strategy was designed to meet the regulatory requirements of ESA, NCCPA, Clean Water Act Sections 401 and 404, the Porter-Cologne Water Quality Control Act, and Section 1602 of the California Fish and Game Code (see discussion in Chapter 1). The conservation strategy provides mitigation for impacts on covered species based on species and habitat needs (see Appendix D for species profiles and models of species habitat). The conservation strategy also provides mitigation for loss of functions resulting from impacts on jurisdictional wetlands and waters.

To meet the NCCPA permit standards, the conservation strategy contributes to species recovery and the prevention of listing of nonlisted species through the protection, restoration, and enhancement of species habitat. The conservation strategy also achieves the following objectives pursuant to the NCCPA (Section 2820)

- Conserves, restores, and provides for the management of representative natural and semi-natural<sup>3</sup> landscapes.
- Establishes preserves that provide conservation of covered species within the inventory area and linkages to adjacent habitat outside the inventory area.
- Protects and maintains habitat areas that are large enough to support sustainable populations of covered species.
- Incorporates a range of environmental gradients and high habitat diversity to provide for shifting species distributions due to changing circumstances.
- Sustains the effective movement and interchange of organisms between habitat areas in a manner that maintains the ecological integrity of the Preserve System.

The conservation strategy is based on the best scientific data available at the time of its preparation and takes into account the limitations of the baseline data available for the inventory area (see Chapter 3).

Sections describing the conservation measures also provide biological goals and objectives to be achieved and principles to be followed. In most cases, these measures prescribe general techniques to be used because specificity will depend on the final configuration, location, and site conditions of the preserves. For example, enhancing grassland as habitat for covered species may require seasonal livestock grazing in one area and a combination of prescribed burning and livestock grazing in another area, depending on the density of exotic grasses and herbs and the depth of dead plant material, or thatch (see Conservation

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<sup>3</sup> A seminatural landscape is defined as one that is disturbed by human activity but still provides important habitat for a variety of native species.

Measure 2.4). The conservation measures have been designed to provide flexibility for future land managers to implement specific techniques on the ground that are best suited to site conditions.

Implementation of most measures will require the preparation of site-specific implementation documents (e.g., preserve management plans, plans and specifications for wetland creation). These plans will be prepared during HCP/NCCP implementation after land is acquired and specific restoration and management needs are determined. Preserve management plans are intended to guide activities within a preserve. In some cases, management documents will be prepared for the entire Preserve System (e.g., recreation management, exotic plant management). A framework management plan is included in this HCP/NCCP (see the Conservation Measures below). Preserve management plans will be completed within 1 year of acquisition of individual preserve sites. All conservation measures will be implemented using an adaptive management approach (see Chapter 7, *Monitoring and Adaptive Management Program*).

The conservation strategy relies on several types of conservation measures:

- Avoidance and minimization.
- Habitat preservation.
- Habitat enhancement.
- Habitat restoration.
- Habitat creation.
- Population enhancement.

Each of these types of conservation measures is defined below. The relationship of the type of conservation measure to conservation scale (i.e., landscape-level, community-level, or species-level) is shown in Table 5-2.

## 5.2.2 Biological Goals and Objectives

The conservation strategy is designed to achieve the biological goals and objectives established for each natural community and the covered species that each community supports. Goals are broad, guiding principles based on the conservation needs of the resources. Biological objectives are expressed as conservation targets or actions. Objectives are measurable and achievable within a given time frame; they clearly state a desired result and will collectively achieve the biological goals.

Biological goals for covered species are required by USFWS's *5-Point Policy* to be included in HCPs (65 FR 35242, June 1, 2000). All the biological goals and objectives on which this Plan is based are presented in Table 5-1. The biological goals are provided for context below. They were developed using several sources:

- Ecological data from species profiles (Appendix D) and natural community descriptions (Chapter 3),
- Federal recovery plans for covered species,
- Data in critical habitat rules for covered species,
- Species-habitat models developed for 21 covered species,
- Input from resource specialists including staff from CDFG and USFWS, and
- Documentation of ongoing resource management in the inventory area (e.g., management and monitoring in the Los Vaqueros Watershed and in EBRPD preserves).

Biological objectives are meant to be clear, succinct, and measurable. As a whole, they are designed to articulate the broad, long-term vision of species and community conservation in the Preserve System. The conservation measures in this chapter contain detailed information on all aspects of preserve management. They describe the biological goals and objectives and provide a strategy for how the goals and objectives will be achieved. It is expected that many of the details of the conservation measures will be modified during Plan implementation through the monitoring and adaptive management program while goals and objectives will remain relatively static.

The biological goals and objectives in Table 5-1 are organized by natural community type and by scale (natural community-level and species-level). Covered species are grouped according to the natural community with which they are most strongly associated. For the most part, the biological goals and objectives for covered species are addressed through the goals and objectives for the natural communities with which species are associated. In cases where all the biological goals and objectives for covered species were addressed within the context of the natural community, no additional species-specific goals were needed. The conservation measures in Chapter 5 that were designed to achieve each objective are shown in Table 5-1; one conservation measure may help achieve multiple objectives.

All goals are listed below by natural community type. Goals and objectives that guide specific conservation measures are also listed throughout this chapter with the conservation measure.

## **Wetlands and Ponds**

### **Natural Community-Level Goals**

- Preserve wetlands and ponds in the inventory area
- Maintain and enhance hydro-geomorphic and ecological function of wetlands and ponds to promote covered species, native biological diversity, and habitat heterogeneity

- Restore wetlands and create ponds in Preserve System to compensate for permanent loss of these habitats
- Restore wetlands and create ponds in the Preserve System to contribute to recovery of covered species

### **Species-Level Goals**

- Enhance habitat for tricolored blackbird in the Preserve System
- Compensate for temporary and permanent loss of giant garter snake habitat
- Maintain or increase the population and distribution of western pond turtle
- Compensate for loss of occupied covered shrimp habitat
- Protect populations of adobe navarretia within wetlands

### **Grassland**

#### **Natural Community-Level Goals**

- Preserve sufficient habitat in the inventory area to maintain viable populations of grassland-dependent covered species
- Enhance grassland to promote native biological diversity and habitat heterogeneity
- Increase availability of burrows within grassland for San Joaquin kit fox, California tiger salamander, California red-legged frog, and western burrowing owl

#### **Species-Level Goals**

- Preserve the most important movement routes and core habitat for San Joaquin kit fox
- Increase the prey base for San Joaquin kit fox
- Maintain or increase population size and distribution of Townsend's western big-eared bat in the Preserve System
- Maintain or increase population size and distribution of golden eagles in the inventory area
- Increase population size and distribution of western burrowing owl
- Protect in the Preserve System at least 11 occurrences of grassland-dependent covered plants
- Enhance populations of grassland-dependent covered plants

## **Oak Woodland**

### **Natural Community-Level Goals**

- Preserve oak woodland and oak savanna in the inventory area
- Maintain the current canopy coverage of oaks and other over-story trees within oak woodland and oak savanna land cover types
- Enhance oak woodland and oak savanna to promote biological diversity and habitat heterogeneity
- Restore oak savanna to compensate for its loss from covered activities

### **Species-Level Goals**

- Protect populations of showy madia within oak woodland and grassland

## **Chaparral/Scrub**

### **Natural Community-Level Goals**

- Preserve chaparral/scrub in the inventory area
- Enhance chaparral to promote native biological diversity and habitat heterogeneity

### **Species-Level Goals**

- Contribute substantially to the recovery of Alameda whipsnake in the inventory area by protecting and enhancing chaparral/scrub
- Protect in the Preserve System at least eight occurrences of chaparral-dependent covered plants

## **Riparian Woodland/Scrub**

### **Natural Community-Level Goals**

- Preserve streams and riparian woodland /scrub in the inventory area
- Enhance riparian woodland/scrub to promote native biological diversity and habitat heterogeneity
- Maintain and enhance instream aquatic habitat for covered species and native fish
- Restore streams and riparian woodland/scrub

## Species-Level Goals

- Maintain or increase population size and distribution of Swainson's hawk in the inventory area
- Protect, maintain, or increase populations of foothill yellow-legged frog

## Avoidance and Minimization Measures

As required by ESA, the conservation strategy includes measures to avoid and minimize take of covered species. The primary focus of these avoidance and minimization measures is to avoid and minimize take of individuals of covered species within the permit area. The intent of these measures is, in part (and when possible), to encourage individuals of covered wildlife species within the permit area to avoid or escape project construction zones. Populations of covered plant populations will be avoided when adequate conservation of these species is not available within HCP/NCCP preserves. Impacts will also be minimized by designing development projects adjacent to the HCP/NCCP Preserve System in ways that reduce their impacts on covered species and habitats.

The permit area excludes most high-quality habitat for covered species, as well as excludes areas important for maintaining regional biological diversity. This exclusion eliminates the need to avoid or minimize impacts on large tracts of habitat within the permit area. Instead, most impacts under the Plan will occur on low-quality habitat for covered species. Habitat preservation and enhancement will be concentrated outside the permit area within the high-quality habitat of the proposed HCP/NCCP Preserve System. Avoidance and minimization measures at the landscape level are therefore built into the Plan. Avoidance and minimization measures that apply to all covered activities (i.e., those at the community and species levels) are described in Chapter 6.

## Land Preservation

Land preservation—in fee title or through establishment of conservation easements to create the HCP/NCCP Preserve System—is the foundation for conservation in this conservation strategy. In areas with active cropland or irrigated pasture, emphasis will be given to acquiring conservation easements on land suitable for restoration of riparian woodland/scrub. Outside active cropland or irrigated pasture, emphasis will be given to acquiring property in fee title to ensure full protection of resource values and land uses that are compatible with HCP/NCCP biological goals and objectives.

## Preserve Design Process

The process for delineating and prioritizing land for acquisition corresponds to the scalar approach of the conservation measures (landscape, habitat, species).

First, consideration was given to large, core preserves that could accommodate major vegetation communities and covered species with large geographical ranges and specific habitat needs. Linkages were also considered so that habitat connectivity goals and objectives could be met. Next, the conservation of rare vegetation communities (e.g., alkali grassland) was considered. Finally, the conservation of species with small ranges was considered. For resources not protected by the core preserves or the habitat linkages, smaller, “satellite” preserves are proposed when necessary to protect isolated but important resources such as populations of covered plants and rare vegetation communities.

Consideration of land use and economic factors in the Preserve System design was also approached in a step-wise manner. The first draft maps of the proposed Preserve System considered biological goals and objectives and maximized conservation benefit with the minimum amount of land. The second iteration of the maps took into account relevant land use and broad financial considerations. For example, areas with larger parcel sizes were selected over areas with very small parcels, all else being equal, due to the higher per-acre cost of small parcels. Areas without extensive rural development (e.g., along Morgan Territory Road) were favored over areas with such development, all else being equal, due to the habitat incursions and edge effects around rural development. Areas not proposed for development were favored over areas that were, all else being equal. This step-wise approach enabled the proposed Preserve System and Permit Area to be developed independently but in a coordinated manner that avoided conflict where possible and resolved it where not possible.

The independent Science Advisors and stakeholders provided early feedback on draft preserve design principles and the preliminary preserve design process. Their valuable input was incorporated into the conservation strategy presented here. The important results of the San Francisco Bay Area Gap Analysis project (Wild 2002) were also considered. Although that study was conducted using an older and much coarser dataset, it provided a wider regional context and established important priorities for conservation in the area. The six vegetative communities listed below were identified as being underrepresented in protected status in the San Francisco Bay Area (Wild 2002) and will receive substantial protection by this Plan:

- Coastal and valley freshwater marsh (a component of wetlands in this Plan).
- Great Valley cottonwood riparian forest (equivalent to riparian woodland in this Plan).
- Coast live oak woodland (a component of oak woodland in this Plan).
- Blue oak woodland (a component of oak savanna and oak woodland in this Plan).
- Nonnative grassland (equivalent to grassland in this Plan).
- Diablan sage scrub (equivalent to chaparral/scrub in this Plan).

## Preserve Design Principles

The preserve design process utilized scientifically accepted tenets of conservation biology in concert with the best available biological data (Noss et al. 1997). Information on species (e.g., population biology, genetics, distribution, life history characteristics) and information on habitats (e.g., distribution, composition, ecological functions) informed the preserve design process. Relevant ecological data for covered species are summarized in the species profiles in Appendix D. Note that detailed biological data are lacking for many of the covered species. The Plan includes funding for research into key management questions that will fill some of these data gaps (see Chapter 6, *Conditions on Covered Activities*, and 8, *Plan Implementation*, and 9, *Funding*).

To be successful, a preserve system must be designed in consideration of multiple ecologically relevant spatial scales. Small- and medium-scale considerations will be driven by the needs of covered species and natural communities. For example, at a small scale, a preserve system must contain the microhabitats necessary for target species (e.g., covered species) to survive. At a medium scale, habitat patches must be large enough to support populations or important portions of populations of covered species and the seasonal movement of species (e.g., aquatic habitat for winter breeding of amphibians and upland habitat for their aestivation [summer hibernation]). At a larger scale, preserves must be linked to allow movement of wide-ranging species for genetic exchange and for recolonization following local extirpation. At the largest scale (landscape or regional), preserves must be able to support ecological functions (e.g., watershed functions, natural disturbance regimes) and conserve regional biodiversity within a matrix of urban development, agricultural land, and other land use features. Larger-scale issues will be guided by the conservation principles for preserve design, landscape-level ecological functions, biological goals for natural communities, and biological goals for wide-ranging covered species.

The following principles of conservation biology (Soule and Wilcox 1980; Soule 1986; Primack 1993; Meffe and Carroll 1997; Noss et al. 1997) were used to guide the design criteria for the Preserve System and will be used to guide the assembly of the Preserve System during implementation.

- **Maximize Size.** The Preserve System should be as large as possible within funding and management limits. It must be large enough to mitigate impacts of covered activities and contribute to the recovery of covered species in the Plan area. A large Preserve System is important to ensure viable populations or portion of populations of covered species, to maximize protection of species sensitive to disturbances from adjacent land use, and to maximize the protection of biodiversity. Large preserves tend to support more species for longer periods of time than small preserves. Large preserves are also generally easier to manage on a per-acre basis because, for example, a large preserve reduces conflicts that may arise when managing for covered species with very different habitat requirements. Large preserves also better allow

for large-scale management treatments such as prescribed burning and grazing and the maintenance of natural disturbance regimes such as flooding.

- **Preserve the Highest-Quality Communities.** The Preserve System should preserve the highest-quality natural communities and habitat for covered species in the inventory area. *Highest quality* is defined using various parameters (many of which are listed below) and differs according to community type, but highest quality habitats are frequently characterized by a high abundance of native species and few roads, trails, or other human disturbances. Degraded communities may need to be preserved as well to capture unique habitats or populations of covered species, to link preserve areas together, or to provide opportunities for habitat restoration required by this Plan.
- **Link Preserves.** The Preserve System should link existing and proposed preserves inside and outside the inventory area to maximize the ability of organisms to move between preserves; facilitate exchange of genetic material, species migration, dispersal, and colonization; and increase the integrity of the network of preserves (e.g., reducing the extent of preserve edge that is in contact with adjacent land uses). Linking preserves may require acquisition of disturbed habitats that can be restored to facilitate better habitat and wildlife movement value. A single large preserve is generally better than several small, linked preserves of equal area in the context of maintaining viable populations of species. (In some cases, however, small and isolated preserves are necessary to protect isolated features or populations with high biological importance [e.g., covered plant species populations, unique or especially diverse land cover types such as alkali wetlands and serpentine grassland/scrub]).
- **Buffer Urban Impacts.** The Preserve System should include buffer land within its boundaries. This comprises undeveloped land at the urban edge that ensures a fixed and adequate separation between urban development and natural communities. The purpose of this buffer land is to minimize indirect effects from urban development and to provide a zone for fuel load management while minimizing adverse effects on covered species and communities. The size of the buffer lands depends on site-specific conditions such as topography, the intensity of adjacent urban development, the natural community being separated from the development, the condition of the buffer lands, and whether covered species are or will be present on these lands.
- **Minimize Edge.** The Preserve System should share a minimum amount of edge (i.e., should have the greatest possible area-to-perimeter ratio) with non-preserve land, especially urban development, to minimize the indirect effects of adjacent land uses on the preserve resources and to minimize management costs. For example, preserves should tend towards round or square configurations rather than long and narrow ones. In some cases, however, preserves with low area-to-perimeter ratios may be appropriate to protect linear features with high biological value, such as streams, riparian woodland, valley bottoms, or ridgelines essential to wildlife movement.

- **Fully Represent Environmental Gradients.** The Preserve System should include a range of contiguous environmental gradients (e.g., topography, elevation, soil types, geologic substrates, slopes, and aspects) to allow for shifting species distributions in response to catastrophic events (e.g., fire, prolonged drought) or anthropogenic change such as global warming.
- **Consider Watersheds.** The Preserve System should include, when possible, entire watersheds, subwatersheds, and headwater streams that are not already in protected status; this approach can help to maintain ecosystem function and aquatic habitat diversity.
- **Consider Full Ecological Diversity within Communities.** The Preserve System should include the full ecological diversity within natural communities in the inventory area (e.g., species composition, dominant species, physical and climatic factors) in order to maintain sufficient habitat diversity and species and population interactions.
- **Consider Management Needs.** Preserves should be manageable. That is, desired management treatments such as livestock grazing, prescribed burning, or exotic species control must be feasible on the preserve land. In general, larger preserves are easier to manage on a per-acre basis, but other factors, such as adjacent land uses and parcel configuration, must also be considered. Management needs may be driven by factors on or off site (e.g., adjacent land uses, watershed processes such as upstream erosion or ongoing contamination).

## Requirements of Covered Species

The HCP/NCCP Preserve System is intended to preserve and in many cases enhance populations of covered species. The ecological information used to determine the needs of covered species is summarized in the species profiles (Appendix D) and in this chapter. The following principles that apply to all covered species were also used to design the Preserve System.

- **Protect Multiple Populations of Covered Species.** In order to maintain viable populations of covered species, multiple populations of covered species will need to be protected and linked through existing or new protected lands to reduce the risk of local extirpation and ensure the genetic connectivity of populations. This is especially important for species that may function as metapopulations<sup>4</sup> or for species that naturally occur at low density or small population sizes.
- **Protect Higher-Quality Habitat for Covered Species.** HCP/NCCP preserves were designed to protect high-quality habitat for covered species and allow most impacts to occur on low-quality habitat.

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<sup>4</sup> A *metapopulation* is a group of partially isolated populations belonging to the same species that are connected by pathways of immigration and emigration. Exchange of individuals occurs between such populations, enabling recolonization of sites from which the species has recently become extirpated (locally extinct).

- **Protect Suitable but Unoccupied Habitat for Covered Species.** Protecting suitable but unoccupied habitat for covered species allows for future shifts in population size and location in response to natural and anthropogenic environmental change.

Consistent with the preserve design approach described above, the needs of covered species were considered at the landscape and habitat levels, and then independently at the species level to ensure that each species' biological goals and objectives would be met.

## Requirements of Key Covered Species

Early in the development of this Plan, it was recognized that two covered species, San Joaquin kit fox and Alameda whipsnake, would greatly influence the design of the Preserve System. San Joaquin kit fox exerts a substantial influence on the Preserve System design because of the species' extensive range and movement requirements. Alameda whipsnake is important because the inventory area contains several of the largest populations of this narrowly restricted species. This species is characterized by specialized habitat requirements in chaparral/scrub, and there is a need to link isolated patches of chaparral throughout the area. Linkages between patches of chaparral are needed to provide movement routes for Alameda whipsnake among isolated breeding sites.

All other covered species also have specialized and important habitat requirements that were considered in the overall Preserve System design. However, their habitats are either localized (e.g., alkali soils) or distributed relatively widely across the landscape (e.g., ponds), and their needs accordingly did not influence the preserve design to the same extent as the requirements of San Joaquin kit fox and Alameda whipsnake. To ensure that the Preserve System would satisfy the habitat needs of Alameda whipsnake and San Joaquin kit fox, the first step in the preserve design process was initiated with both species in mind. These species were not used as umbrella species<sup>5</sup> but as a starting point in the preserve design process.

### San Joaquin Kit Fox

San Joaquin kit fox is largely restricted to annual grassland (see the species profile in Appendix D). Annual grassland is the dominant natural land cover type in the inventory area and the natural land cover type subject to the greatest potential impacts from covered activities.

San Joaquin kit foxes occupy home ranges of 1–12 square miles (Knapp 1978; Spiegel and Bradbury 1992; White and Ralls 1993) and move up to 20 miles in a season for foraging or dispersal (Girard 2001). San Joaquin kit foxes have been observed in 53 locations in the inventory area (Duke et al. 1997; U.S. Fish and

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<sup>5</sup> *Umbrella species* are species whose occupancy areas are large enough and whose habitat requirements are broad enough that, once protection is established, it will bring other species under that same protection (e.g., Lambeck 1997; Fleishman et al. 2000; Rubinoff 2001; DeNormandie and Edwards in press).

Wildlife Service 1998; California Natural Diversity Database 2002), including Black Diamond Mines Regional Preserve, Round Valley Regional Preserve, and the Los Vaqueros Watershed. If these existing protected lands were isolated from the rest of the kit fox range to the south, they would not be large enough to support viable kit fox populations on their own. Therefore, it is critical to maintain linkages for kit fox between these existing protected areas and kit fox habitat outside the inventory area. The connection between core kit fox populations in the San Joaquin Valley and the population in Contra Costa County is dependent on maintaining viable habitat through Alameda, San Joaquin, and Stanislaus Counties.

If kit foxes are to persist in the protected lands in the inventory area and in the inventory area as a whole, the existing protected lands must be expanded, connected to each other, and connected to Alameda County and to the larger kit fox populations in the San Joaquin Valley. To conserve and recover San Joaquin kit fox in the inventory area (linking habitat through Alameda County and beyond is beyond the scope of this Plan), it is critical to preserve the kit fox habitat on either side of the Los Vaqueros Watershed lands.

Existing potential movement routes between Black Diamond Mines Regional Preserve and the Los Vaqueros Watershed are long (2.5–8 miles) and narrow (0.2–2 miles) relative to habitat connections for the species in the southern portion of its range. Long and narrow routes are probably used less frequently than shorter, wider routes because they are harder to find and enter and take longer to traverse (Orloff, pers. comm.). Long and narrow routes may also increase risk of predation by coyotes, vehicular mortality, and other sources of mortality or disturbance (Orloff 2003; Hilty and Merelender 2004). Movement routes with the highest chance of success are the shortest and widest corridors. Shorter routes minimize the risk associated with narrow habitat patches. Wider routes (often called habitat linkages) tend to contain more cover, higher-quality foraging, and higher-quality breeding habitat that allows for resting or even establishment of breeding territories.

No field studies investigating minimum widths of movement routes for kit fox have been conducted. An earlier analysis of conservation priorities in the inventory area suggested that a movement route at least 0.5 mile wide is necessary to support kit fox, based on expert opinion (Jones & Stokes Associates 1996). Because it was deemed inappropriate to establish arbitrary parameters for length and width of movement corridors, a site-specific analysis of potential movement routes in the inventory area was conducted to determine which may be the most viable for long-term kit fox use. Staff scientists examined the kit fox habitat model developed for this Plan, existing and future land use patterns, aerial photographs, topography, kit fox home range sizes, and kit fox sightings to define the most viable movement routes through the inventory area. The analysis also benefited from significant input from the Science Advisors (HCPA Science Advisory Panel 2003; Orloff 2003).

### **Alameda Whipsnake**

Modeled habitat for Alameda whipsnake is chaparral, coastal sage scrub, and habitats adjacent to them (grassland, oak savanna, and oak woodland within 500 feet of chaparral). The habitat model assumes movement habitat occurs within one mile of chaparral patches. Rock outcrops near these areas are also important for the species. Alameda whipsnakes move relatively long distances (up to 4 miles) between scrub patches and utilize this grassland habitat for some life-history requirements. The species is closely restricted to the western and central portions of Alameda and Contra Costa Counties. Due mostly to urban development, its range is now fragmented into five distinct populations (U.S. Fish and Wildlife Service 1997, 2000, 2002b). The inventory area encompasses approximately 75% of the Mount Diablo–Black Hills recovery unit (U.S. Fish and Wildlife Service 2002b), which supports one of these five populations. Moreover, 19 of the 48 recorded occurrences (40%) of the taxon are from within the inventory area. Because the range of this species is so small, and because the inventory area contains a large proportion of the species' range and known occurrences, a goal of the HCP/NCCP is to enable Alameda whipsnake recovery in the inventory area. USFWS lists habitat loss and fragmentation due to rural/suburban development as one of the primary threats to the species within this recovery unit. The unit is considered to have a high potential for achieving recovery of the species within it (U.S. Fish and Wildlife Service 2002b).

The core habitat for this species, chaparral/coastal sage scrub, does not support any other covered species except Mount Diablo manzanita, Diablo helianthella, and Mount Diablo fairy lantern. Chaparral/coastal sage scrub and rock outcrops are relatively uncommon in the inventory area (3,016 acres and 119 acres, respectively) and are naturally fragmented into many patches that are highly variable in size. Because of the fragmentary distribution of breeding sites, Alameda whipsnake populations may function as a metapopulation. In order to maintain Alameda whipsnake in the inventory area, it is critical to protect suitable movement habitat linking these patches of chaparral and coastal sage. These specialized habitat and linkage requirements and the goal to contribute substantially to the species' recovery in the inventory area were considered in the overall design of the Preserve System.

## **The Use of Maps to Define the Preserve System**

Regional conservation plans take a variety of approaches in the use of maps to develop land acquisition requirements. At one end of the spectrum, a conservation plan may use maps to delineate exactly where preserves are to be created. In this type of plan, often called a *map-based plan*, map designations define the application of regulations, fees, land acquisition, restoration, or other elements of the plan. Because all landowners must agree to the designation placed on their lands, purely map-based plans (otherwise known as *hard boundary* plans) are difficult to develop on a large scale and are rare.

At the other end of the spectrum, a conservation plan may not display any maps (or only very general maps) and instead develop a *process-based* land acquisition

strategy. A purely process-based plan (also known as a *policy-based* or *criteria-based* plan) has no map of where preserves will be established or other mitigation accomplished. Instead, the plan outlines a detailed process by which reserves are assembled according to clear criteria. The amount of flexibility in a process-based plan depends on the flexibility of the preserve assembly criteria.

The ECCC HCPA considered the full range of available approaches and chose to employ a combination of these strategies. This Plan uses a hybrid approach in which maps display conservation priorities on a regional scale. Land acquisition will be undertaken in accordance with a detailed set of requirements, while maintaining flexibility in how the Preserve System is ultimately assembled. Although the final boundaries of the system cannot be known, the general location, size, configuration, and protected resources of the preserves are spelled out in the preserve acquisition conservation measure. The HCPA considered this element of the plan to be essential to its success.

## Habitat Acquisition and Acquisition Analysis Zones

To develop priorities and identify potential locations for preserve acquisition, the inventory area was subdivided geographically into six *Acquisition Analysis Zones*. Acquisition Analysis Zones (Zones) were further divided into Subzones as necessary to distinguish between important landscape features. Acquisition priorities for each Zone were developed primarily on the basis of the ecological opportunities and constraints for collectively achieving the biological goals and objectives for covered species, natural communities, and landscapes. Identification of Zones and Subzones was undertaken to achieve the purposes listed below.

- Describe the specific areas in which land preservation (through fee title or conservation easements) will occur without identifying individual parcels.
- Focus the conservation strategy into geographic areas within the inventory area while maintaining the flexibility to acquire different parcels that would meet the same acquisition goals.
- Ensure that conservation measures are applied throughout the inventory area.
- Provide a mechanism to apply land acquisition requirements at several spatial scales (e.g., within a Zone, within a combination of Subzones, or within a single Subzone).
- Highlight key regional conservation priorities in a spatially explicit manner.

The Zones (Figure 5-1) incorporate all undeveloped land outside the major urban areas of Bay Point, Pittsburg, Antioch, Oakley, and Brentwood that is not already protected in large preserves (i.e., Black Diamond Mines Regional Preserve, Mount Diablo State Park, Morgan Territory Regional Preserve, Round Valley Regional Preserve, Los Vaqueros Watershed lands, Cowell Ranch State Park, and Vasco Caves Regional Preserve). Most of this undeveloped land occurs outside the ULL. Large undeveloped areas within the ULL were included in the

Zones if they had potential conservation value and were connected to undeveloped lands outside the ULL. Rural public facilities were included within Zones because their protection status for conservation may be uncertain. The six Zones include some areas of small and isolated public lands (e.g., Byron Airport conservation easements) and small and isolated patches of development; these areas would not be acquired as part of the HCP/NCCP Preserve System and are excluded from all calculations of Zone size. With these exceptions, the Zones represent all undeveloped and unprotected land in the inventory area with regional conservation value and within which the preserve system can be designed.

Zone boundaries were determined on the basis of physical and biological features at the landscape level, such as watersheds, ridgelines, and major breaks in land cover types or vegetation communities. Subzones were created on the basis of smaller watershed boundaries; landscape position; land cover dominance; conservation value within a Zone; and, in some cases, their function as potential movement routes for San Joaquin kit fox. The boundaries of each Zone are described below and illustrated in Figure 5-1. Table 5-3 lists the land cover types and vegetation communities found within each Zone.

### **Zone 1: Pittsburg Hills**

Zone 1 (8,613 acres) was created to encompass all the undeveloped and unprotected lands with potential conservation value in the northwest corner of the inventory area. The northern boundary of Zone 1 follows the boundary between undeveloped grassland and the urban development of Bay Point and Pittsburg, but it excludes the large areas of designated open space south of Pittsburg. The western boundary of Zone 1 follows the inventory area boundary but excludes Detachment Concord. The eastern boundary of Zone 1 abuts Black Diamond Mines Regional Preserve; a disjunct and undeveloped area between urban development in Antioch and the northern boundary of the park is also included in Zone 1. The southern boundary of Zone 1 follows the boundary between the Kirker Creek and Mount Diablo Creek watersheds.

### **Zone 2: Watersheds of Northern Tributaries of Marsh Creek**

Zone 2 (14,583 acres) was created to encompass the area dominated by annual grassland with oak savanna and oak woodland land cover types in the lower elevations of the center of the inventory area. This Zone covers the key habitat linkages between Cowell Ranch/Los Vaqueros in the east and Black Diamond Mines Regional Preserve and the Concord Naval Weapons Station (outside the inventory area) in the west. Zone 2 also includes a key linkage between Black Diamond Regional Preserve and Mount Diablo State Park.

The northern boundary of Zone 2, from west to east, follows the boundary between the Kirker Creek and Mount Diablo Creek watersheds, the southern boundary of Black Diamond Mines Regional Preserve, and the urban boundary of Antioch. The eastern boundary follows the urban boundary of Brentwood (and the ULL) and the northwestern corner of Cowell Ranch State Park. The southern boundary of Zone 2 follows the Briones Creek/Marsh Creek watershed line to Clayton Ranch (EBRPD). The southern boundary of Zone 2 is completed

in the west by Keller Ridge, which separates Irish Canyon from the main stem of Mount Diablo Creek. Zone 2 includes an isolated unprotected area of mostly annual grassland between Cowell Ranch State Park and the southern boundary of Brentwood's urban development (the portion of the Cowell Ranch property not purchased by the Trust for Public Land and currently being developed). Zone 2 excludes the large conservation easements in and near the Roddy Ranch golf course.

### **Zone 3: Clayton Area, Mount Diablo Foothills**

Zone 3 (2,174 acres) comprises the undeveloped land in the watershed of the main stem of Mount Diablo Creek at the eastern and southwestern edges of the city of Clayton. Most of Zone 3 is bounded on the north by Zone 2, on the east by the Clayton Ranch (EBRPD), on the south by the Mount Diablo State Park boundary, and on the west by the inventory area boundary.

### **Zone 4: Slopes of Mount Diablo and Main Stem Marsh Creek Watershed**

Zone 4 (14,338 acres) was designed to incorporate the area at the highest elevations of Mount Diablo foothills not in public ownership. This area is dominated largely by mixed evergreen forest, dense oak woodland, chaparral, and coastal sage scrub. Although present, annual grassland is mostly restricted to small patches in valleys and on south-facing slopes. Zone 4 is bounded by Mount Diablo State Park, the inventory area boundary, Morgan Territory Regional Preserve, Round Valley Regional Preserve, Cowell Ranch State Park, and Zone 2. A private inholding between the Los Vaqueros Watershed, Round Valley Regional Preserve, and Cowell Ranch State Park is also included in Zone 4. Zone 4 excludes the 640-acre conservation easement over the Morgan Territory Ranch owned by Seeno Homes (between Subzones 4f, 4g, and 4h).

### **Zone 5: Byron Hills**

Zone 5 (13,156 acres) comprises all the unprotected lands dominated by annual grassland and alkali grassland between the Los Vaqueros Watershed lands and the Alameda/Contra Costa County line. This Zone incorporates all uncultivated areas in the southern portion of the inventory area that have potential conservation value to the HCP/NCCP. The conservation easements surrounding the Byron Airport and the developed portions of the Byron Airport are excluded from Zone 5.

### **Zone 6: East County Cultivated Agriculture**

Zone 6 (32,916 acres) was designed to include all cultivated agriculture outside the ULL plus conservation opportunities within the ULL in eastern and northern Oakley. The northern boundary of Zone 6 follows the inventory area boundary and extends west to the edge of urban development in Oakley. To the west, Zone 6 borders the ULL in eastern Brentwood. To the southwest, Zone 6 borders Zone 5. To the east, the boundary is formed by the inventory area and the Discovery Bay ULL.

## Preserve Acquisition Priorities

Acquisition priorities within each Zone were based on the ecological and conservation opportunities within each Zone for achieving the biological goals and objectives for covered species and natural communities. Factors that affect conservation opportunities include land cover type, extent, and distribution; existing land use patterns; and planned future land use activities. Land was given a higher priority for acquisition if it met more of the preserve design criteria, provided or could provide through restoration the habitat requirements for one or more covered species, and provided the needs of one of the key covered species.

## Pre-acquisition Surveys

The Implementing Entity will conduct pre-acquisition surveys on potential preserve lands to evaluate whether these lands will meet the requirements of the HCP/NCCP. Once the Implementing Entity has entered into an agreement with a landowner interested in selling land for the Preserve System, qualified biologists will conduct a pre-acquisition survey to determine the suitability of the site for the Preserve System. Types of information collected during these surveys will include an assessment of location, quantity, quality, and type of covered species, habitat, and natural communities present on surveyed lands, as well as other site conditions and infrastructure that would benefit or conflict with the preserve's biological goals and objectives. This information will help the Implementing Entity prioritize acquisition of preserve lands based on their relative contribution toward meeting the biological goals and objectives.

## Habitat Enhancement, Restoration, and Creation

The primary means of mitigating impacts on and conserving covered species and natural communities are preservation of high-quality habitat in accordance with the preserve design criteria outlined above. In order to meet regulatory requirements and to contribute to the recovery of covered species, habitat enhancement, restoration, and creation are also important components of the conservation strategy. Some vegetation communities or land cover types that are lost to covered activities will be replaced<sup>6</sup> with the same or similar communities or land cover types within the HCP/NCCP preserves. Habitat enhancement, restoration, and creation ensure that there will be no net loss of certain resources (e.g., wetlands, breeding habitat for specific covered species). In other cases, restoration and enhancement are used to supplement preservation to adequately mitigate the loss of vegetation communities or land cover types. Many habitat restoration requirements exceed those typically required for individual projects in order to contribute to the recovery or prevent listing of covered species that these habitats support. Depending on the resource, creation, restoration, or

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<sup>6</sup> Some vegetation types may not be completely replaced because of uncertainties in the success of restoration techniques (e.g., they may not replace all functions of the original community). In these cases, mitigation ratios are increased to account for these uncertainties.

enhancement is required as part of the conservation strategy. Habitat enhancement, restoration, and creation will occur in addition to, not as a substitute for, land preservation. Success criteria for habitat enhancement, restoration, and creation will be based in part on reference stands within the region. Use of reference stands within the region will allow habitat enhancement, restoration, and creation plans to incorporate any unique regional characteristics of these habitats. Each of these terms is defined below.

## Habitat Enhancement

Habitat enhancement is the improvement of an existing degraded vegetation community. Enhancement involves improving one or more ecological factors, such as native species richness, species diversity, overall vegetative cover, and wildlife habitat function. Habitat enhancement activities typically occur on soils that are largely intact (e.g., soils that have not been tilled or otherwise disturbed). An example of enhancement would be planting blue oak seedlings in an existing stand of blue oaks to increase blue oak cover and density and improve the age-class structure of the blue oak population. Improving wildlife habitat function might include removing barriers or reducing hazards to animal movement such as removing fences, adding or resizing culverts, or reducing traffic on roads within the Preserve System.

The measures of enhancement will differ according to each natural community and site. For example, some communities in the inventory area have inherently low productivity, low species richness, or low vegetation cover (e.g., alkali sink scrub). Enhancement of these communities may be measured by an increase in relative cover of native plants or a decrease in inappropriate disturbance.

The appropriateness of habitat enhancement will be considered on a site-by-site basis and in the context of the entire Preserve System and Plan goals and objectives. Habitat enhancement will be undertaken within the preserves on all acreage (where appropriate) to conserve the populations of all covered species and maintain or improve ecological processes.

## Habitat Restoration

Habitat restoration is the establishment of a vegetation community in an area that historically supported it, but no longer does because of the loss of one or more required ecological factors. Restoration may involve altering the substrate to improve a site's ability to support the historic vegetation community. For example, riparian woodlands could be restored to stream reaches that historically supported them. In this Plan, habitat restoration is only allowed in those vegetation communities or land cover types for which techniques are generally successful and where restoration would substantially enhance habitat for covered species and native biological diversity. Habitat restoration is allowed only in the HCP/NCCP preserves, except in cases where sufficient sites are not available. In

these cases, restoration will be allowed on public lands adjacent to an HCP/NCCP preserve (see Conservation Measure 2.1 for more details).

It should be noted that habitat restoration may not restore all functions of natural communities. Recent studies of wetland restoration projects indicate that many of them fail to meet success criteria or lack important functions of natural reference sites (National Research Council 2001). The conservation strategy takes this uncertainty into account by relying primarily on habitat preservation for mitigation and by requiring habitat restoration in amounts exceeding typical mitigation ratios. Also, uncertainty is taken into account by the adaptive management strategy (see Chapter 7, *Monitoring and Adaptive Management Program*).

## Habitat Creation

Habitat creation is the establishment of a vegetation community in an area that did not previously support it. For example, ponds can be created as breeding habitat for California red-legged frog or California tiger salamander in areas along streams that did not previously support ponds. This type of habitat creation must be balanced by the need to maintain and enhance stream functions. Habitat creation should occur in damaged or disturbed areas whenever possible to minimize the loss of existing habitats by the creation of new ones.

In-kind/like-function habitat creation is the establishment of the same vegetation community as the vegetation community lost to the covered activity, and that would establish the same type of ecological functions over time. For example, creating an artificial pond with species similar to those found in a natural pond would be in-kind/like-function creation.

Out-of-kind/like-function creation of habitat is the establishment of a different vegetation community with some of the same ecological functions as the affected vegetation community. For example, it may not be feasible to create streams to replace the functions of those streams removed to make way for development. In this instance, ponds or seasonal wetlands may be created as out-of-kind mitigation for impacts on streams. Ponds and seasonal wetlands can provide equal or greater function than streams as habitat for some wildlife species and less function for other species.

## Population Maintenance and Enhancement

Most of the landscape-level and habitat-level measures are expected to at least maintain current populations of covered and other native species in the Preserve System. In some cases, populations of covered species are expected to increase as a result of land preservation, habitat enhancement, habitat restoration, and habitat creation. In order to meet some biological goals and objectives, species-level conservation measures have been developed to maintain or enhance covered species populations within the Preserve System. For example, the Implementing

Entity may, where appropriate, create artificial burrows in some grasslands to encourage colonization by western burrowing owl and, if possible, increase the western burrowing owl population within the Preserve System.

### 5.2.3 Mitigation for Jurisdictional Wetlands and Waters

The conservation strategy for this HCP/NCCP has been designed to address the regulatory requirements for impacts on state and federal jurisdictional wetlands and waters, including wetlands and waters regulated under Sections 404 and 401 of the CWA, the Porter-Cologne Water Quality Control Act and Section 1602 of the California Fish and Game Code. Specific biological goals and objectives for jurisdictional wetlands and waters have been developed (Table 5-1). The conservation strategy includes measures to mitigate impacts on these resources according to established ratios for habitat preservation and restoration. These conservation measures are intended to be used for subsequent regional permits for jurisdictional wetlands and waters as discussed in Chapter 1.

### 5.2.4 Sources

The primary sources of data for the conservation strategy were the ecological profiles of covered species (Appendix D), species distribution models, and the inventory of existing conditions summarized in Chapter 3. Other sources consulted to develop the conservation strategy are listed below:

- Species recovery plans, if available (U.S. Fish and Wildlife Service 1998, 2002b, 2004c).
- Species and natural community experts, including the independent Science Advisors for the HCP/NCCP.
- The *East County Biodiversity Study* (Jones & Stokes Associates 1996).
- Approved or in-process HCPs for adjacent or nearby areas with similar natural communities and covered species (e.g., San Joaquin County Multi-Species Conservation Plan [approved], Yolo County HCP [in process], Solano County HCP [in process]).
- Management or mitigation plans for large-scale projects in the inventory area that address biological goals and objectives similar to those of the HCP/NCCP (e.g., Los Vaqueros Reservoir project mitigation program [e.g., Contra Costa Water District and U.S. Bureau of Reclamation 1993]).

## 5.3 Conservation Measures

The conservation strategy is composed of conservation measures divided into three categories based on spatial scale: landscape, natural community, and species. Conservation measures are tools, strategies, comprehensive programs, and actions required to conserve habitats and landscape-level processes and to conserve and recover covered species in the Plan area.

Conservation measures are given a two-digit numeric code according to their position in the hierarchy and their topic area. The first digit denotes the scale level (1 for landscape-level, 2 for natural community-level, or 3 for species-level). The second digit is sequential; this numbering system continues into Chapter 6, *Conditions on Covered Activities*.

### 5.3.1 Landscape-Level Conservation Measures

Landscape-level conservation measures are divided into two categories: preserve assembly and preserve management.

#### Preserve Assembly

##### Conservation Measure 1.1. Acquire Lands for Preserve System

The Implementing Entity will establish the Preserve System through acquisition of land in fee title, conservation easement, mitigation banking, or land dedication. Lands will be acquired from willing sellers in keeping with the patterns and procedures described below. Land will be acquired that supports functioning vegetation communities and covered species habitat and that may contain sites suitable for restoration or creation of vegetation communities and habitat.

##### Preserve Assembly Strategy

The Implementing Entity will assemble the Preserve System in the Acquisition Analysis Zones in any of six ways:

- Purchase of land in fee title from willing sellers.
- Purchase of conservation easements from willing sellers.
- Purchase of land or conservation easements in partnership with other organization(s).
- Acceptance of land or easement dedication in lieu of fee payment under certain circumstances.

- Acceptance of credits sold in private mitigation banks under special circumstances.
- Acceptance of land or easement dedication as a gift or charitable donation.

Acquisition of land in fee title will likely be the primary mechanism used in Zones 1–5. A combination of acquisition in fee title and conservation easements is expected to be used in Zone 5 due to the prevalence of wind turbines in that area, and in Zone 6 because of the dominance of intensive agriculture.

The terms of each conservation easement will be tailored to each landowner, parcel, and agricultural operation, but will be consistent with goals of the conservation strategy, the general principles for easements outlined in this Plan (see Chapter 8), and with the guidelines in the Implementing Agreement. Conservation easements on cultivated lands in Zone 6 will help to meet the biological goals and objectives of the HCP/NCCP while maintaining economically viable agricultural operations.

The land and conservation easement acquisition process and the conditions under which the other four preserve assembly techniques may be used are discussed in detail in Chapter 8.

### **Field-Verified Conditions**

Land cover data, species distribution data, and species habitat models were developed for this HCP/NCCP at a regional scale and general level of resolution. These data and models were used in this HCP/NCCP to estimate impacts of covered activities and to develop a sound conservation strategy for the inventory area at a regional scale. These data and models are not intended for site-specific planning because of their low resolution and the lack of field verification. Project proponents must verify in the field all land cover types and suitable habitat for covered wildlife species as described in Chapter 6.

All requirements in this conservation strategy for land cover preservation, species habitat preservation, and covered plant species preservation will be verified in the field through planning surveys. The Implementing Entity will conduct planning surveys for land cover type and covered species habitat on all lands considered for acquisition to measure in the field whether the proposed acquisition site meets HCP/NCCP requirements. The details of these land acquisition planning surveys are described in Chapter 8.

### **Acquisition Credit by Zone**

To achieve the biological goals and objectives of the HCP/NCCP, including the recovery of covered species, it is important to focus land acquisition where it will have the greatest conservation benefit. By concentrating land acquisition in certain areas, larger effective preserves can be assembled by augmenting and connecting existing protected lands. However, the Implementing Entity must retain flexibility in deciding where to acquire land because the Plan depends on the availability of willing sellers. The HCP/NCCP balances these needs by focusing acquisition of certain land cover types within certain Zones and Subzones.

Credit will only be given if the acquisition occurs in the required Zones (Table 5-4) and fulfills land cover preservation requirements (see requirements below) or if the acquisition meets another requirement within the Zone not specific to the land cover type. Because Zone boundaries were drawn to distinguish habitat with the highest value for covered species and natural communities from lower value habitat, preservation of the same land cover type outside the specified Zones would not meet HCP/NCCP biological goals and objectives. For example, acquisition of annual grassland will be focused in Zones 1, 2, 3, 4, and 5. A small amount of annual grassland occurs in Zone 6. If annual grassland is acquired in Zone 6, no credit will be given towards the overall requirements for preservation of annual grassland because it is of much lower quality for most covered species than grassland in the other Zones.

Most natural land cover types will be acquired in Zones 1–5. Acquisition in Zone 6 will focus on land suitable for restoration (e.g., riparian woodland/scrub, wetland, and adjacent upland) as habitat for tricolored blackbird, western burrowing owl, Swainson’s hawk, and giant garter snake. Credit will also be given to acquisition of some aquatic land cover types, such as seasonal wetlands, perennial wetland, and sloughs/channels, in Zone 6. These aquatic land cover types are generally compatible with agricultural operations and may be used by resident and migratory waterfowl that frequent cultivated agricultural areas. Credit will also be given for preservation of alkali grassland in Zone 6 because this land cover type is rare and preservation opportunities are limited.

### **Role of Existing Public Lands and Other Open Space**

The HCP/NCCP Preserve System builds on an extensive network of public lands and other open space (e.g., private conservation easements) in the inventory area. The Plan could not succeed without these lands (see Section 2.2.4 in Chapter 2 for a description of major public lands and their management). Existing public lands and other open space help to achieve the HCP/NCCP biological goals and objectives because they provide habitat linkages, source populations of covered species for HCP/NCCP preserves, and other important functions. Existing public lands and other open space, however, do not count toward the land acquisition requirements in this conservation measure.

### **Land Acquisition Requirements for Wetlands, Ponds, Streams, and Riparian Woodland/Scrub**

All wetlands, ponds, and streams to be impacted or preserved will be delineated in the field prior to impacts or acquisition (see Chapter 6). To mitigate impacts on these aquatic land cover types, the Implementing Entity will acquire these land cover types in-kind within preserves according to the ratios in Table 5-5.

Wetlands and streams exhibit a high degree of biological, physical, and hydrologic diversity in the inventory area. Consequently, it is important to preserve, enhance, restore, or create the full diversity of these land cover types as they occur in the area. Wetland delineations conducted prior to wetland impacts will be used, in part, to classify wetland types lost to ensure that the same types are being acquired within HCP/NCCP preserves. In addition, vegetation in wetlands and streams will be classified at the association or alliance level (rather

than as a single land cover type) in order to help ensure that a diversity of communities is preserved. It is also important to preserve adequate uplands and buffer zones around wetlands, ponds, and streams to maintain their hydrologic function and provide adequate upland habitat for aquatic and other covered species (see also Conservation Measures 2.2, 2.9, 2.10, and 2.12).

Mitigation will also include creation, restoration, or enhancement of aquatic land cover types as described in Conservation Measures 2.2 and 2.3 (Wetland Restoration Program). In order to conserve and recover covered aquatic and riparian species in the Plan area, the Implementing Entity will create or restore key aquatic land cover types within preserves above and beyond the mitigation requirements. These requirements are also described in Conservation Measures 2.2, 2.3, 2.9, 2.10, and 2.12.

Impacts on all aquatic land cover types will be limited to the amount of the same land cover type available for acquisition in accordance with the preservation ratios in Table 5-5. Preservation ratios were determined on the basis of the following factors.

- The rarity and irreplaceability<sup>7</sup> of the land cover type within the inventory area (rarer and more irreplaceable land cover types have higher ratios).
- The biological value of the land cover type (e.g., overall biological diversity, function as habitat for covered species, ecosystem function).
- Standard mitigation ratios used by state and federal regulatory agencies (these ratios were used as starting points rather than guides for this Plan).

Avoidance and minimization of impacts on aquatic land cover types (see Conservation Measure 2.12) at proposed project sites may reduce the amount of preservation area required if preserved aquatic land cover types meet minimum distance requirements from dense urban development (see *Buffer Zones* below). Once preservation sites with the appropriate aquatic land cover type are no longer available in the inventory area, impacts on that land cover type will no longer be covered under this HCP/NCCP unless an alternative mitigation strategy can be developed. Based on a detailed regional wetlands inventory (see Appendix J), each aquatic land cover type occurs in sufficient quantity in the Acquisition Analysis Zones to meet expected preservation needs except for seasonal wetlands. If key sites are not available from willing sellers, alternative mitigation approaches will be evaluated by the Implementing Entity on a case-by-case basis. For example, in lieu of preservation, mitigation options could include restoring aquatic land cover types at a greater ratio than that required by the HCP/NCCP. For seasonal wetlands, allowable impacts will be capped at one-third of the amount of seasonal wetlands preserved by the Implementing Entity (to meet the 3:1 preservation ratio requirement), after a 2-year start-up period.

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<sup>7</sup> A habitat or land cover type is irreplaceable if it cannot be restored or created elsewhere due to unique soil requirements (which cannot be re-created), topography, or other conditions.

The HCP/NCCP land cover inventory identified 448 acres of riparian woodland/scrub in the inventory area, with 82 acres (18%) in existing public lands. According to the land cover mapping, 205 acres of riparian woodland/scrub is available for acquisition within the Zones. The remaining 243 acres occurs along streams in existing and proposed future urban areas. Credit for land acquisition of riparian woodland/scrub will be given within the Zones or within the ULL along Marsh Creek. An exception is provided for lower Marsh Creek because of its particular value for a number of covered and native species; this exception is part of the conservation strategy described below. For example, lower Marsh Creek provides some of the best opportunities for restoration of riparian woodland/scrub in the inventory area (Natural Heritage Institute 2002; Natural Heritage Institute and Delta Science Center 2002). Expanding existing stands of riparian woodland/scrub along lower Marsh Creek will benefit Swainson's hawk by increasing available nesting sites within 1 mile of suitable foraging habitat (i.e., cropland and pasture) (Estep pers. comm.). Expanding riparian woodland habitat along lower Marsh Creek would also enhance native fisheries (see Appendix C).

Preservation of streams will be accomplished according to whether a stream is perennial, intermittent, or ephemeral; these terms are defined in USACE regulations and in the Glossary (Appendix I). Impacts on perennial or intermittent streams are expected from routine road maintenance, bridge replacement, or new road crossings. These impacts will be mitigated at a preservation ratio of 2:1 for perennial streams and 1:1 for intermittent streams to ensure that these high-value streams are extensively preserved by the Plan.

Impacts on ephemeral creeks are expected to occur primarily within the Willow Creek watershed (Appendix J) where urban expansion of Pittsburg will extend into the upper watershed areas. Because it is not practicable for development to avoid the many ephemeral creeks in this area, they are likely to be filled. Impacts on ephemeral streams will be mitigated at a preservation ratio of 1:1 because ephemeral creeks provide lower biological and hydrologic value (although they are seasonally important hydrologically) than perennial or intermittent streams. Typically, ephemeral creeks do not provide unique habitat for any covered species.

Mitigation for impacts on streams will primarily include in-kind compensatory habitat restoration (e.g., creating meanders in existing channelized streams, removing concrete lining) but also may include out-of-kind restoration of wetland and pond habitats. Restoration compensation for impacts on perennial streams may be accomplished through enhancement of riparian woodland/scrub. Restoration compensation for impacts on intermittent streams may be accomplished through enhancement of perennial or intermittent streams. Restoration compensation for impacts on ephemeral creeks can be accomplished through wetland restoration. In addition to compensatory restoration, the Implementing Entity will conduct stream, wetland, and pond restoration to help recover tricolored blackbird, California red-legged frog, California tiger salamander, western pond turtle, and foothill yellow-legged frog in the Plan area. See Conservation Measures 2.2 and 2.3 for more details.

Note that project proponents that receive take authorization under this HCP/NCCP and that wish to fill jurisdictional wetlands and waters must obtain separate permits and certification from USACE and RWQCB, respectively, to comply with CWA Sections 404 and 401, and may also need permits from RWQCB under the Porter-Cologne Water Quality Control Act and from the CDFG under California Fish and Game code Sections 1600 et seq.

### **Buffer Zones**

When the Implementing Entity acquires land adjacent to existing dense urban development that has no buffer zone, or an inadequate buffer zone, one must be created on the preserve to reduce fuel loads and minimize fire hazards to adjacent development from preserve management activities. To account for this loss of habitat function, any area adjacent to development disked for fuel management (e.g., 50–100 foot width) will not be credited towards land acquisition requirements. The remainder of any buffer zone may be credited towards terrestrial land cover or species habitat preservation requirements because they will provide habitat for some species and serve an important function. However, aquatic land cover types and aquatic covered species breeding habitat without sufficient buffer zones will not be credited toward meeting preservation requirements because their proximity to intensive urban development can greatly reduce their habitat value for covered species. See Table 5-6 for minimum setback distances required for aquatic land cover types to be counted towards Plan goals for land acquisition and habitat restoration.

### **Land Acquisition under Different Urban Development Areas**

As described in Chapter 2, the pace and final extent of urban development in East Contra Costa County during the permit term is somewhat uncertain. To account for some of this uncertainty, two permit areas were developed for this Plan (see Chapter 4). One permit area assumes that urban development would be consistent with the current County ULL and city limits (this permit area includes the initial urban development area; Table 4-2). A second permit area anticipates limited additional development consistent with future land use plans approved by local government (the permit area includes the maximum urban development area; Table 4-3).

An important source of funding for this Plan will be fees imposed on urban development and projects involving urban infrastructure outside the UDA. The amount of urban development that will be permitted under the Plan must not be overestimated or there will be a substantial funding shortfall. The HCPA is committed to creating a Preserve System that is fully functional, meets all regulatory requirements, and meets the biological goals and objectives of this Plan. To achieve this goal, some components of this preserve acquisition measure are designed to be “scalable” beyond a certain point; that is, these components will be adjusted according to the amount of urban development that is actually permitted under the HCP/NCCP.

Land acquisition requirements within Zones 1, 2, and 3 that are described in this measure will be met regardless of how much urban development is permitted under the Plan (i.e., regardless of which urban development area is used).

Habitat within Zones 1–3 is critical to the success of the conservation strategy and is also under the greatest threat of loss or degradation. Habitat in Zones 4 and 5 is important for many covered species but is not as threatened by development in the foreseeable future as in Zones 1–3. Land acquisition requirements in Zones 4, 5, and 6 will be scaled according to the extent of urban development permitted under the Plan to ensure that the funding obligations of the Plan can be met.

This conservation measure sets minimum land acquisition requirements that must be met in all Zones. Once the total amount of urban development permitted under the Plan exceeds that assumed in the initial urban development area (Table 4-2), the amount of land that must be acquired within Zones 4, 5, and 6 will increase in proportion to the impacts above this threshold. Above the initial UDA threshold, (i.e., within the maximum UDA), land cover acquisition requirements will increase in proportion to the land cover impact. For example, if the amount of development within the UDA exceeding the initial urban development area is 50% of the projected maximum impact on grassland, then the land cover acquisition requirement for grassland will be 50% of the total grassland requirement for the maximum urban development area.

Requirements are established such that the amount of land acquired is always greater than strict mitigation requirements. In other words, the Plan will always contribute to the recovery of covered species; but within Zones 4, 5, and 6, land acquisition will more closely track the funding limitations imposed by the pace of urban development. Requirements for habitat restoration and creation are already tied, in part, to actual impacts through the use of mitigation ratios. Requirements to meet all other conservation measures in this Plan will not change regardless of the amount of urban development permitted under the HCP/NCCP.

### **Land Acquisition Requirements by Acquisition Zone**

A key element of the Preserve System is acquiring land in large blocks. Large preserves provide greater viability as management units, maximize preserve capacity to support viable populations of covered species, maintain existing ecological functions, and preserve existing biodiversity. To achieve these beneficial outcomes, it is important to establish large, linked blocks of vegetation communities as well as a mosaic of these communities, where appropriate, within the Preserve System. Land cover types will be used as a primary unit for defining and assessing compliance with acquisition requirements. The total acquisition requirements for each terrestrial land cover type under the initial urban development area and maximum urban development area are listed in Tables 5-7 and 5-8, respectively. The land cover acquisition requirement can be met in any Zone allowed in Table 5-4. However, additional site-specific land cover acquisition requirements also apply to some Zones, so overall land cover requirements are not completely interchangeable among the eligible Zones defined in Table 5-4.

To ensure that acquisition occurs in locations that will maximize the benefits to vegetation communities and covered species, acquisition requirements are also

defined by Zone and, in some cases, by Subzone. The priorities for land acquisition within the Zones under the initial urban development area are shown in Figure 5-2. Land acquisition priorities under the maximum urban development area are shown in Figure 5-3. As described above, the differences between the two urban development areas are in Zones 4, 5, and 6. There are no differences between the two urban development areas in Zones 1, 2, and 3. Specific land acquisition requirements for each Zone and Subzone are discussed below.

In addition to numeric land acquisition requirements by land cover and Zone, qualitative land acquisition requirements are also provided for some Zones. For instance, connection to existing public lands or preservation of a certain number of ponds or covered plant populations could be required.

The primary rationale for each land acquisition requirement is described with each requirement (rather than at the end of the section as in other conservation measures). The specific benefits of this measure to each covered species are summarized in the section on species-specific conservation measures.

### **Actual Extent of Land Acquisition**

The acreage requirements in Tables 5-7 and 5-8 are the minimum required under the HCP/NCCP to satisfy overall land cover requirements. Additional minimum land acquisition requirements apply to some Zones and Subzones. Actual acquisition of some land cover types will likely be greater than the combined minimum requirements because parcel boundaries typically do not follow ecological boundaries, and the boundaries of acquired parcels will include land cover types that are not specified by acquisition requirements. In addition, qualitative requirements for habitat connectivity or for preservation of plant populations could also require additional acreage.

For example, to meet the requirements for grassland in Subzone 1c, parcels that also contain oak woodland will likely be acquired. Acquisition of oak woodland in Subzone 1c will contribute to the overall requirement for oak woodland. Because oak woodland is widely distributed in the inventory area, it is expected that oak woodland will be acquired far in excess of the land acquisition requirement shown in Tables 5-7 and 5-8.

To estimate the actual extent of the Preserve System, the amount of land that would need to be acquired in order to meet all the requirements of this conservation measure was estimated. Table 5-9 summarizes the minimum and maximum Preserve System size. The minimum size assumes that simply achieving all numeric requirements will also meet all other land acquisition requirements (e.g., covered species habitat, habitat linkages, covered plant populations, rare landscape features). This is highly unlikely because parcel boundaries will not correspond to ecological boundaries. The estimated maximum Preserve System size assumes that meeting all numeric and qualitative requirements will demand significant additional acreage. The actual size of the Preserve System is likely to fall somewhere between the minimum and maximum values.

### **Acquisition Requirements for Zone 1**

The Implementing Entity will acquire at least 1,450 acres of annual grassland in Subzones 1b and 1c to create an important connection from Black Diamond Mines Regional Preserve to Detachment Concord. An important goal of conservation in this area will be to provide a large block of contiguous annual grassland or oak savanna to support western pond turtle, California tiger salamander, California red-legged frog, and other covered species. This preserve will also enhance movement between the existing protected areas. Detachment Concord supports western burrowing owl, western pond turtle, California tiger salamander, and California red-legged frog, (Tetra Tech 2002). Two ponds in the upper ridge of the inland unit of Detachment Concord are known to support California tiger salamander (Tetra Tech 2002) and may link salamanders traveling over the ridge from within the inventory area (Orloff pers. comm.).

The Implementing Entity will acquire approximately 85 acres of annual grassland in Subzone 1a consistent with the MOU between Discovery Builders (Seeno Homes) and the HCPA regarding this site (see Section 9.7 of the Implementing Agreement for more details). This site will provide an important linkage for California tiger salamander between Detachment Concord and permanently protected open space in Pittsburg. A substantial population of California tiger salamander occurs in this area whose source is likely ponds in Detachment Concord (Gan pers. comm.). Wetland enhancement and restoration on permanently protected open space in Pittsburg will likely enhance the population of California tiger salamander in this area. Land in Subzone 1a will also provide foraging habitat for golden eagle and a buffer zone between development and known golden eagle nests on the west side of the ridge line in Detachment Concord (Hale pers. comm.).

The Implementing Entity will acquire at least 25% of Subzone 1d. Acquisition in this Subzone will be focused in the southern half of the Subzone in order to secure annual grasslands that will provide better linkage between Black Diamond Mines Regional Preserve and Detachment Concord. Lands acquired in this Subzone will provide habitat for grassland-dependent covered species such as western burrowing owl.

There is no land acquisition requirement for Subzone 1e because of the expected development and the existing public land within it (see Figure 2-3). However, if land is acquired in this Subzone to meet other requirements (e.g., overall annual grassland requirement), it must be contiguous with lands acquired in Subzones 1a, 1b, or 1c, or with Detachment Concord.

### **Acquisition Requirements for Zone 2**

The Implementing Entity will acquire at least 60% of Subzone 2a. Acquisitions in Subzone 2a will focus on the northwestern and southeastern corners of this Subzone to increase the size of habitat connections between Black Diamond Mines Regional Preserve, Detachment Concord, and Clayton Ranch (EBRPD). Acquisition of land in the northwestern and southeastern corners of Subzone 2a will protect the headwaters of two tributaries of Mount Diablo Creek. The Implementing Entity will also acquire land in Subzone 2b or 2c or both to

connect Black Diamond Mines Regional Preserve and Clayton Ranch. The connection must be at least 0.5 mile wide to provide an adequate movement route that minimizes edge for Alameda whipsnake, California tiger salamander, California red-legged frog, and other covered species<sup>8</sup>. The additional requirements below apply to Zone 2.

- The Implementing Entity will acquire at least seven of the 13 ponds in Subzone 2c to provide breeding habitat for tricolored blackbird, California tiger salamander, western pond turtle, or California red-legged frog. This Subzone is the only one with a specific requirement to protected ponds because it has an unusually high density of unprotected ponds compared with the rest of the inventory area. Protection of most of these ponds will protect an important core population of California red-legged frog, California tiger salamander, and western pond turtle in the center of the Preserve System. For example, research on the movement patterns of California tiger salamanders shows that there is a clear relationship between the linear distance between breeding sites and the amount of genetic exchange between those sites (Trenham et al. 2001; Shaffer and Trenham in press). The Science Advisors Report prepared for the Merced County HCP/NCCP recommends a rule of thumb to retain sets of at least 4–6 breeding sites within about 1 km of each other to maintain maximum connectivity for this species. Preservation of at least seven ponds in Subzone 2c will exceed this recommended density of breeding sites for tiger salamander.
- The Implementing Entity will acquire 90% of the remaining chaparral in Subzones 2a, 2b, and 2c (i.e., 90% of 135 acres) to protect patches of chaparral that serve as modeled core habitat for Alameda whipsnake and provide important assumed linkages for whipsnake populations between Mount Diablo State Park and Black Diamond Mines Regional Preserve. Preservation of these patches will also protect suitable habitat for Mount Diablo manzanita. USFWS has identified the area between Mount Diablo State Park and Black Diamond Mines Regional Preserve as critical for Alameda whipsnake recovery because it will provide connectivity between these core areas of whipsnake habitat (U.S. Fish and Wildlife Service 2002b).
- The Implementing Entity will acquire land in Subzone 2a to protect the known population of Mount Diablo manzanita.
- Land acquired in Subzone 2f for the San Joaquin kit fox movement route must also include the two known occurrences of big tarplant and the known occurrence of round-leaved filaree in Deer Valley. Where possible, land acquired to meet kit fox and big tarplant requirements should also include sites known to support alkali soils in Deer Valley (Olson pers. comm.).
- Land acquired in Subzones 2h must include the two known occurrences of big tarplant.

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<sup>8</sup> There is no accepted width of habitat for these species to provide adequate movement; viable movement routes vary according to landscape conditions (e.g., topography, vegetation) and length of the route. One-half mile was chosen for this area as an achievable minimum goal (given parcel sizes and configurations) to provide suitable breeding habitat for the target species within the habitat linkage.

- Land acquired in Subzone 2h must include the known occurrences of Mount Diablo manzanita and Brewer's dwarf flax (Mundie & Associates and City of Antioch 2002).
- Land acquired in Subzone 2d must include the known occurrence of round-leaved filaree.
- If preacquisition field surveys show modeled suitable habitat for silvery legless lizard in Subzone 2h to be suitable for this species, the Implementing Entity will give these sites a high acquisition priority.
- The Implementing Entity will acquire land that supports suitable habitat for vernal pool invertebrates wherever possible.

Additional land acquisition in Zone 2 is required to protect San Joaquin kit fox movement routes. See discussion of these requirements in *Land Acquisition Requirements in Zones 2 and 4 to Protect Kit Fox Movement Routes* below.

### **Acquisition Requirements for Zone 3**

The Implementing Entity will acquire at least 90% of the modeled suitable core habitat for Alameda whipsnake in Subzone 3a (i.e., 90% of 177 acres) to protect the largest block of chaparral/scrub in the inventory area outside existing public lands. The requirement to protect 90% was the maximum feasible target for this Subzone based on parcel size and configuration to help meet the biological goal to contribute substantially to the recovery of Alameda whipsnake in the inventory area. The Implementing Entity will also acquire land in Subzone 3a to increase the width of the linkage between the large chaparral patch in the Subzone and other chaparral patches in Mount Diablo State Park. All land acquired in this Subzone must contribute to this linkage and must be connected to Clayton Ranch through existing protected lands or HCP/NCCP preserves. Protection of 90% of core habitat and the protection of perimeter and movement habitat around it will provide a key linkage between existing protected Alameda whipsnake habitat in Mount Diablo State Park and Black Diamond Mines Regional Preserve and will contribute to the recovery of Alameda whipsnake. Acquisition of land within Subzone 3a will also protect headwater tributaries of Irish Canyon Creek.

There are no acquisition requirements in Subzones 3b and 3c, but land acquired within these Subzones can count towards land cover acquisition requirements.

### **Acquisition Requirements for Zone 4**

As described above in *Land Acquisition under Different Urban Development Areas*, land acquisition requirements in Zones 4, 5, and 6 differ according to the amount of urban development that is covered under the HCP/NCCP. Minimum land acquisition requirements under the initial urban development area were designed to meet all biological goals and objectives and regulatory requirements in the event that build-out in the inventory area does not exceed the initial UDA.

**Acquisition under Initial Urban Development Area.** Land acquisition in Zone 4 will be focused in two primary areas: along Marsh Creek in the Briones Valley (Subzone 4d) and upstream (Subzone 4c), and the Upper Marsh Creek Subbasin (Subzones 4a, 4c, 4e, 4f, 4g, and 4h). Acquisition in Subzone 4d will also meet

biological objectives to protect movement routes for San Joaquin kit fox; protect modeled and known breeding habitat for western burrowing owl, California tiger salamander, and California red-legged frog; and protect potential foraging habitat for golden eagle. Subzones 4c and 4d contain 103 acres of riparian woodland/scrub, or 50% of this land cover type available for conservation (i.e., mapped in the Acquisition Analysis Zones). Acquisition in Subzones 4c and 4d along Marsh Creek will preserve important breeding habitat for migratory birds and a variety of covered species. Land acquisition in the Upper Marsh Creek Subbasin will be focused in Subzones 4a and 4h to help to achieve goals for preservation of core and movement habitat for Alameda whipsnake. Preservation in these areas will also create important linkages between existing open space and expand protection of the headwaters of Marsh Creek. Additional preservation will occur within the Upper Marsh Creek Subbasin within Subzones 4c, 4e, 4f, and 4g to provide watershed protection and preserve the topographic and biological diversity in this area.

USFWS has identified the area through Morgan Territory Regional Preserve as critical for Alameda whipsnake recovery because it provides connectivity between the Los Vaqueros Watershed lands and Mount Diablo State Park, both core areas of whipsnake habitat (U.S. Fish and Wildlife Service 2002b). The current link (i.e., through existing public lands) is as narrow as 0.5 mile and is subject to a high level of edge effects along its southwestern border because of urban development in the hills above Danville (e.g., Blackhawk area). Connectivity for Alameda whipsnake and other species could be improved by expanding public lands north of Morgan Territory Regional Preserve to encompass more patches of chaparral/scrub and grassland and extensive stands of oak woodland. Acquisition in Subzones 4a and 4h will preserve the majority of the headwaters of Marsh Creek and its upper tributaries. Land acquisition in Zone 4 will be conducted in all Subzones except Subzone 4b to ensure that a diversity of species, elevation zones (i.e., an elevational gradient), vegetation associations (e.g., mixed evergreen forest contrasted with oak woodland), and habitat types are included in the Preserve System. There are no land acquisition requirements for land cover types in Subzone 4b because of the high density of rural ranchette development along Morgan Territory Road and the abundance of small parcels that are not cost-effective for the Implementing Entity to acquire (however, see the requirement on the next page for a population of Mount Diablo fairy lantern).

Land acquisition in Zone 4 will be focused along Marsh Creek wherever possible, especially where modeled suitable breeding habitat for foothill yellow-legged frog occurs. Acquisition of portions of Marsh Creek will protect modeled breeding and dispersal habitat for California tiger salamander, California red-legged frog, and foothill yellow-legged frog; modeled movement habitat for Alameda whipsnake; and cottonwood and other riparian forest types that are very

rare and underprotected in the San Francisco Bay Area (Wild 2002). Streambed and an appropriate buffer zone will be acquired<sup>9</sup>.

The Implementing Entity will acquire land in Zone 4 according to the minimum acreage requirements listed in Table 5-10. These acreage requirements apply only to natural land cover types (i.e., orchard or urban land cover types will not count toward these requirements). Land acquisition requirements within Subzones 4c, 4e, 4f, and 4g are interchangeable except where noted below because of the similar land cover types, topography, and habitat values within these Subzones. Other specific requirements for land acquisition within Zone 4 are listed below.

- The Implementing Entity will acquire at least 270 acres of chaparral/scrub (of 435 acres present) within Zone 4 to protect suitable core habitat for Alameda whipsnake and to meet the overall HCP/NCCP requirements for acquisition of this land cover type under the initial urban development area.
- Acquisition in Subzone 4h must link the Morgan Territory Ranch (Seeno conservation easement) with Morgan Territory Regional Preserve and Mount Diablo State Park.
- Acquisition in Subzones 4a and 4h must include at least 90% of the modeled suitable core habitat for Alameda whipsnake (i.e., 90% of 222 acres).
- Land acquisition in Subzone 4c under the initial urban development area must focus first on protecting riparian woodland/scrub along Marsh Creek or areas of the creek suitable for riparian woodland/scrub restoration.
- Acquisition must protect the known occurrence of Brewer's dwarf flax in Subzone 4f to meet biological objectives for this species (Tables 5-1 and 5-20).
- Acquisition must protect the known occurrence of Diablo helianthella and Brewer's dwarf flax in Subzone 4a to meet biological objectives for this species (Tables 5-1 and 5-20).
- Acquisition must protect the known occurrence of Mount Diablo fairy lantern in Subzone 4b, if it is still extant, to meet biological objectives for this species (Tables 5-1 and 5-20).

If land acquisition occurs in Subzone 4a at the border of the inventory area, any natural land cover types incidentally acquired outside the inventory area (i.e., as a function of parcel boundaries occurring outside the inventory area) can be counted toward the acreage requirements for this Zone and Subzone and toward overall land cover requirements.

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<sup>9</sup> Quantitative targets for streambed acquisition are not provided because the amount of stream acquisition required will depend on actual stream impacts, and parcel boundaries in this area are not mapped precisely enough to determine which parcels contain streambeds. See Table 6-2 for stream setback requirements of covered activities and Table 6-3 for guidance on stream buffers to best preserve stream functions.

Additional land acquisition in Zone 4 is required to protect San Joaquin kit fox movement routes. See discussion of these requirements in *Land Acquisition Requirements in Zones 2 and 4 to Protect Kit Fox Movement Routes* below.

**Acquisition under Maximum Urban Development Area.** The only difference between acquisition in Zone 4 under the initial and maximum urban development areas is that additional land will be acquired in either Subzone 4c, 4e, 4f, or 4g under the maximum urban development area (Table 5-10). Additional land acquisition requirements in these Subzones will increase protection and restoration opportunities for riparian woodland/scrub along Marsh Creek, increase protection of suitable habitat for covered amphibians, increase watershed protection, and increase habitat linkages across habitat and elevational gradients in this large area.

Land acquisition requirements in Subzone 4c, 4e, 4f, or 4g will be scaled according to the level of impact above the initial urban development area limits. See *Land Acquisition under Different Urban Development Areas* above for a discussion of how to calculate the new acquisition requirements under the maximum urban development area.

### **Acquisition Requirements for Zone 5**

**Acquisition under Initial Urban Development Area.** Under the initial urban development area, the Implementing Entity will preserve at least 5,300 acres of annual grassland and 750 acres of alkali grassland in Zone 5 in Subzones 5a, 5c, and 5d (Table 5-11 and Figure 5-2). Under this scenario, land acquisition in Zone 5 will bring total protection of alkali grassland and alkali wetlands in the inventory area to at least 65%, based on current mapping of this land cover type<sup>10</sup> (the majority of these land cover types that are unprotected occur in Zone 5) (Table 5-7). Land acquisition will be focused mostly in Subzone 5a to maximize the acquisition of the largest blocks of alkali grassland and alkali wetland and to meet conservation goals for San Joaquin kit fox, covered invertebrates, and covered amphibians. Habitat in Subzone 5a is among the most important in the inventory area<sup>11</sup> because it supports the habitat features listed below.

- Extensive suitable breeding and movement habitat for San Joaquin kit fox in relatively flat terrain; undeveloped flat terrain is now uncommon in the inventory area.
- The most extensive stands of unprotected alkali grassland and alkali wetland in the inventory area.
- Extensive suitable habitat for alkali-dependent covered plants.
- A crucial habitat linkage between Alameda and Contra Costa Counties through the large Byron Airport conservation easements (Habitat Management Lands).

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<sup>10</sup> The proportion of protection may change as field surveys are conducted and actual extent of alkali grassland and alkali wetland are refined.

<sup>11</sup> Based on a landscape-level analysis, feedback from regulatory agency staff, and recommendations from the Science Advisors.

- The watershed supporting a large vernal pool and alkali wetland complex adjacent to the Bryon Airport.
- Habitat that is largely free of wind turbines that injure and kill some covered birds (see discussion below).

A secondary priority in Zone 5 under the initial urban development area is acquisition in Subzone 5d to improve linkages between Vasco Caves Regional Preserve and surrounding open space and to protect movement and breeding habitat for San Joaquin kit fox. Another secondary priority in Zone 5 is to preserve at least 1,000 acres of annual grassland in Subzone 5c to provide the dual benefits of foraging habitat for Swainson's hawk and additional breeding and movement habitat for San Joaquin kit fox.

Acquisition in Zone 5 will preserve a substantial amount of suitable habitat for recurved larkspur, San Joaquin spearscale, and brittlescale (Table 5-12). The HCP/NCCP preserve lands in this Zone will protect a substantial amount of suitable core habitat for San Joaquin kit fox (both annual and alkali grassland; see Table 5-13) and improve connectivity between known breeding habitat.

Land acquired in Subzones 5a and 5d must be connected to existing public lands or open space when the Preserve System is completed (i.e., early acquisitions may not be connected to existing public lands or open space, but they must be before the Preserve System is complete). Land acquired within these Subzones will also provide a connection between the Byron Airport conservation easements, the Los Vaqueros Watershed, and the Contra Costa–Alameda County line.

In addition to the landscape and species habitat requirements above, the Implementing Entity must achieve the following objectives.

- Protect two of the four known occurrences of brittlescale in Subzones 5a and 5d that occur outside existing protected lands to meet biological objectives for this species (Tables 5-1 and 5-20).
- Protect at least two occurrences of recurved larkspur in Subzone 5a or Subzone 6d to meet biological objectives for this species (Tables 5-1 and 5-20).
- Acquire sites with suitable habitat for vernal pool invertebrates and protect habitat within the Altamont Hills core area recovery region for vernal pool species (U.S. Fish and Wildlife Service 2004c).

Land in Zone 5 provides important breeding and foraging habitat for many raptors, including golden eagle and western burrowing owl. Land in lower elevations of Zone 5 may also provide important foraging areas for Swainson's hawk, especially with enhancement of rodent populations. However, the abundant wind turbines in the Zone (mostly in Subzones 5d and 5b) are serious hazards to many species, especially red-tailed hawk, American kestrel, western burrowing owl, and golden eagle (Orloff and Flannery 1992, 1996; Thelander and Rugge 2000; National Wind Coordinating Committee 2001; Thelander et al.

2003). Wind turbines are abundant and somewhat evenly distributed within Zone 5, so they will inevitably occur in some lands acquired under the HCP/NCCP preserves. However, land mapped as wind turbines<sup>12</sup> cannot be credited toward any land acquisition requirement.

Land acquisition in wind turbine areas can contribute to the goals and objectives of this HCP/NCCP. However, the Implementing Entity is encouraged to consider retiring wind turbine leases on land it acquires when these leases come up for renewal, or require turbine reconfiguring (e.g., replace many old turbines with fewer turbines of new design in locations better for wildlife). Either action could significantly reduce wind turbine impacts on covered species and other native wildlife. Decisions to retire wind turbine leases will be made in consultation with CDFG and USFWS. (Note that take of covered species by wind turbines or take of migratory birds by wind turbines under the Migratory Bird Treaty Act is not covered by this Plan.)

Land acquisition in areas with existing San Joaquin kit fox habitat conservation easements in Zone 5 (e.g., surrounding the California Aqueduct) will not count toward the land acquisition requirements.

**Preserve System around Byron Airport.** Rather than pay applicable fees, the County may choose to mitigate impacts from future development at the Byron Airport by implementing an avoidance and preservation program in and around the airport property. The land on airport property to be impacted, avoided, and preserved in perpetuity under this optional program are shown in Figure 5-4. The lands that would be newly preserved contain valuable alkali grassland, alkali wetland, and grassland landcover types adjacent to the mitigation bank and the airport's existing Habitat Management Lands were established when the airport was built. The lands that would be preserved are in a biologically significant area and their conservation would benefit numerous covered species known or suspected to occur there including San Joaquin kit fox, western burrowing owl, California red-legged frog, California tiger salamander, vernal pool fairy shrimp, San Joaquin spearscale, and brittlescale. In addition to the 113 acres to be conserved on the airport property (Figure 5-4), the County would be required to preserve 170 acres in Subzone 5a or 5d to contribute to the Preserve System and manage these lands according to the terms of the HCP/NCCP.

The following additional conditions apply should the County choose the avoidance and preservation program option:

- The County must dedicate a conservation easement on the areas proposed for permanent preservation in Figure 5-4 on an incremental basis before impacting the last 22 of the 88 acres that remain covered by the 1992 and 1993 permits (see Chapter 2 for more information on prior permits). For every acre of impact above this threshold, 2.4 acres will be preserved up to a

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<sup>12</sup> The wind turbine land cover type was mapped as strips of wind turbines and 50 feet on either side; see Chapter 3 for further details. This may be a good estimate of the actual footprint of turbines and associated facilities. Grassland between sets of turbines was mapped as grassland and includes most of the access roads between sets of turbines.

maximum preservation requirement of 283 acres with full buildout of the airport. The first 113 acres of preservation must occur on properties owned by the airport and shown in Figure 5-4 unless an exception is granted by the Implementing Entity, CDFG, and USFWS. Lands to be acquired must be consistent with all aspects of the *Land Dedication In Lieu of Development Fee* section in Chapter 8 and must be in Subzone 5a or 5d.

- The existing and new conservation lands on the airport property must be managed in perpetuity by the County in a manner consistent with this Plan.
- The areas immediately adjacent to runways or taxiways can neither be developed nor credited for conservation (Figure 5-4). Vegetation management on these areas must not affect adjacent new or existing airport conservation lands.
- Recreational parachute landings will be restricted to the current landing site west of the north access road (Figure 5-4) to avoid impacts to sensitive habitats and covered species in conserved areas<sup>13</sup>. Landings will be monitored by airport staff to ensure they are restricted to this area. If landings cannot be constrained, the Implementing Entity and the airport must consult with CDFG and USFWS to develop additional mitigation measures to minimize or offset these impacts.
- Utility lines may be installed in the newly conserved lands subject to the provisions of Chapter 6, including but not limited to the provisions for mitigating utility construction in preserves.
- The airport may subsequently elect to avoid and permanently preserve 14 acres of the area proposed for impact on the north edge of the east-west runway, including a road alignment to connect this area to the existing airport access road, parking lots, and hangars. Should the airport elect to avoid and permanently preserve the entirety of this 14 acre area, the requirements for off-airport conservation may be reduced by 42 acres.
- The Byron Airport may also propose a mitigation package that combines fees and land acquisition or dedication. A mitigation package different from those in this Plan will be negotiated with the Implementing Entity and approved by CDFG and USFWS.

**Acquisition under Maximum Urban Development Area.** If urban development permitted under the HCP/NCCP exceeds that predicted by the initial urban development area, the acquisition requirements within Zone 5 will increase in proportion to the amount of urban development permitted under the Plan up to the limits in Table 5-11. Above the initial UDA threshold, (i.e., within the maximum UDA), land cover acquisition requirements will increase in proportion to the land cover impact (see *Land Acquisition under Different Urban Development Areas* above for a discussion of how to calculate the new acquisition requirements under the maximum urban development area).

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<sup>13</sup> Continuation of this use reduced the credit that could be offered under the avoidance and preservation program for the newly conserved lands.

If urban development reaches the maximum limit assumed under the Plan, the Implementing Entity will have acquired at least 8,100 acres (79%) of the annual grassland in Subzones 5a, 5b, 5c, and 5d; at least 900 acres (80%) of the alkali grassland; and 40 acres (90%) of the alkali wetlands to expand the core preserve (Table 5-11). This core preserve must create a continuous habitat connection at least 1 mile wide linking the conservation areas surrounding the Byron Airport with the Los Vaqueros Watershed lands. The preserve must also create a link of conservation land at least 1 mile wide between Vasco Caves Regional Preserve and the Contra Costa–Alameda County line. This connection would almost link the Brushy Peak Regional Preserve in Alameda County with Vasco Caves. All land preserved in Subzones 5a and 5b must be connected to other preserve lands within Zone 5 or to existing public lands such as the Los Vaqueros Watershed, Vasco Caves Regional Preserve, or the Byron Airport conservation easements. If parcels acquired in Subzones 5a and 5b extend into Alameda County, land cover and habitat types that occur in Alameda County can be counted toward the requirements in this Zone and the overall land cover requirements. Parcels wholly within Alameda County do not count toward any acquisition requirements of this Plan.

If fully acquired under the maximum urban development area, the core preserve in Zone 5 will protect more of the crucial linkage for San Joaquin kit fox between its range in Contra Costa County and its range in Alameda County. This expanded core preserve will also protect the majority of potentially suitable habitat for covered plants that are restricted to alkali soils: brittlescale, San Joaquin spearscale, and recurved larkspur. Acquisition in Zone 5 will also protect extensive habitat for tricolored blackbird (breeding and foraging), golden eagle (foraging), western burrowing owl (breeding and foraging), and some habitat for Swainson’s hawk (foraging).

In addition to the landscape- and species-level habitat requirements above, and regardless of the amount of urban development beyond the initial urban development area, the Implementing Entity must also achieve the following objectives in addition to those listed for the initial urban development area:

- Protect all of the four known occurrences of brittlescale in Subzones 5a or 5d that occur outside existing protected lands.
- Acquire the seasonal and alkali wetlands along the Contra Costa–Alameda County line south of the California Aqueduct to link with CDFG lands in Alameda County.
- Give priority to acquiring those sites with suitable habitat for vernal pool invertebrates in areas designated as recovery units (U.S. Fish and Wildlife Service 2004c), including rock outcrops and basins that provide suitable habitat for longhorn fairy shrimp.
- Where feasible to meet other requirements, acquire land in Subzone 5c modeled as suitable for silvery legless lizard. Most, if not all, of this habitat

may be on private quarry land unsuitable for inclusion in the HCP/NCCP Preserve System<sup>14</sup>.

The exclusions and guidelines described for the initial urban development area regarding wind turbines also apply to land acquisition in Zone 5 under the maximum urban development area.

### **Acquisition Requirements for Zone 6**

In Zone 6, the Implementing Entity will focus on the following priorities:

- Acquiring fee title or conservation easements on cropland or pasture along Marsh Creek or Kellogg Creek that provide outstanding opportunities for riparian restoration along the creeks to enhance suitable habitat for covered wildlife species such as Swainson's hawk and to protect foraging habitat for Swainson's hawk.
- Acquiring fee title or conservation easements on most of the alkali grassland and alkali wetland land cover types in Zone 6.
- Land acquisition and wetland and upland restoration in Subzone 6a to support and augment the Dutch Slough restoration project.

**Acquisition under Initial Urban Development Area.** Land acquisition requirements in Zone 6 are shown in Table 5-11. The Implementing Entity will acquire 250 acres of cropland or pasture in any of the following areas to help achieve biological goals and objectives for several covered species (areas are not listed in order of priority).

- **Adjacent to Dutch Slough (Subzone 6a).** Dutch Slough is a 1,166-acre site in northeastern Oakley that was recently acquired by the California Coastal Conservancy and the California Department of Water Resources with the goal of restoring the site to a self-sustaining mixture of shallow water, intertidal marsh, floodplain, riparian, and upland habitats for a variety of native and special-status species (California Coastal Conservancy 2002). The Dutch Slough restoration project is by far the largest restoration project underway in the inventory area. The project site is adjacent to two other large sites with future restoration potential: the Big Break Regional Shoreline and the Ironhouse Sanitary District parcels. Accordingly, the potential habitat value in this area is expected to grow as other sites in the immediate vicinity are restored. There are opportunities to support and augment the Dutch Slough project by acquiring cropland or pasture immediately east of the site that contains a similar mixture of significant restoration opportunities. The Implementing Entity will consider land acquisition in this area to meet land acquisition requirements in Zone 6.
- **Adjacent to Kellogg Creek (Subzones 6b, 6c, or 6f).** Land acquired by the Implementing Entity along Kellogg Creek could provide excellent riparian restoration opportunities as well as opportunities to enhance upland habitat adjacent to restored riparian woodland to support tricolored blackbird,

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<sup>14</sup> Note that quarries are not included as a covered activity in this HCP/NCCP (see Chapter 2).

Swainson's hawk, and western pond turtle. Riparian habitat restored in these Subzones could provide nesting sites for Swainson's hawk because these sites are in close proximity to extensive foraging habitat for this species.

- **Adjacent to Marsh Creek** (Subzones 6a and 6c and within the ULL). Assessments of various reaches of Marsh Creek have shown that there are excellent opportunities for riparian restoration on many parcels that now support cropland or pasture (Natural Heritage Institute 2002; Natural Heritage Institute and Delta Science Center 2002). The Implementing Entity will consider acquiring parcels adjacent to Marsh Creek as long as those parcels are within 1 mile of the Zone 6 boundary. This limitation ensures that riparian restoration on these sites will attempt to provide adequate foraging habitat for Swainson's hawks nearby. Swainson's hawks can nest in large stands of riparian woodland that are close to urban development as long as there is sufficient foraging habitat within at least 1 mile (Estep pers. comm.). Portions of acquired sites that are not used for riparian restoration will be enhanced as upland habitat and used as a buffer zone between riparian areas and development.

Acquisition of cultivated agriculture in Zone 6 is limited to 250 acres for several reasons. First, as of 2004, there has been little history in Zone 6 of successful purchase of conservation easements on irrigated agricultural land. Because landowners have had limited exposure to conservation easements, finding willing sellers is expected to be difficult. Second, in order to meeting biological goals and objectives, land acquired through conservation easements must be conditioned to prohibit conversion to vineyards or orchards. This limit on crop type will further reduce the pool of willing sellers in Zone 6. Lastly, the primary function for covered species of cropland and pasture in Zone 6 is as foraging habitat for Swainson's hawk. (Acquisition of cropland or pasture near Dutch Slough will also provide habitat and restoration opportunities for giant garter snake.) Approximately 6,000 acres of cropland and pasture is expected to be lost to covered activities during the permit term (Table 4-3). However, the vast majority of the remaining 18,782 acres of these land cover types is already protected by strong zoning in Contra Costa County. For example, the entire approximately 6,000 acres of cropland in Subzone 6b is within the Agricultural Core designation in the County General Plan, which strictly limits development. Assuming much of this habitat remains cropland or pasture, it will remain foraging habitat for Swainson's hawk (some will also remain upland habitat for giant garter snake) whether or not the Implementing Entity acquires it. Acquisition of cropland and pasture in Zone 6 is focused on creating opportunities for riparian restoration to expand cottonwood and other riparian forest types that are very rare and underprotected in the San Francisco Bay Area (Wild 2002).

If conservation easements are used, these easements will require that all enrolled agricultural lands be managed to support new foraging habitat or to improve existing foraging habitat for tricolored blackbird, golden eagle, western burrowing owl, or Swainson's hawk. Management that will be required under the easements will be compatible with an ongoing economically viable agricultural operation. Agricultural conservation easements will be in perpetuity.

In the event that cropland or pasture cannot be acquired in Zone 6 or within the ULL along Marsh Creek to meet land acquisition requirements (e.g., due to a lack of willing sellers), a contingency is provided:

- Preservation of cropland or pasture in Zone 6 can be substituted for preservation of grassland habitat that is suitable foraging habitat for Swainson's hawk (see species habitat model in Appendix D for suitable habitat in Subzones 5a and 5c) on an acre-for-acre basis.
- Preservation of cropland or pasture in Zone 6 can also be substituted for preservation of riparian woodland/scrub at a 5:1 ratio (i.e., 5 acres of cropland preservation can be substituted for 1 acre of riparian woodland/scrub preservation).
- Cropland or pasture preservation in Zone 6 can also be substituted for riparian restoration at a ratio of 10:1.
- Riparian woodland/scrub preservation or restoration can only count toward this substitution if it occurs within the range of Swainson's hawk within the inventory area as mapped by the species model or based on the best available information.

The Implementing Entity will also acquire at least 100 acres (21%) of the alkali grassland in Zone 6 to preserve potential habitat for alkaline plants and to protect alkali sink scrub, a rare vegetation association (Table 5-11). The Implementing Entity will also acquire at least 20 acres of alkali wetland, which occurs primarily in Subzones 6d and 6e. The Implementing Entity will protect at least two occurrences of recurved larkspur in Subzone 5a or 6d to meet biological objectives for this species (Tables 5-1 and 5-20).

**Acquisition under Maximum Urban Development Area.** Land acquisition requirements for Zone 6 under the maximum urban development area are the same as those under the initial urban development area except that land acquisition requirements for cropland/pasture are increased to 400 acres (Table 5-11). Land acquisition requirements for alkali grassland and alkali wetland in Zone 6 increase to 300 and 40 acres, respectively.

### **Preservation of Habitat Continuity for San Joaquin Kit Fox**

An important regional goal of this HCP/NCCP is to provide a viable connection for San Joaquin kit fox between the large block of public lands in and around the Los Vaqueros Watershed and Black Diamond Mines Regional Preserve. Because this habitat continuity spans several Zones (2, 4, and 5), a separate analysis was conducted to determine the needs of San Joaquin kit fox across the Zones. This analysis and the requirements to preserve habitat continuity across the inventory area for San Joaquin kit fox are presented below.

San Joaquin kit foxes occur in the Los Vaqueros Watershed and Black Diamond Mines Regional Preserve and are assumed to regularly move through and forage within the lands in between. This movement must continue in order to ensure a viable population in the area and to maintain kit foxes in the northern portion of the inventory area. There have been only two sightings of kit foxes between

these areas; consequently, their movement patterns between these public lands are largely unknown.

Four potential movement routes or habitat linkages<sup>15</sup> are predicted for San Joaquin kit fox between Black Diamond Mines Regional Preserve and the Los Vaqueros Watershed (and adjacent public lands) (Figure 5-5). This prediction of movement routes is based on the land cover mapping and habitat modeling conducted for this HCP/NCCP, verified sightings of kit foxes, topography, and field visits. All four routes are in Zones 2 and 4, and each is described below.

**1. Round Valley.** Annual grasslands that connect Round Valley to Black Diamond Mines Regional Preserve through Subzones 4e, 4c, 2c, and 2b (and possibly 2a) comprise the southernmost potential movement route for kit fox. This route is by far the longest in the inventory area at 7.5–8 miles<sup>16</sup>, approximately 6.5 miles of which crosses private land. This route is also the narrowest in the inventory area, with long stretches 0.25 mile wide or less. The grasslands within the movement route occur in a variety of landforms, including valleys and ridges. San Joaquin kit foxes have been sighted in Round Valley and within this movement route near Marsh Creek Road, suggesting that portions of the route may be used. However, the northwestern end of the route has large sections of rugged, steep terrain that is closely bounded by dense stands of oaks and coastal sage scrub, which may seriously impede kit fox movement (Orloff 2003). Portions of this valley may serve as a habitat linkage (e.g., Round Valley Regional Preserve), while most of the route likely serves only as a movement route.

The long-term viability of this potential movement route is in question. The California Bay-Delta Authority (CBDA) is studying the potential to expand the Los Vaqueros Reservoir to as much as 500,000 acre-feet from its current capacity of 100,000 acre-feet (CALFED Bay-Delta Program 2002). The maximum size of the expanded reservoir would increase its surface elevation by 164 feet and its surface area by 1,810 acres. This increase would flood nearly all the modeled kit fox core habitat on the southwest side of the reservoir, eliminating that connection across the Kellogg Creek watershed (Figure 5-6). The proposed reservoir expansion would also reduce the width and viability of the route along the northern shore due to expansion of the dam footprint (which may include building a new and larger dam immediately downstream of the existing dam) and construction of additional pumps, pipelines, and other facilities. Because of the inherently poor quality of the movement route and the future reduction in its viability due to the potential reservoir expansion, this route is not considered for conservation in this HCP/NCCP. The proposed reservoir expansion is not covered by this HCP/NCCP, but its effects are considered in Chapter 4 as cumulative effects in the inventory area.

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<sup>15</sup> “Movement habitat” is defined as areas through which San Joaquin fox will move but not remain long enough to establish dens, breed, or forage extensively. “Habitat linkages” are areas that provide important connections (i.e., support movement) and there is enough suitable habitat for San Joaquin kit fox to breed and forage.

<sup>16</sup> The route is slightly shorter around the north end of the Los Vaqueros Reservoir (by the dam) and slightly longer around the southwest end.

**2. Briones Valley.** This potential movement route runs through Briones Valley in Subzones 2c, 2d, and a portion of 2e. A secondary connection from Los Vaqueros may exist through the Cañada de los Poblanos in Subzone 4d. The movement route is approximately 5 miles long, 4.5 miles of which traverses private land. Because Marsh Creek Road runs through a portion of this relatively narrow valley (0.2–0.25 mile wide), the viability of this valley for kit fox movement is uncertain. In addition, development of rural ranchettes in lower Briones Valley threatens to fragment grassland habitat within the valley. The hills between Briones Valley and Cañada de los Poblanos also contain annual grasslands that are suitable for kit fox movement. A kit fox has been observed in Briones Valley near Deer Valley Road, indicating that portions of the Briones Valley movement route are used.

Suitable core habitat through most of Briones Valley is more than 0.5 mile wide but is discontinuous at one end. At the northwest end of Briones Valley, suitable core habitat narrows to less than 0.1 mile (Figure 5-7). To traverse this area from Briones Valley, kit foxes would have to cross into Oil Canyon and Black Diamond Mines Regional Preserve through patches of oak woodland, which is not considered suitable habitat for the species. Although Briones Valley provides moderate to poor connectivity for kit fox overall, the southern end of the valley is relatively wide (0.5–0.75 mile) and provides a route from the Los Vaqueros Watershed lands into Deer Valley and Horse/Lone Tree Valleys (Orloff 2003). Most of Briones Valley likely serves only as a movement route, not a habitat linkage, for kit fox. Briones Valley is considered an important secondary movement route for kit fox in this conservation strategy.

**3. Deer Valley.** The potential movement route through Deer Valley occurs in Subzones 2e and 2f. The movement route is approximately 4 miles long and is already partially protected by the dedication of development rights on and around the Roddy Ranch Golf Course. Suitable core habitat through most of Deer Valley is more than 0.5 mile wide and is continuous from end to end. Suitable core habitat narrows to approximately 0.3 mile near Black Diamond Mines Regional Preserve where oak savanna and oak woodland may constrain kit fox movement (Orloff 2003) (Figure 5-8). The ridge separating Deer Valley from Horse Valley is relatively low and covered in sparse vegetation, so it may not be a barrier to kit fox movement. The Roddy Ranch Golf Course also separates the two valleys but is not considered a barrier to kit fox because annual grassland is interspersed between the greens and fairways (Orloff pers. comm.) (Figure 5-9) and kit fox are known to use golf courses in the southern part of their range (Cypher pers. comm.). Most of Deer Valley likely serves as a habitat linkage for kit fox in the region. Deer Valley is considered an important movement route for kit fox in this conservation strategy.

**4. Horse and Lone Tree Valleys.** Horse and Lone Tree Valleys together form the widest potential movement route for San Joaquin kit fox between Black Diamond Mines Regional Preserve and Cowell Ranch State Park. Kit foxes have been sighted along the eastern edge of Black Diamond Mines Regional Preserve (adjacent to Subzone 2h); accordingly, they may use this area to move between

Los Vaqueros Watershed lands and Black Diamond Mines. This movement route traverses Subzones 2e, 2f, 2g, 2h, and 2i.

The route is wide enough (1–3 miles) and long enough (approximately 5 miles) to potentially support breeding of one or several kit fox pairs within the route. Therefore, Horse and Lone Tree Valleys serve as a habitat linkage for kit fox in the region. The Horse/Lone Tree Valley potential movement route is part of a much larger area of modeled suitable core habitat for kit fox at the southern edge of Antioch (Figure 5-10). According to the land cover mapping, up to 4,815 acres of suitable core habitat is present in Subzones 2h, 2g, 2i, and 2e. Due to the large size of this route, it is considered to have the highest biological viability for kit fox movement (Orloff 2003). The home range size of kit foxes in Contra Costa County is unknown, but based on home range sizes in the San Joaquin Valley (1–12 square miles), this area could support between one and five kit fox pairs (although the lower number may be more likely given that this area is at the periphery of the species' range [Orloff pers. comm.]). Researchers have consistently indicated that the ecology of kit foxes in the northern portion of their range is poorly known and may be different from the ecology of foxes in the southern part of their range (Laughrin 1970; Swick 1973; Morrell 1975; Orloff et al. 1986; Sproul and Flett 1993; Bell 1994; Duke et al. 1997). For example, the northern populations of kit foxes appear to use different prey (ground squirrels instead of kangaroo rats), and their dens tend to be derived from existing ground squirrel or badger burrows rather than dug themselves (Orloff et al. 1986). In addition, habitat (ground cover, dominant vegetation, land use practices, rainfall, and in some cases topographic relief) is substantially different in the north than in the south, where kit foxes are more abundant and well studied.

Development of up to 4,870 housing units has been proposed in the city of Antioch within the Sand Creek area (Mundie & Associates and City of Antioch 2002), which includes portions of Subzones 2g, 2h, and 2i. In November 2005, voters in the City of Antioch passed a measure to create an urban limit line south of their city limits. If annexation of this area is ultimately approved by the Local Area Formation Committee (LAFCO), the city limits would extend to the northern edge of Subzone 2f, encompassing all of Subzone 2h and almost all of Subzone 2g (though large portions of Subzone 2h are not planned for development by the City of Antioch). The new Antioch urban limit line greatly reduces the feasibility of acquiring most of Subzone 2g and portions of Subzone 2h to establish a kit fox linkage through Horse and Lone Tree Valleys.

**Conclusions.** The movement habitat through Round Valley is likely already too long and narrow for normal dispersal movements. This route may lose its limited viability due to the proposed expansion of the Los Vaqueros Reservoir. The route through Briones Valley is viable through the southern part of the valley but has uncertain viability in the northern portion where oak woodland encroaches on the grassland corridor; accordingly, Briones Valley will be a secondary movement route for kit fox. The Deer Valley habitat linkage appears viable because it is outside the new Antioch ULL and largely separated from future urban development by the Roddy Ranch Golf Course (which will remain as a golf course due to a dedication of development rights).

The routes through Horse and Lone Tree Valleys are the widest and shortest movement routes and the only routes within this area currently large enough to likely and consistently support a breeding pair of kit foxes (i.e., they provide a substantial habitat linkage). However, the probable expansion of the Antioch city limits to the south makes their complete acquisition infeasible. Instead, conservation of narrower movement routes will be pursued through the western and central portions of Horse Valley through Subzone 2h (west of and through the Roddy Ranch Golf Course) to connect to larger proposed conservation areas in Lone Tree Valley.

With acquisition of part of the Horse/Lone Tree Valley movement route and all of the Deer Valley movement route, there would be a minimum of two and possibly up to three routes for kit fox in the Preserve System into Black Diamond Mines Regional Preserve with the Briones Valley as a secondary route.

**Land Acquisition Requirements in Zone 2 to Protect San Joaquin Kit Fox and other Covered Species.** The Implementing Entity will acquire at least 2,400 acres of annual grassland within Subzones 2e, 2f, and 2h (i.e., 3.75 square miles, or 75% of grassland within the Subzones) to preserve a continuous band of modeled suitable core or low-use habitat for kit fox between Cowell Ranch State Park and Black Diamond Mines Regional Preserve. This acreage was determined from the habitat model for San Joaquin kit fox and the movement route analysis described above; it represents the minimum acreage needed to maintain the existing movement route and habitat linkage through Deer Valley and to preserve connections through Horse Valley and Lone Tree Valley in Zone 2. When combined with suitable core habitat adjacent to these subzones, and with improved management (e.g., Conservation Measure 2.4), this area should also be capable of supporting at least one pair of San Joaquin kit foxes. To minimize the indirect effects of new development expected in Antioch, the boundary between the development and the preserve must be as straight a line as possible, incorporating topographic features, if appropriate. In addition, it is critical that wildlife-friendly design features are incorporated into urban development (see Conservation Measure 1.9 and Appendix E) to minimize adverse effects on the adjacent preserve.

The Implementing Entity will acquire at least 600 acres (58%) of the grassland within Subzone 2h to enhance movement opportunities for San Joaquin kit fox through this area and to provide a wide buffer zone between future development in the Sand Creek area and the movement routes in Horse and Deer Valleys. Land acquisition in this area will also provide an important buffer between development and the known habitat of kit foxes at the eastern edge of Black Diamond Mines Regional Preserve.

Zone 2 contains 31% of the annual grassland in all the Zones and supports large blocks of suitable habitat for several covered species including California red-legged frog, California tiger salamander, western pond turtle, foothill yellow-legged frog, and big tarplant. In order to meet the overall requirement for preservation of this land cover type, to meet the preserve configuration requirements described above for this Zone, and to support the conservation

goals and objectives for other covered species besides kit fox, the Implementing Entity will acquire annual grassland in each Subzone to at least the minimum requirements listed in Table 5-14. These values were determined based on the following factors:

- The ecological requirements of covered species.
- The need for kit fox linkages between Cowell Ranch State Park, Black Diamond Mines, and Clayton Ranch (emphasis on Subzones 2b, 2c, 2e, and 2f).
- The need to provide viable movement routes for San Joaquin kit fox from Cowell Ranch State Park to Black Diamond Mines Regional Preserve (emphasis on Subzones 2e, 2f, and 2h).
- The need to preserve and enhance ponds within the Zone to maintain and enhance populations of pond-dependent covered species (emphasis on Subzones 2b, 2c, and 2d).
- The need to provide environmental gradients and a diversity of habitats within the Zone (emphasis on all Subzones except 2g and 2i).
- The need to provide some flexibility in preserve assembly within the Zone in case there is a lack of willing sellers.

### **Land Acquisition Priorities**

The preserve acquisition requirements are designed to provide flexibility to the Implementing Entity in assembling the Preserve System, especially early in the permit term. Despite this flexibility, the Implementing Entity should prioritize land acquisition, where possible, in order to buy parcels under the greatest threat of development and whose cost is expected to rise fastest. Land in Zone 2 is subject to both the greatest threat and the greatest potential for cost inflation during the early phases of the permit term; accordingly, land acquisition must be focused there when willing sellers are available. Land in Zone 2 is also critical to creating and maintaining movement and habitat linkages in the inventory area for San Joaquin kit fox, one of the key covered species.

When possible, land should be acquired adjacent to the existing Preserve System to ensure that, in the unlikely event that public funding does not become available (see Chapter 9 for details), the Preserve System is at least a cohesive unit rather than many isolated parcels.

### **Incorporating Covered Plant Populations in the Preserve System**

The location of all covered plants within the inventory area is not known due to survey and mapping limitations. General habitat distribution models were developed for eight of the 11 covered plant species, but the conservation value of these models is limited because of the paucity of known occurrences of most species in the inventory area. The habitat requirements of the remaining three species are not well known enough to develop a credible model at this time.

Because of these limitations in the knowledge of the habitat requirements of all covered plants, impacts on and conservation of covered plants will be based on

known *populations* rather than suitable habitat. Impacts on covered plants will be tracked by population (see Chapter 4 and Table 4-6). Likewise, the Implementing Entity must ensure that adequate numbers of populations of covered plants are included in the Preserve System. Many covered plants likely have unique microhabitat requirements such as soil types or plant associations that cannot be mapped at the regional scale used in this Plan. Therefore, there is too much uncertainty in using the broad habitat models in this Plan to account for impacts and conservation for covered plants (these models were useful for defining the regional Preserve System).

The great majority of known populations of covered plants in the inventory area are outside the permit area, so many populations are expected to be included incidentally in preserves as the Preserve System is established to meet natural community and wildlife species goals and objectives. However, the Implementing Entity must ensure that impacts to covered plants do not exceed those predicted in Table 4-6 and predicted impacts are offset through preservation of populations in the Preserve System. If the Implementing Entity cannot preserve the necessary plant populations, then applicants with impacts to covered plants will be required to do so in order to receive take authorization under this Plan for any covered species. Data collection will occur through site-specific surveys for covered plants in impact areas (planning surveys) and pre-acquisition surveys in new preserves.

To ensure that the Plan adequately protects covered plants, pre-acquisition surveys on properties considered for acquisition must establish the presence, absence, and health of populations of covered plants (see below for a definition of “health” and Chapter 6 for survey requirements). To prioritize sites for acquisition, the size of the populations preserved (measured in terms of acreage and either plant cover or number of individuals, whichever is most appropriate for the species and site) must always be at least as large as the populations of the same species lost to covered activities. A *healthy population* of covered plants is defined as one that has a stable or increasing population growth rate or has a high potential to increase in size with improved management. This value cannot be determined in the field on the basis of a single survey. For the purposes of this HCP/NCCP, the health of a plant population will be inferred in the field on the basis of the relevant characteristics listed below and assessment by a qualified botanist. These inferences will be confirmed by the Implementing Entity within the preserves<sup>17</sup>. (Several surveys per season or surveys over multiple years may be necessary to assess all relevant site and population characteristics and to ensure that populations within potential preserves are healthier than populations lost to covered activities.)

- **Physical condition.** Individuals in good or excellent physical condition for the species (e.g., little or no signs of disease, viruses, severe herbivory, nutrient deficiencies) are more likely to survive, achieve an average or

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<sup>17</sup> Assessments of covered plant populations on sites of covered activities will be limited to inferences of population health from surveys in a single season.

above-average lifespan, and reproduce more successfully than individuals in poor physical condition.

- **Age structure.** For perennial plants, having an age structure with many seedlings or juvenile plants relative to adults suggests a stable or positive rate of population growth. Seeds in the soil (i.e., the seed bank) are also part of a plant population's age structure, but this component is generally very difficult to measure. Similarly, for the geophyte Mount Diablo fairy lantern, dormant bulbs in the soil are a stage of the population age structure.
- **Reproductive success.** Populations with evidence of average or above-average reproductive success for the species (e.g., production of flowers per plant, seed production per flower or per plant, proportion of seeds that appear to be viable based on visual observations) are more likely to be increasing than populations with below-average reproductive success because this is often a key component of population growth rate. If reproductive success cannot be measured, plant size or other physical features may be an appropriate surrogate in some covered species.
- **Availability of suitable habitat.** In order for a plant population to remain stable or grow, enough suitable habitat must be present. Populations near unoccupied suitable habitat or without evidence of shrinking suitable habitat areas (e.g., exotic plants that may be expanding, native shrubs that may be advancing) will be considered more healthy than populations without these indicators.
- **Diversity of suitable habitat.** Populations that occupy a wide range of microhabitats for the species may exhibit relatively high genetic diversity and therefore population health. Populations that occupy unusual microhabitats for the species may indicate unusual genetic composition or adaptations that should be preserved.

Sites selected for preservation of healthy plant populations will be incorporated into the Preserve System to ensure long-term viability of these populations. Preserves will contain adequate buffers between the plant population and adjacent land uses; sufficient suitable habitat for the covered plant to support population expansion and fluctuation; and a sufficient area in which to apply beneficial management techniques such as appropriate disturbance regimes (see Conservation Measure 3.9).

When practicable, all lands protecting covered plant populations will be connected to existing protected areas or HCP/NCCP preserves. When not practicable, the minimum preserve size to protect covered plant populations will be determined on the basis of site-specific conditions but will not be less than 40 acres unless acquiring a smaller site is the only way to meet a land-acquisition requirement in this Conservation Measure (i.e., all other options have been exhausted). The minimum preserve size required for the long-term viability of covered plant populations will vary depending on species, site conditions, population status, and surrounding land uses but will generally be unknown. A 40-acre minimum has been established because it is a common parcel size in the inventory area (1/16 of a section) and because this is the estimated minimum size

needed to properly manage a site in the inventory area. Because land acquired for the Preserve System must be linked to other HCP/NCCP preserves or existing public lands whenever possible, few, if any, isolated, 40-acre preserves are expected to be established. Additionally, preserves must be configured to minimize the extent of edge (e.g., rectangles, squares, or circles instead of strips or fragments).

### **Mitigation and Conservation Components**

As discussed in Chapter 1, NCCPs are required to conserve species and their habitats. To achieve this standard, this conservation strategy goes beyond typical mitigation requirements. Although the Plan provides a single conservation strategy to mitigate impacts and conserve covered species, it is important to roughly delineate the mitigation obligations of the Plan from the conservation components because USFWS and CDFG can only fund land acquisition that contributes to the conservation component of the HCP/NCCP (i.e., they cannot subsidize mitigation).

To address this need, the land acquisition requirements for terrestrial land cover types were assigned to either a mitigation component (i.e., acquisition required by the Plan as a result of covered activities) or a conservation component (i.e., acquisition required by the Plan to contribute to species' recovery) based on a "fair share" analysis. This analysis is described in more detail in Chapter 9 and Appendix G. Briefly, this analysis considers the pace of open space acquisition relative to the pace of development before and after adoption of the HCP/NCCP, and assigns the land acquisition requirements of the HCP/NCCP according to the premise that future development should mitigate impacts in the inventory area proportionate to its share of the overall habitat impacts in the inventory area (i.e., impacts in the past and the future). The analysis takes into account the fact that cultivated agriculture removes some but not all biological and open space values from a site. According to the analysis, new development is responsible for 52% of the land acquisition requirements shown in Tables 5-7 or 5-8, and existing development (i.e., the public) is responsible for 48% of land acquisition shown in these tables. The fair share analysis cannot be applied to wetland land cover types. Wetland impacts are already clearly separated by mitigation and conservation components on the basis of other factors (see Tables 5-5, 5-16, and 5-17).

This analysis is provided only for convenience in future accounting, and to help delineate eligibility for public grant funding for the conservation portion of the Plan. The HCP/NCCP is a single plan that must be implemented as a whole. Permits will be issued on the basis of implementation of the entire Plan. The development mitigation fees described in Chapter 9 will cover the responsibilities and requirements that the Implementing Entity and participating local jurisdictions have to mitigate impacts in the inventory area. The remaining goals of the conservation strategy will be met through a combination of state and federal contributions, maintenance of existing local, state, and federal conservation efforts, and from other funding from federal, state and private competitive grants.

### **Stay-Ahead Provision and Rough Proportionality**

The timing and sequence of preserve assembly relative to impacts of covered activities is critical to the success of the HCP/NCCP. Progress towards assembling the Preserve System must stay ahead of progress towards total impacts allowed under the permit. This sequence ensures that preserve assembly is keeping pace with development and that the Implementing Entity is making steady progress towards the full Preserve System.

Such progress toward assembly of the Preserve System is a requirement under the NCCPA. The NCCPA requires that implementation of mitigation and conservation measures be “roughly proportional in time and extent to the impact on habitat or covered species authorized under the plan” (California Fish and Game Code Section 2820[b][9]). To meet the requirements of this section, CDFG requires that NCCPs make progress towards the final conservation goals (i.e., the ultimate size and configuration of the Preserve System) in proportion to the impacts of covered activities. The Stay-Ahead provision in this Plan described in Chapter 8 (Section 8.6.1) addresses this requirement.

To meet this Stay-Ahead provision at the beginning of HCP/NCCP implementation, some land should be acquired prior to any permits being issued under the HCP/NCCP to “jump start” the Preserve System. See Table 5-15 and Section 8.6.1 for jump start guidelines.

### **Relationship to Land Acquisition outside the Inventory Area**

In order to meet the requirements of this conservation strategy, all land acquisition must occur within Contra Costa County and within the inventory area, with two minor exceptions described above for Zones 4 and 5. The HCPA recognizes, however, that land acquisition and management outside the inventory area is important for the conservation of many covered species and natural communities (Wild 2002). For example, Detachment Concord is a 12,920-acre facility containing outstanding examples of grassland and riparian communities and likely serves as core habitat for covered species such as western burrowing owl, California tiger salamander, and California red-legged frog. There are 150 acres of high-quality riparian woodland and forest within the facility along Mount Diablo Creek (Tetra Tech 2002). This area is adjacent to the inventory area and the future HCP/NCCP Preserve System. The upland unit of the facility adjacent to the inventory area is currently inactive. Although it currently supports high-quality habitat, its future land use and management will greatly influence the Preserve System near it.

The HCP/NCCP inventory area is also adjacent to San Joaquin County. The San Joaquin County Council of Governments has been purchasing conservation easements in western San Joaquin County since the Multi-species Habitat Conservation and Open Space Plan was completed in 2001 (San Joaquin County Council of Governments 2001). Agricultural lands acquired by the Implementing Entity in Zones 5 and 6 may support conservation efforts in nearby San Joaquin County, and vice-versa.

To the south, the Preserve System will border Alameda County and come close to connecting with existing public lands such as Brushy Peak Regional Preserve. There is no approved or in-process regional conservation plan in Alameda County. However, several agencies (EBRPD, City of Livermore, CDFG, and the Altamont Landfill Open Space Committee) are actively acquiring land in fee title or conservation easements for open space and conservation purposes in Alameda County near Zone 5. Coordinated actions of the Implementing Entity and the land acquisition agencies operating in Alameda County will enhance the effectiveness of the HCP/NCCP preserves. Long-term acquisition needs in Alameda County near the HCP/NCCP preserves include expanding Brushy Peak Regional Preserve, linking the Los Vaqueros Watershed to the City of Livermore Springtown Alkali Sink Preserve, and linking Bethany Reservoir Recreation Area to Vasco Caves Regional Preserve (Stewart and Doyle pers. comms.). A summary of the regional connections needed to link the HCP/NCCP Preserve System with areas outside the inventory area is shown in Figure 5-11.

### **Conservation in the Inventory Area beyond HCP/NCCP Requirements**

The land acquisition requirements above are not designed to provide the blueprint for all conservation in the inventory area. Open space acquisition will continue separate from the HCP/NCCP during and after the permit term, and projects not covered by the Plan will need to implement their own mitigation. However, conservation that occurs separate from this Plan will benefit the Plan and the biological resources of the inventory area if these acquisitions occur in coordination with the Plan. The following general priorities were developed to help guide conservation separate from the HCP/NCCP and to guide conservation actions under the HCP/NCCP, in the event that separate conservation or other actions prevent land from being acquired under the HCP/NCCP. These guidelines build on the HCP/NCCP Preserve System to create a larger system of conservation and open space in East Contra Costa County.

- **Subzones with High Acquisition Priority.** More land acquired in Subzones already designated as high priority for conservation (i.e., bringing the total acquisition in these Subzones close to 100%) will strengthen the Preserve System by creating larger, more contiguous conservation areas that are better able to link with Alameda County existing protected areas in Contra Costa County such as Black Diamond Mines Regional Preserve, Los Vaqueros Watershed, and Mount Diablo State Park.
- **Subzones 4d, 4e, 4f.** Additional acquisition in these Subzones will increase protection of the Upper Marsh Creek Subbasin, including reaches of the mainstem of Marsh Creek (4d). Additional land acquisition in these Subzones will also widen protection of the Briones Valley (4d) and protect additional suitable core habitat for Alameda whipsnake (4f).
- **Subzones 4c, 4g.** More acquisition in these Subzones will also protect more of the Upper Marsh Creek Subbasin, including reaches of the mainstem of Marsh Creek (4c). Acquisition here will increase linkages between lower- and mid-elevation sections of the Preserve System in oak woodland and mixed evergreen forest.

- **Subzone 5c.** Subzone 5c supports extensive stands of annual grassland that are primarily east of Vasco Road. Areas abandoned by and reclaimed from the active sand mine present opportunities for habitat restoration on relatively rare sandy soils. Additional acquisition in this Subzone could link the Byron Airport Mitigation Lands with Cowell Ranch State Park east of Vasco Road.
- **Subzones 3b, 3c.** Acquisition in these small Subzones on the flank of Mount Diablo would extend the park boundaries to incorporate steep slopes and varied habitats. Rural residential development (3b) and gravel mining (3c) limit acquisition opportunities.
- **Subzones 1d, 4b, 6d, 6e.** The remaining Subzones have opportunities for land acquisition that would support the Preserve System. Acquisitions in Subzone 1d south of the future Buchanan Bypass would provide a useful buffer between the road and the Preserve System. Subzone 4b is fragmented by rural residential development along Morgan Territory Road, but small parcels that remain could expand the Preserve System in adjacent Subzones. Subzones 6d and 6e are largely cultivated agriculture, but acquisition of key parcels could contribute to protecting all remaining alkali grassland and wetland in these Subzones.

## Preserve Management

Preserve management is designed to maintain and enhance vegetation communities, habitat for covered species, biological diversity, and ecosystem function. The location of preserves and condition of resources within these preserves will not be known until suitable sites are identified, surveyed, and purchased. Therefore, site-specific management objectives and techniques cannot be developed until preserve sites are known.

The Implementing Entity will prepare two types of preserve management plans: system-wide plans and preserve-specific plans (called *preserve management plans*). System-wide management plans will be prepared to define an overall approach to control exotic species and recreational uses of preserve lands. Exotic species control is a serious regional issue and must be evaluated at that level. For example, exotic plants that occur in the inventory area must be identified and prioritized regionally for eradication or control. Efforts to eradicate or control these species will only be successful in coordination with other land management agencies and private landowners in the region. Similarly, recreational use must be addressed in the preserve system as a whole so that a balanced, integrated, and well-distributed mix of low-impact recreational opportunities can be provided, and potential conflicts with resource protection goals can be effectively avoided and minimized. Policies and guidelines for exotic species control and recreational uses for use in preparing the system-wide management plans are presented in Conservation Measures 1.4 and 1.5 below.

Preserve management plans will also be developed for each preserve to identify, on the basis of site-specific conditions and preserve objectives, the management/maintenance actions necessary to ensure that desired ecosystem

characteristics and functions are maintained and protected. Preserve management plans must also address and minimize the conflicts that may arise when managing for multiple species and habitats. Preserve management plans will also implement the system-wide plans for exotic species control and recreational uses.

All system-wide and preserve management plans must be reviewed and approved by CDFG and USFWS. Plans will also be updated and revised as part of the adaptive management program (see Chapter 7). Prior to adoption of the first preserve management plan, land management must be applied according to the HCP/NCCP and best scientific practices. The conservation measures below describe the objectives, principles, and general requirements of these preserve and system-wide plans.

## **Conservation Measure 1.2. Prepare and Implement Preserve Management Plans for Natural Habitat Lands**

Preserve management plans will be prepared by the Implementing Entity for each preserve on natural land cover types (i.e., on land not cultivated or irrigated for crops or pasture; mostly in Zones 1–5; see Conservation Measure 1.3 for management of other lands). Preserve management plans will describe preserve-specific conservation strategies for maintaining and improving existing habitat conditions for covered species and managing enhanced/created/restored habitats to maintain or improve their functions for covered species over time through the adaptive management process.

Preserve management plans will be prepared as soon as reasonably possible but not longer than 1 year following acquisition of the first parcel in a preserve area. Management plans will be developed in cooperation with adjacent land management agencies, resource agencies, and current grazing lessees, if any. As additional lands are added to the preserve, the management plan will be revised (see schedule below) to reflect new management methods that may become necessary. Until management plans are developed or formally approved, preserve lands will be managed in the interim to maintain and improve covered species habitats in accordance with the best available information and management methods used there or in other protected areas in the inventory area or in other established HCP/NCCP preserves. Management regimes that existed prior to acquisition will continue until it can be shown through management on other HCP/NCCP preserves or elsewhere in the inventory area, pilot studies, experimentation, or other relevant studies that changing management immediately will benefit natural communities or covered species.

Preserve management plans will be working documents; accordingly, they should not preclude the modification of management measures prior to plan updates in cases where adaptive management or new research identifies more effective techniques. The Implementing Entity shall formally review and systematically revise preserve management plans at least every 10 years. This review should be based on an evaluation of the success of management methods (i.e., knowledge

gained through the monitoring and adaptive management program) in achieving objectives of the preserve, as well as on results of other outside research. As applicable to each preserve, preserve management plans should include the following types of information.

**Objectives of the Conservation Area.** Each preserve management plan will clearly identify the biological objectives (e.g., aerial extent of each preserved, enhanced, and restored community) for the preserve. Biological objectives for each preserve will be tiered from the biological goals and objectives of the HCP/NCCP (Table 5-1). Each preserve management plan will also identify the landscape-, community-, and species-level conservation measures applicable to the preserve.

**Vegetation Management.** Each preserve management plan will describe preserve-specific objectives for the following goals.

- Reducing the abundance and distribution of exotic plants.
- Increasing or maintaining the abundance and distribution of covered plants, native plants in general, and rare vegetation alliances.
- Where appropriate, reducing the fuel load of the preserve so that the risk to biological resources of catastrophic wildfire is at an acceptable level and the risk to adjacent urban areas is minimized (meeting all state and local requirements). The methods and intensity of fuel management will vary depending on the location of the preserve relative to human populations and structures; emergency vehicle access; and the sensitivity of resources in the preserve to fuel load reduction techniques (e.g., fuel breaks, prescribed fire, mowing). Because fuel load reduction in chaparral habitats may be problematic (i.e., high-quality chaparral habitat is frequently characterized by periodic wildfire), it may be necessary to establish buffers in which to implement fuel load reduction.
- Minimizing the impacts of vegetation management techniques on native biological diversity and covered species (some impacts on covered species from vegetation management are expected and are included in the take allowances provided in this HCP/NCCP; see Chapter 4, *Effects on Ecosystems, Communities, and Species*).

Each preserve management plan will identify the types of management actions and the implementation schedule required to achieve the vegetation management objectives. Anticipated methods for managing vegetation include, but are not limited to, the following.

- Livestock grazing.
- Prescribed burning.
- Mechanical mowing (e.g., mowing fire breaks near the end of the growing season around the margins of preserves or to simulate grazing in areas where livestock cannot be used; large-scale use of heavy machinery to remove vegetation such as chaparral/scrub will not be used).

- Hand removal of vegetation (e.g., to remove infestations of exotic plants).
- Application of herbicides (e.g., spot spraying to remove infestations of exotic plants). There may be a need to apply herbicides on a large scale (e.g., to control star-thistle). Note that herbicides are not proposed for coverage in the Section 10(a)(1)(B) permit.

Preserve management plans will also describe the ongoing vegetation management actions that must be undertaken to implement community-level measures required on each of the preserves. The following sections include detailed recommendations for management techniques and principles that must be incorporated appropriately into each preserve management plan. These measures describe management requirements and guidelines that will be applied to vegetation communities to benefit suites of covered species:

- Wetland and Pond Management (Conservation Measure 2.2)
- Wetland Restoration and Pond Creation (Conservation Measure 2.3)
- Grassland Management (Conservation Measure 2.4)
- Natural Burrow Availability and Prey Base for Covered Species in Grasslands (Conservation Measure 2.5)
- Oak Woodland and Oak Savanna Management (Conservation Measure 2.6)
- Compensate for Loss of Oak Savanna (Conservation Measure 2.7)
- Chaparral/Scrub Habitat Management (Conservation Measure 2.8)
- Streams and Riparian Woodland/Scrub Management (Conservation Measure 2.9)
- Compensate for Loss of Streams and Riparian Woodland/Scrub (Conservation Measure 2.10)

The following conservation measures are meant to address any additional requirements for species conservation not adequately addressed by the natural-community-level conservation described above. Management requirements and guidelines in these measures must be incorporated into the appropriate preserve management plans:

- Protect and Enhance Roosting Habitat for Townsend's Western Big-Eared Bat (Conservation Measure 3.1)
- Minimize Predation on Tricolored Blackbird Colonies (Conservation Measure 3.2)
- Protect Golden Eagle Nest Sites within Preserve System (Conservation Measure 3.3)
- Temporarily Create Artificial Burrows in Grasslands to Attract and Retain Burrowing Owls (Conservation Measure 3.4)
- Establish Artificial Perches to Attract and Retain Burrowing Owls (Conservation Measure 3.5)

- Enhance Habitat for Western Pond Turtle (Conservation Measure 3.7)
- Conduct Experimental Management to Enhance Covered Plant Populations (Conservation Measure 3.9)

**Fire Management.** Each preserve management plan will include a fire management plan with the following elements.

- A map of fire access roads and gates.
- Identification of fuel load management methods and criteria for their application.
- Criteria and procedures for use of prescribed fires for management purposes.
- A description of fire suppression criteria, procedures, resources, and responsibilities.
- A discussion of restoration/rehabilitation of vegetation following a fire.

Fire is an important natural component of local ecosystems. Therefore, some wildfires should be allowed to burn naturally to provide periodic disturbances that will benefit natural communities and covered species. The fire management plan must include a clear decision system to be used in determining when a wildfire will be left to burn and when it must be partially or wholly contained to prevent damage to structures, prevent injuries, or cause excessive disturbance to natural communities.

Fire management plans, to the extent practicable, must be consistent with achieving the biological objectives of the preserve. Preparation of fire management plans for preserves will be coordinated with the California Department of Forestry and Fire Protection, local fire districts, and the Bay Area Air Quality Management District. Copies of all fire plans, including maps of access roads and gates, will be provided to local fire fighting units.

The development of the fire management plan will, based on the location of existing access roads and gates, include an assessment of the need to develop additional fire access roads sited to minimize impacts on sensitive species and communities and to minimize the need for new access roads (which could affect sensitive species and communities) to be constructed under emergency conditions (i.e., during fires). In addition, all access gates will include common locks that will allow for ready access by firefighting agencies.

**Maintenance of Infrastructure.** Each preserve management plan will include a map showing the location of infrastructure, including roads, firebreaks, fences, gates, pumps, wells, water control structures, ditches, canals, drains, powerlines, and buildings. The management plan will include a schedule for inspecting infrastructure to determine the need for maintenance. Work needed to maintain infrastructure that is necessary for maintaining preserves (e.g., firebreaks, fences) will be conducted as soon as practicable after the need for maintenance has been identified. The management plan will also identify periods during which maintenance activities should be conducted to avoid or minimize adverse affects

on covered communities and species. The Implementing Entity will also prepare a hazardous materials management/spill prevention plan to identify procedures that must be followed if hazardous materials are encountered or a spill occurs on the preserve.

**Monitoring Requirements.** Each preserve management plan will describe monitoring requirements, including monitoring schedules and reporting requirements, applicable to the individual preserve. The monitoring element of preserve management plans will tier from and supplement the overall monitoring plan for the HCP/NCCP. Preserve management plans will also describe how monitoring will be coordinated with monitoring conducted elsewhere in the Preserve System and with monitoring in other public lands in the inventory area. Examples of the types of monitoring that will be required, as applicable to each preserve area, are described in Chapter 7, *Monitoring and Adaptive Management Program*.

**Adaptive Management.** Each preserve management plan will include a description of adaptive management. The adaptive management approach in preserve management plans will tier from and supplement the overall adaptive management program for the HCP/NCCP (see Chapter 7). This section of the preserve management plan should include a description of how the results of the effectiveness monitoring will be used to adjust management of the preserve within the decision-making structure of the adaptive management process (see Section 7.2.4, *Organizational Structure*, in Chapter 7).

### **Conservation Measure 1.3. Prepare and Implement Management Plans for Cultivated Agricultural Lands**

Agricultural management plans will be prepared by the Implementing Entity for preserved croplands and irrigated pasture. As described in Conservation Measure 1.1, cropland or irrigated pasture will be acquired primarily in Zone 6 along Kellogg Creek, Marsh Creek, or adjacent to Dutch Slough. Lands may also be acquired along Marsh Creek within the ULL in Oakley or Brentwood. The primary purpose of acquired agricultural lands will be to provide opportunities for riparian woodland/scrub restoration along creeks and to expand the restoration opportunities adjacent to Dutch Slough. Agricultural operations on lands acquired by the Implementing Entity may or may not be compatible with these goals (e.g., riparian restoration on small parcels may need to occur on most of the parcel). If acquired agricultural parcels will be completely restored to natural land cover types and agricultural operations will cease, a management plan will be prepared according to Conservation Measure 1.2 (*Prepare and Implement Preserve Management Plans for Natural Habitat Lands*), rather than Conservation Measure 1.3, though such plans must incorporate key provisions of Conservation Measure 1.3 related to Swainson's hawk and giant garter snake if the parcel provides suitable habitat for these species.

Agricultural lands owned in fee title by the Implementing Entity or a participating partner may continue in agriculture use under lease to farmers

where that use is consistent with riparian restoration and upland habitat goals for the site (e.g., foraging habitat for Swainson's hawk, foraging/breeding habitat for western burrowing owl, or foraging habitat for tricolored blackbird, if applicable). Some agricultural lands will be preserved under conservation easements; in these cases, the Implementing Entity will prepare the management plans in cooperation with the landowner and consistent with the conservation easement.

The agricultural management plan will describe the agricultural practices that will be undertaken to ensure the land's suitability as upland habitat or as an upland buffer adjacent to riparian woodland/scrub. The plan will also include limitations on permitted practices to reduce adverse effects of some types of practices on covered species and other wildlife (see Conservation Measure 2.11). Habitat maintenance and enhancement measures will be designed to meet the habitat needs of covered species as described in the species profiles. Habitat maintenance and enhancement measures required in agricultural management plans will be compatible with maintaining the ongoing economical viability of agricultural use.

Site-specific conservation measures designed to maintain and enhance habitat for Swainson's hawk, western burrowing owl, tricolored blackbird, giant garter snake, or other native species will be documented in the agricultural management plan. Agricultural management plans will include the following components:

- An inventory of the conservation values of the site at the time the easement is enacted, including habitat values for relevant covered species.
- A schedule of major farming activities (e.g., tilling, planting, harvesting).
- A description of allowable crop types and locations farmed.
- A description of allowable crop rotation patterns.
- A description of how roads and field margins will be maintained.
- An application schedule for and types of herbicides and pesticides to be applied.
- A description of provisions for compliance inspections, including access and landowner notification.
- Specific measures to maintain and enhance habitat for covered species through avoidance, minimization, and enhancement.
- Provisions for adaptive management and monitoring consistent with Chapter 7.

The Implementing Entity, with concurrence of the landowner, may also consider managing lands preserved to provide Swainson's hawk foraging habitat in a manner that provides desirable benefits for other wildlife. For example, lands managed in corn or grains could be managed in a manner that would also provide suitable foraging habitat for wintering waterfowl during late fall and winter when Swainson's hawks are not present. If the site contains aquatic habitat that

supports or could support tricolored blackbird or other native species, the management plan could also describe measures to maintain or enhance these species. Examples of types of management actions that could improve foraging or breeding conditions for native species are listed below:

- Delaying the harvesting of hay and grain crops until as late as possible to increase the reproductive success of ground-nesting birds that nest in agricultural fields and to extend the period of forage availability.
- Deferring the tilling of corn and grain fields until later in the fall to increase the amount and availability of forage for waterfowl.
- Leaving a portion of corn or grain fields unharvested to increase the quantity of forage available for waterfowl (the forage would gradually become available to these species as senescent plant stalks fall over as a result of weathering).
- Establishing a seasonal or permanent buffer zone around aquatic habitats to reduce disturbance and improve foraging habitat for tricolored blackbirds.
- Shallow-flooding corn, grain, and irrigated pastures during the fall and winter to improve foraging conditions for waterfowl and shorebirds.

The Implementing Entity, with the concurrence of the landowner, will also manage the agricultural lands to benefit giant garter snake whenever feasible. The following techniques could be used to benefit this species:

- Maintain water in canals or ditches within the range of the species during their activity period (early spring through mid-fall).
- Maintain or enhance emergent vegetation in canals for escape cover and foraging habitat.
- Maintain or enhance patches of grassland connected to waterways to provide basking sites.
- Create or maintain upland areas above flood stages to provide a refuge for giant garter snakes during floods.

Agricultural management plans must be completed by the Implementing Entity within 1 year of acquiring the agricultural parcel or a conservation easement on the parcel. The key elements of the agricultural management plan (e.g., conservation goals and standards) will be negotiated with the landowner and included in the conservation easement when this form of ownership interest is acquired. The management plan will include details on the techniques and tools that will be used to achieve these goals. See Chapter 8, Section 8.6.3 for the required elements of these easements, including the prohibitions on uses that would degrade the conservation value of the easement land.

### **Rationale**

Agricultural management plans are necessary to provide sufficient enforceable terms in agricultural lease agreements and conservation easement agreements to ensure that preserved agricultural lands will be managed in a manner that will

achieve stated biological objectives and meet terms and conditions of permits (e.g., monitoring requirements).

Lands in cultivated agriculture provide the only suitable foraging habitat for Swainson's hawk in the inventory area, with the exception of low-elevation grasslands of Zones 5 and 6 (see species model in Appendix D). Agricultural lands and sloughs provide the only suitable breeding and foraging habitat for giant garter snake in the inventory area. Restoration and management of these lands in a manner compatible with Swainson's hawk and giant garter snake is one of the only means of preserving and enhancing habitat for these two covered species in this Plan.

### **Conservation Measure 1.4. Prepare and Implement an Exotic Plant Control Program for the Preserve System**

An Exotic Plant Control Program will be developed by the Implementing Entity and implemented for the Preserve System. When completed, applicable elements of the system-wide plan will be incorporated into the individual preserve management plans.

The goals of the Exotic Plant Control Program for the Preserve System will be to control the spread of noxious weeds (as defined by the California Department of Food and Agriculture) and invasive, exotic plants listed by the California Exotic Pest Plant Council (California Invasive Plant Council 2006 or latest list<sup>18</sup>) into new areas and to control infestations of noxious and serious weeds, where practicable. Most nonnative plants within HCP/NCCP preserves cannot or should not be controlled because they are either not invasive or are so widespread that control is infeasible. An important goal of the Exotic Plant Control Program will be to distinguish those species for which eradication or control will be the objective and those species that will be addressed through landscape-level management. The following major elements should be included in the Exotic Plant Control Program:

1. An assessment of the exotic plants within the Preserve System that includes the following components:
  - ❑ maps and descriptions of their distribution and abundance;
  - ❑ their known or potential effects on ecosystem function, native biological diversity, sensitive natural communities, and covered species;
  - ❑ the means and risk of their spread to other areas within and outside the preserves; and
  - ❑ the cost, feasibility, and effectiveness of available control measures for each species.

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<sup>18</sup> See <http://www.cal-ipc.org/> for the latest list. The name of the organization was recently changed from the California Exotic Pest Plant Council.

2. Assessment of exotic plants not currently found in the preserves but that are found nearby or in similar habitats and that might invade the preserves in the future. The assessment should include a description of known or potential effects on ecosystem function, native biological diversity, sensitive natural communities, and covered species.
3. Development and application of criteria for establishing exotic plant control priorities.
4. Integration and coordination of exotic plant control efforts in the Preserve System with efforts of other ongoing exotic plant control efforts (e.g., participation in weed control activities in the Alameda–Contra Costa Weed Management Area and coordination of weed control efforts with the Contra Costa Resource Conservation District; the Contra Costa County Department of Agriculture, Weights, and Measures; EBRPD; and CDPR).
5. A description of methods to control and prevent the establishment of exotic plants and criteria for evaluating the suitability of application of these methods based on site-specific conditions.
6. Description of a process by which future exotic plants can be evaluated quickly to determine the best course of action for their effective removal or control.

Development of the Exotic Plant Control Program will be coordinated with the Contra Costa County Department of Agriculture, Weights, and Measures and other major resource management agencies in the inventory area, including CCWD, EBRPD, and CDPR. Control of many exotic plants in the inventory area is a regional issue, so coordination with these agencies is essential. Coordination could include sharing costs, staff, and equipment and conducting joint management programs to address the regional problem of exotic plants. Management to control exotic plants will be prioritized such that the exotic plants with the greatest impacts on covered species are addressed first.

The Exotic Plant Control Program will be prepared within no more than 2 years of acquisition of the first parcel. However, control of exotic plants on preserve lands should begin immediately after acquisition if infestations are serious (e.g., yellow star-thistle). The program will be evaluated and revised as needed. Formal evaluations and revisions will take place at least every 5 years<sup>19</sup>.

### **Rationale**

Exotic plants pose a serious threat to ecosystem function, native biological diversity, and many covered plant species. However, the number of exotic plants in the inventory area is unknown, as is the number of highly invasive noxious weeds. Within the Los Vaqueros Watershed alone, biologists identified 13 noxious weeds during surveys between 1987 and 1995 (Jones & Stokes Associates 1989; Brady & Associates 1996). Since these surveys were conducted, new noxious weeds may have invaded the area. For example,

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<sup>19</sup> This is the approximate interval at which the list of invasive plants in California is updated by the California Invasive Plant Council.

stinkweed (*Dittrichia graveolens*), an invasive species not recorded in *The Jepson Manual* (Hickman 1993), has been recently identified in the inventory area (HCPA Science Advisory Panel 2003). Furthermore, many exotic plants cannot be effectively controlled due to their great abundance, high reproduction rate, and proficient dispersal ability; the high cost of control measures; or unacceptable environmental impacts of control measures.

The spread of exotic plants may be exacerbated by covered activities (e.g., increased human and pet populations that serve as dispersal vectors, increase in roads and other dispersal corridors). Accordingly, an aggressive Exotic Plant Control Program is needed to minimize the adverse impacts of exotic plants and to enhance natural communities. Moreover, improved management within the preserves is expected to increase the resilience of natural communities to invasion by new exotic plants.

A system-wide Exotic Species Control Program will allow the Implementing Entity to evaluate the threat of exotic plants across the Preserve System and then determine the sites in greatest need of control measures and the sites where control measures will be most effective and efficient.

### **Conservation Measure 1.5. Prepare and Implement a System-wide Recreation Plan for the Preserve System**

A recreation plan will be developed by the Implementing Entity and implemented for the Preserve System. This plan will address lands that are acquired for the Preserve System where recreational and educational uses are compatible with the preservation and enhancement of natural communities, covered species, and biological diversity. When completed, applicable elements of the system-wide plan will be incorporated into the individual preserve management plans (see Conservation Measure 1.2).

Generally, new public access on conservation easements acquired for the Preserve System will be more limited than on Preserve System lands not in private ownership, though regional trail connections and related facilities such as backpack camps may be needed on lands protected via conservation easement. Public access to privately owned land under conservation easements will only be permitted with the landowner's consent. See Chapter 10, *Assurances*, for more details.

Recreational uses will be designed to minimize impacts on biological resources and must adhere to the guidelines listed below:

- In all preserves, recreation is of secondary importance and must defer to the biological goals and objectives of this HCP/NCCP.
- Recreation will only be allowed where it is compatible with the biological goals of the HCP/NCCP and has less-than-significant impacts on biological

resources after implementation of necessary mitigation measures, as described in the EIR/EIS.

- Recreational use and impacts will be monitored by the Implementing Entity to ensure that uses do not adversely affect biological resources. If uses are found to be adversely affecting biological resources, the use will be discontinued until adjustments in the use can be made to reduce or eliminate impacts (see Chapter 7 for details on monitoring).
- Recreational uses allowed in preserves include hiking, non-motorized bicycle riding, walking, horseback riding, wildlife observation and photography, and environmental education and interpretation on designated trails at appropriate sites. If determined to be compatible by USFWS and CDFG, up to four staging areas, four small day-use picnic areas and two small backpack camps shall be allowed within the preserve areas (see below for design restrictions on these facilities). Activities will be allowed based on the ecological needs of the given habitat. Any activities off-trails and other active recreation not listed above (e.g., outdoor sports) are prohibited.
- As approved by USFWS and CDFG, new picnic areas shall be operated during daylight hours only and limited to eight standard picnic benches, restrooms, potable water and trash receptacles. No irrigated turf or landscaping shall be allowed in picnic areas. To the extent feasible, picnic areas will be located on the perimeter of preserve areas and will be sited in already disturbed areas. No private vehicles shall be allowed in picnic areas, unless the picnic area is at a staging area and except for limited special events approved by the Implementing Entity. Maintenance and emergency vehicles shall be permitted access to picnic areas.
- As approved by USFWS and CDFG, new backpack camps shall be limited to use by no more than 25 people. Restrooms, potable water and trash receptacles shall be provided. When feasible, campsites will be sited in already disturbed areas. Private vehicles may be allowed to drive into camps only during daylight hours, and only for the purpose of delivering supplies or providing access for campers with disabilities. This restriction shall not apply to maintenance and emergency vehicles. With the exception of Americans with Disabilities Act (ADA) service animals, dogs shall only be allowed in backpack camps on-leash and during daylight hours only. The Implementing Entity will ensure that use of backpack camps is adequately supervised and controlled, and may implement a reservation and permitting process for use of backpack camps.
- The no more than four new staging areas will be developed only in areas within preserves that are already disturbed and not suitable for habitat restoration, and that do not contribute to the conservation objectives for covered species habitats and natural communities. Sites at the edges of preserves will be chosen over sites on the interior of preserves.
- Public access to caves, abandoned mines, or abandoned structures will be prohibited to maintain habitat for Townsend's western big-eared bat and reduce liability. Management of caves, mines and structures may be necessary periodically to maintain bat habitat and to protect public safety.

- No motorized vehicles or boats will be allowed in preserves, except for use by the preserve manager or with the prior approval of the preserve manager (e.g., contractors implementing HCP/NCCP conservation measures such as habitat restoration and monitoring, grazing tenants, fire-suppression personnel, and maintenance contractors). For preserves under conservation easements, vehicle use will be allowed as part of the regular use of the land (e.g., agricultural operations, permanent residents, utilities, police and fire departments, other easement holders), as specified in the easement.
- When compatible with HCP/NCCP biological goals and objectives, dogs may be allowed in daylight hours in designated preserves or in designated areas of preserves but only on leash. Leash laws will be strictly enforced by preserve managers and staff because of the potential impact of dogs on biological resources, including covered species such as San Joaquin kit fox, western burrowing owl, Alameda whipsnake, and California red-legged frog. Leash enforcement may include citations and fines. Dogs used for herding purposes by grazing lessees must be under verbal control and show proof of vaccination.
- Recreational hunting or fishing within preserves will be prohibited. However, hunting for management purposes (e.g., feral pigs, bullfrogs) is encouraged where it will contribute to achieving the goals and objectives of the HCP/NCCP. The Implementing Entity will coordinate with CDFG to develop hunting protocols.
- Public collecting of native species will be prohibited within preserves.
- Introduction of domestic or feral animals, including ducks, fish, reptiles, and any exotic, non-naturalized species, is prohibited within the preserves to prevent interference with and mortality of native species, except by the preserve manager for management purposes.
- Trails will be established on existing roads or trails wherever possible to minimize the need for new ground-disturbing activities and to reduce new and ongoing maintenance costs.
- New trails will be sited to minimize impacts on sensitive species (including covered species) and communities including covered species, as well as disturbance to adjacent landowners and land uses. Wetlands will be avoided, and trails through woodland or riparian habitat will not require tree removal or substantial pruning.
- Recreational uses will be controlled using a variety of techniques including fences, gates, clearly signed trails, educational kiosks, trail maps and brochures, ranger and police patrols, and interpretive programs.
- Construction of recreational facilities within preserves will be limited to those structures necessary to directly support the authorized recreational use of the preserve. Existing facilities will be used where possible. Facilities that support recreation and that may be compatible with the preserve include parking lots (e.g., small gravel lots), trails, educational and informational kiosks, up to one visitor center located in a disturbed or non-sensitive area, and restroom facilities located and designed to have minimal impacts on

habitat and waters. Playgrounds, irrigated turf, off-highway vehicle trails, and other facilities that are incompatible with the goals and objectives of this HCP/NCCP will not be constructed.

- Signs and informational kiosks will be installed to inform recreational users of the sensitivity of the resources in the preserve, the need to stay on designated trails, and the danger to biological resources of introducing wildlife or plants into the preserve.
- New trails will not be constructed through chaparral patches in order to minimize disturbance to and prevent mortality of Alameda whipsnakes and reduce the likelihood of wildfire ignition. If possible, existing trails through chaparral should be rerouted around chaparral patches.
- The Implementing Entity will prohibit or limit bicycle use on trails within 500 feet of core habitat for Alameda whipsnake to minimize impacts on this species.
- Trails, picnic areas, and backpack camps will be closed between January 15 and August 1 within 0.5 mile of active golden eagle nests to prevent disturbance or harassment.
- Trails, picnic areas, and backpack camps will be prohibited within 300 feet of wetlands and streams that provide suitable habitat for covered amphibians or tricolored blackbird.
- When compatible with HCP/NCCP biological goals and objectives, recreation plans for preserves adjacent to existing public lands will try to ensure consistency in recreational uses across open space boundaries to minimize confusion among the public. Preserves adjacent to non-HCP/NCCP public lands with different recreational uses will provide clear signage to explain these differences to users that cross boundary lines.
- Preserves will be closed to all recreational uses until a recreation plan for the Preserve System is developed and approved by the Implementing Entity Governing Board, CDFG, and USFWS. If recreational activities will occur near aquatic features, then EPA and USACE will be asked to comment on the plan.

Exceptions to the guidelines listed above will be considered by the Implementing Entity on a case-by-case basis and will also require approval of the CDFG and USFWS.

At a minimum, the recreation plan will contain the following elements:

- Identification of sites within preserves where recreational use is compatible with the goals and objectives of the HCP/NCCP.
- Maps of existing and proposed recreational trails, staging areas, and facilities and of habitat types impacted.
- Site-specific methods of recreational use controls.
- Trail and use monitoring methods, schedules, and responsibilities.

- A framework for enforcement of recreational restrictions.
- An evaluation of whether the impact of planned recreational use is below the limits set in the EIR/EIS, and whether planned recreation is compatible with the biological goals and objectives of the HCP/NCCP.
- Clear triggers for use restrictions or closure based on sensitive biological indicators (e.g., seasonal closures of some trails based on covered or sensitive species activity periods).

The recreation plan will be prepared within no more than 3 years after acquisition of the first parcel or when 25% of the Preserve System has been acquired, whichever comes first. Recreation will not be allowed on HCP/NCCP preserves until a recreation plan has been prepared and adopted for that site by the Implementing Entity, CDFG, and USFWS, unless the preserve has a pre-existing recreational use, in which case a recreation plan must be approved within 1 year in order for the site to continue to be considered part of the Preserve System. The recreation plan will be revised as needed as the Preserve System expands. Formal evaluations and revisions, if needed, must occur at least every 5 years.

### **Rationale**

Recreational uses may have impacts on biological resources, including vegetation communities and covered species. However, the societal benefit of recreational uses within limited areas of the preserves justifies accepting some minimal level of impact on these resources. Allowing limited recreational use within preserves will broaden the appeal of this HCP/NCCP; such access can be an important tool in educating the public about the value of protecting and properly managing biological resources. An educated and supportive public is essential for securing additional funds for HCP/NCCP implementation.

Recreational users who understand the sensitivity of the resources in the preserves may help patrol the preserves and provide valuable assistance to preserve managers in ensuring that users follow the rules. Responsible users can also become volunteers to assist preserve managers in maintaining preserves (e.g., trail maintenance) and in complying with the terms of the HCP/NCCP (e.g., covered species monitoring and habitat stewardship). This involvement may reduce the overall cost of HCP/NCCP implementation.

Recreation within HCP/NCCP preserves is limited to low-intensity uses because of the primary function of the preserves as habitat for covered species. A wide variety of recreational opportunities are already available in rural parks throughout the inventory area; these include Black Diamond Mines, Round Valley, and Morgan Territory Regional Preserves; Contra Loma Regional Park; Mount Diablo State Park; and the Los Vaqueros Watershed. These parks and open spaces total over 35,000 acres within the inventory area. Any funds generated as a result of recreational activities will be invested in the preserve system.

## 5.3.2 Natural Community–Level Conservation Measures

### Multiple Communities

#### Conservation Measure 2.1. Enhance, Restore, and Create Land Cover Types and Species Habitat

Enhancement is required for all land cover types on all acreage, where appropriate, to improve the function of natural communities, maintain or increase populations of covered species, and promote native biological diversity within the preserves. Enhancement will be accomplished through the conservation measures listed in Table 5-18.

Restoration or creation is also required for impacts on some land cover types to ensure no net loss of these land cover types, to replace the functions of natural communities and species habitat lost to covered activities, and to contribute to the recovery of covered species. These requirements are in addition to the preservation requirements described in Conservation Measure 1.1. Table 5-18 lists the type of compensation that is required for each land cover type. An important goal of enhancement, restoration, and creation is to create self-sustaining natural systems with minimal artificial inputs (e.g., supplemental water, pesticides, exclusion fencing, artificial perches and burrows).

Land cover restoration or creation will be conducted for land cover types that have been lost or seriously degraded due to past activities, and for which restoration is feasible and success has been demonstrated elsewhere: oak savanna, riparian woodland/scrub, wetlands, and streams (Table 5-18). Where restoration is infeasible, in-kind or out-of-kind/like-function creation of land cover types is required.

Restoration and creation will be accomplished in two ways. The Implementing Entity will be required to compensate for impacts of covered activities on specific land cover types through either restoration or creation at the ratios listed in Tables 5-16 or 5-17 for the initial urban development area or maximum urban development area, respectively. These ratios were determined on the basis of current regulatory standards for compensation and the likelihood and time requirements of successful restoration. For example, oak savanna, riparian woodland/scrub, perennial wetlands, and ponds have ratios of 1:1 because replacement of these land cover types is relatively simple, techniques are reliable, and there is a high likelihood of success. Other factors were considered such as required preservation ratios and restoration for species recovery (see below). Ratios for alkali wetland and seasonal wetland are 2:1 because these land cover types are rare in the inventory area, so compensation should be undertaken at a higher ratio to offset losses. Required restoration ratios for all wetland land cover types and oak savanna will apply at the end of the vegetation-establishment

period (i.e., compliance with required ratios will be assessed once restoration has met its success criteria, see Table 5-2).

The actual acreage of compensatory restoration or creation needed will be determined through planning surveys conducted at project sites to determine the actual extent of impacts (see Chapter 6, *Conditions on Covered Activities*). The Implementing Entity will also restore or create land cover types to contribute to the recovery of covered species. Tables 5-16 and 5-17 list the acreage requirements for recovery contributions that are required in addition to compensatory habitat restoration and creation.

Land for the preserve system will be acquired that includes areas suitable for restoration or creation as specified in the Conservation Strategy. Restoration and creation will be designed within preserves to meet the goals and objectives for each relevant habitat and covered species. Land cover restoration and creation will increase habitat for specific life history requirements of covered species. Sites selected for restoration will support soils and topography suitable for restoring the target land cover type that was historically present at the site. Restoration and creation will be designed and constructed to avoid or minimize direct or indirect impacts on existing functioning habitat for covered species.

All habitat enhancement activities will be conducted within HCP/NCCP preserves. Restoration and creation of habitat will also be conducted in HCP/NCCP preserves except in rare instances. If no suitable sites are present or actions are not biologically practicable in HCP/NCCP preserves (e.g., because they may substantially adversely affect habitat for a covered species), then restoration and creation may be conducted on lands in the inventory area permanently protected for conservation (e.g., owned by EBRPD, CDP, CCWD, or a local land trust, or on a private mitigation bank<sup>20</sup>). Such habitat restoration and creation sites must be located in areas of existing protected lands that are managed consistently with HCP/NCCP Preserve System principles. To allow restoration to occur on lands outside the HCP/NCCP Preserve System, the Implementing Entity will enter into a binding agreement with the landowner ensuring that management of the area surrounding the restoration site will continue to be consistent with the HCP/NCCP. The Implementing Entity may share management responsibilities of the site and must maintain access in order to monitor restoration development. Habitat restoration and creation on existing protected lands (i.e., outside the HCP/NCCP Preserve System) will be funded by the Implementing Entity. (Project proponents may also fund habitat restoration or creation directly according to the terms described in the section *Wetland Mitigation Fee* in Chapter 9.) Responsibilities for ongoing management and monitoring of these sites will be determined on a case-by-case basis but will always be funded by the Implementing Entity. Every effort will be made to find suitable restoration or creation sites in HCP/NCCP preserves.

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<sup>20</sup> See Chapter 8, *Plan Implementation*, for more details on when private mitigation banks can be used for credit under the HCP/NCCP.

Restoration or creation conducted as mitigation for impacts must stay ahead of impacts, just as land acquisition must stay ahead of impacts (see Section 8.6.1). Restoration or creation that contributes to recovery effects can be implemented at any time. Restoration or creation conducted to mitigate impacts must be initiated so that mitigation requirements are ahead of impacts on each land cover type by at least 5%. Measurement of this stay ahead provision will begin 2 years after permit issuance to allow the Implementing Entity to establish the HCP/NCCP Preserve System and initiate land cover restoration and creation, provided that actual restoration and creation may never lag requirements by more than 20 acres. For example, if after 5 years, impacts on oak savanna total 10 acres, the Implementing Entity must have initiated at least 10.5 acres of oak savanna restoration. If restoration or creation cannot keep pace with impacts, then impacts cannot be permitted under the HCP/NCCP.

As described in the preserve assembly measure (Conservation Measure 1.1), a major focus in Zone 6 is acquisition of land along Marsh Creek, Kellogg Creek or adjacent to Dutch Slough to provide opportunities for restoration of riparian woodland/scrub. Most of the riparian woodland/scrub restoration required by this Plan is expected to occur on these sites (see Figures 5-2 and 5-3). The Implementing Entity must also consider investing habitat restoration effort on Dutch Slough. According to preliminary assessments, there are opportunities for extensive restoration on the site for wetland and upland habitat consistent with the restoration requirements of this Plan (see Conservation Measures 2.1, 2.3, 2.7, and 2.10) including seasonal marsh and floodplain (137 acres), mixed riparian-oak woodland (82 acres), and emergent marsh (224 acres) (California Coastal Conservancy 2002). The Implementing Entity could contribute significantly to the goals of the Dutch Slough project and help meet HCP/NCCP requirements for restoration. Several covered species have been observed on or near Dutch Slough, including Swainson's hawk, western pond turtle, and silvery legless lizard; the site also provides suitable habitat for giant garter snake. Restoration at this site could enhance habitat for these covered species.

Restoration procedures and guidelines for specific vegetation communities are found in the conservation measures listed in Table 5-18. Restoration actions are covered activities because some of the restoration techniques are expected to have temporary adverse impacts on covered species and may result in take of these species. Mitigation for these impacts is included in the conservation strategy.

Almost all restoration or creation projects within the Preserve System are expected to be completed (i.e., reach project success criteria) within the permit term (30 years) because

- almost all restoration or creation is linked to impacts of covered activities,
- most impacts are expected within the first half of the permit term,
- restoration projects must be started before impacts occur, and
- most restoration projects are expected to reach success criteria within 5 years of construction.

Oak savanna restoration may take up to 50 years to reach maturity, which is well outside the permit term. However, no covered species are dependent on oak trees, or the restoration of this land cover type. Instead, oak savanna restoration is included to comply with NCCP requirements for natural communities. See Conservation Measure 2.6 for more details.

## Wetlands and Ponds

### Conservation Measure 2.2. Manage Wetlands and Ponds

Wetlands and ponds within HCP/NCCP preserves will be managed to increase hydrogeomorphic and ecological functions, and improve habitat for covered species (see Conservation Measures 2.9 and 2.10 for measures related to streams and riparian woodland/scrub). A variety of management techniques will be applied to wetlands within the preserves. Conservation measures to be applied will depend on the type, location, extent, and condition of the wetlands as determined by the wetland delineation conducted in accordance with Conservation Measures set forth in Chapter 6, *Conditions on Covered Activities*. Wetland enhancement measures must be designed for specific wetland types (i.e., hydrogeomorphic context) and, in some cases, for specific sites. As described below, the success of various techniques depends on the wetland type and the site conditions under which they are applied. Wetlands that are highly degraded may require more intensive management. Wetlands already in good condition (e.g., that support populations of covered species) may require little or no enhancement measures. The biological goal and objectives are as follows:

**Goal: Maintain and enhance hydrogeomorphic and ecological function of wetlands and ponds to promote covered species, native biological diversity, and habitat heterogeneity**

- **Maintain or increase native emergent vegetation, where appropriate**
- **Reduce sediment deposition and transport where appropriate**
- **Maintain or increase wetland and pond capacity and water duration as appropriate**
- **Maintain or increase flows to and connectivity among wetlands and wetland complexes as appropriate**
- **Eliminate or reduce non-native animals**
- **Eliminate or reduce exotic plants**
- **Maintain or enhance upland habitat adjacent to wetlands and ponds to support the life-history requirements of wetland-dependent covered species**

#### **Establish Baseline Conditions**

Wetland delineations will be required in all impact areas in order to quantify the impacts on jurisdictional wetlands and waters. Similarly, wetland delineations

are required within all preserves in order to demonstrate that the preservation requirements of the HCP/NCCP, as well as those of the regional wetlands permitting programs that will be developed from it, are being met. Wetlands within preserves will also be surveyed to determine whether they support covered aquatic or amphibian species or have the potential to support these species. In addition, stockponds will be assessed to determine if they maintain water in typical rainfall years for periods sufficient to support aquatic life stages of California tiger salamander or California red-legged frog.

### **Guidelines for and Uncertainties in Applying Management Techniques**

The techniques listed below may be employed to enhance and manage wetlands; however, this is not an exhaustive list.

- Where appropriate, minimize grazing pressure to reduce trampling of vegetation, soil compaction, development of “cow contours,” and bank destabilization. Livestock surrounding wetlands and ponds should be managed to maintain and enhance upland breeding, aestivation, and hibernation habitat for wetland- and pond-dependent species such as California red-legged frog, California tiger salamander, and western pond turtle.
- Introduce grazing to some areas to eliminate or reduce cover of exotic plants when such a technique is consistent with maintaining values for covered species. Grazing rotation can also reduce the erosive impacts described above.
- Install fencing around some wetlands and upland buffers to permanently or temporarily exclude livestock and feral pigs.
- Where exotic fish and bullfrogs are present, stockponds and other wetlands can be drained (in concert with summer dry-season cycles) and subsoil removed or sterilized to eliminate these species and improve the wetland or pond’s long-term suitability for covered aquatic species and amphibians. Some pond bottoms could be sealed with a liner to prevent recolonization by exotic bullfrogs. This procedure will kill any native amphibians aestivating in the pond, but it is expected that native amphibians aestivating in adjacent uplands should recolonize the pond. This technique is being used effectively by EBRPD (S. Bobzein pers. comm.) but should be used only when less disruptive techniques are ineffective.

Repairs could be made to improve water retention in stockponds that are not functioning properly or not retaining water due to leaks; additionally, stockpond capacity and water duration can be increased (e.g., by raising spillway elevations) to support salamander and frog populations.

- Where severe incision of sloughs/channels results in erosion and high sediment loads, floodplain disconnection, bank destabilization, or groundwater subsidence, geomorphically appropriate check dams can be placed to stabilize the channel’s longitudinal profile, reduce erosive flow velocities, arrest further channel incision, and encourage in-channel sediment storage. Banks can be stabilized by biorestoration techniques including live

vegetation, brush-matting, vegetated soil lifts, root wad structures, and other techniques that can be used in combination with grade control structures.

- Where artificial fill, debris, or other structures have been deposited/built in channels, floodplains, or other wetland flow pathways, these materials can be removed to enhance wetland areas and improve hydrologic functioning.
- Culverts will be evaluated in terms of their operation/function and hydrologic/erosive impacts; poorly functioning culverts or culverts that block passage of native species will be repaired, retrofitted, or stabilized.
- In conjunction with controlling exotic plants in permanent marshes and ponds, native emergent vegetation can be planted to improve habitat values for some covered species (e.g., provide substrate for amphibian egg attachment, cover for amphibian larvae, roost and nest sites for tricolored blackbirds where the wetlands are located near foraging habitat). Enhancement of these habitats must be balanced with the need to minimize mosquito production (see below).

Ten covered species are dependent on wetlands and ponds in the inventory area. Conflicts may arise when managing for multiple species and habitats. For example, California red-legged frog and California tiger salamander have different habitat requirements (see species profiles in Appendix D), which are not necessarily compatible at the same site. Management techniques should be implemented to address the needs of covered species already at the site, and to enhance populations of all wetland-dependent covered species in the Preserve System. Many of these techniques are described in detail in the program designed for similar enhancement measures in the Los Vaqueros Watershed (Jones & Stokes Associates 1993b). Successful elements of this program can be incorporated into Preserve System management.

Wetland enhancement will be developed and implemented in coordination with the Contra Costa Mosquito and Vector Control District (CCMVCD) to ensure that enhanced wetlands do not substantially increase mosquito populations in the preserves and threaten human health. CCMVCD staff will have reasonable access to all wetland sites of concern to monitor mosquito populations and control these populations if warranted. Before applying control techniques within the HCP/NCCP Preserve System, CCMVCD, the Implementing Entity, CDFG, and USFWS will agree to acceptable treatments (i.e., techniques, application rates, timing of application). Control techniques currently used by CCMVCD include biological control (adding fish such as Sacramento perch, mosquitofish [*Gambusia* sp.], or others); water management; vegetation management; and chemical application (Malamud-Roam pers. comm.). The period of concern for mosquito production (primarily *Culex torsalis*) in the inventory area is mid-July through late September or October, depending on the start of the rainy season. Seasonal wetlands that dry prior to this period (e.g., vernal pools, small ponds) are not a concern for mosquito production.

Once wetlands restored or created under Conservation Measure 2.3 reach their success criteria, they will be brought under the wetland enhancement and management program.

### **Rationale**

Fencing wetlands on Los Vaqueros Watershed lands has been shown to be a rapid, successful, and cost-effective method of enhancing some wetlands. After fencing, vegetation cover and wetland species diversity can increase substantially in stockponds and other permanent or near-permanent freshwater wetlands that have been degraded by cattle grazing (Contra Costa Water District 2002). In this HCP/NCCP, fencing locations and specifications will depend on several factors, including site-specific conditions and the biological objectives that are being addressed. For example, fencing wetlands may not be appropriate in some locations, because promoting dense vegetation may adversely affect some aquatic species, such as California tiger salamander (Bobzien pers. comm.).

In studies at Los Vaqueros, livestock exclosures were found to benefit seasonal alkali wetlands in the short term. After 1 year, the relative cover, species richness, and species diversity of native target plants was greater in exclosures than immediately outside them (Jones & Stokes 1992b). The positive trend, however, was not statistically significant, suggesting that improvements in this vegetation community will be gradual and that further research is necessary.

Upstream factors that may have contributed to the decline of seasonal wetlands in the inventory area include hydrologic changes that led to channel incision, changes in channel runoff, hydrologic disconnection of channel and floodplain, lowering of groundwater, and reduction of soil moisture in riparian areas (Jones & Stokes Associates 1992b). A variety of methods/approaches are available to arrest channel incision. For example, grazing management and fencing can be used to curtail negative hydrologic effects. Check dams have been shown to be effective at arresting channel erosion in seasonal alkali wetlands in the Los Vaqueros Watershed within 6 months of dam installation (Jones & Stokes Associates 1992b). Over time, such small dams may also increase the recharge of the local aquifer, raising the water table and increasing soil moisture levels near the surface. This effect could, in turn, increase the cover and extent of seasonal wetland vegetation along stream channels.

### **Conservation Measure 2.3. Restore Wetlands and Create Ponds**

In addition to the avoidance and minimization measures discussed in Chapter 6 and the enhancement approaches of Conservation Measure 2.2, the Implementing Entity will restore wetlands and create ponds in HCP/NCCP preserves according to the requirements in Tables 5-16 and 5-17. Compensation for impacts on wetlands or ponds will be accomplished through restoration of wetland land cover types at ratios of either 1:1 or 2:1, as well as through creation of ponds at a ratio of 1:1 (Tables 5-16 and 5-17). The Implementing Entity will also restore or create wetland and pond land cover types to contribute to the recovery of California red-legged frog, California tiger salamander, western pond turtle, tricolored blackbird, and covered vernal pool invertebrates. Guidelines for wetland restoration and pond creation include the following:

- Provide a net increase of wetland and pond area, functions, and values in the inventory area. See Appendix J for a detailed discussion of the function and values of aquatic resources in the inventory area by watershed and subwatershed.
- Compensate for the temporal loss of wetland and pond functions with preservation of in-kind wetlands (Conservation Measure 1.1) while wetland restoration or creation projects are implemented and restored wetlands are developing their full functions. Applicants for coverage under the HCP/NCCP who fill jurisdictional wetlands and waters will require separate permits from USACE, RWQCB, or CDFG for authorization to fill those waters. These agencies may require additional mitigation for these permits, although it is the intent of the HCP/NCCP to incorporate any foreseeable requirements of these agencies to avoid the need for additional mitigation.
- Implement in-kind restoration of wetlands and ponds in preserves where technically feasible and where restoration would avoid significant effects on existing biological resources.
- Where in-kind restoration is not technically feasible as determined by the Implementing Entity in consultation with appropriate agencies, wetland restoration will be achieved out-of-kind using a system of wetland functional units to ensure that functions of restored wetlands are greater than the functions of wetlands lost (Appendix J; Jones & Stokes Associates 1993b, 1994).
- All wetlands and ponds restored or created will be designed to support covered aquatic or amphibian species when physical and biological conditions allow.
- All restoration actions will avoid take of migratory birds and their eggs and nests according to the restrictions of the Migratory Bird Treaty Act.
- When feasible, reduce mosquito production by designing wetlands to minimize suitable habitat for *Culex tarsalis* and other human disease vectors. Provide reasonable access for CCMVCD staff to monitor and control mosquitos at wetland sites when warranted and consistent with an agreement between the Implementing Entity and CCMVCD.

### **Guidelines for Selecting Restoration Sites**

Potential restoration sites will be identified and selected on the basis of their physical processes and hydrologic, geomorphic, and soil conditions to ensure that successful restoration can occur and be self-sustaining. Such an approach increases the likelihood of successful restoration and reduces long-term management and maintenance costs.

Restoration sites will be selected within the same watershed as the expected wetland impacts, when feasible. This prioritization will ensure that wetland mitigation occurs close to the impact area and preserves and enhances watershed functions. Smaller watersheds in the western portion of the inventory area (e.g., Kirker Creek, Willow Creek) will not support wetland restoration equivalent to expected impacts in those watersheds.

Restoration sites will also be selected based on their ability to support covered species, support implementation of species-specific conservation measures, and meet species-specific biological goals and objectives. For example, sites designed to support tricolored blackbird should be located a sufficient distance away from black-crowned night-heron rookeries to minimize predation on tricolored blackbird (see Conservation Measure 3.2). Sites designed to support breeding habitat for covered amphibians must have adequate upland habitat for aestivation nearby. Restoration sites for aquatic land cover types must meet minimum distances from dense urban development (Table 5-6) to receive credit under this Plan.

### **Restoration and Creation Principles and Techniques**

Wetland restoration or pond creation will be accomplished using the techniques outlined in this section and described in detail in the conceptual wetland restoration program being implemented for the Los Vaqueros Reservoir project (Jones & Stokes Associates 1993b, 1994; Contra Costa Water District 2001a, 2001b). Restoration/creation principles and rationales for each aquatic land cover type are described below.

**Alkali wetlands.** The Implementing Entity will restore alkali wetlands at a ratio of 2:1 (estimated to be 62 acres of compensation for alkali wetland complexes<sup>21</sup> with the maximum urban development area) and restore an additional 5 acres of alkali wetland, including alkali meadows and alkali marshes, to contribute to species recovery (Table 5-17) (Jones & Stokes Associates 1989). Restoration will occur on suitable alkaline soils that have been degraded by disturbances such as overgrazing or cultivation and that previously supported wetlands. Historic photos and other historic records will be used to determine the former extent and type of alkali wetlands present on potential sites. A key requirement for alkali wetlands is the seasonal delivery of surface flows or shallow subsurface flows that support the wetland environment. Structural flow impediments and channel incision have historically altered flow delivery to such wetlands. Restoration programs have been designed for a large alkaline wetland complex in Alameda County and the city of Livermore (H. T. Harvey & Associates 2000; Jones & Stokes 2001) that is similar to those found in the inventory area; these designs, although untested, may be used as models.

**Seasonal wetlands.** The Implementing Entity will restore seasonal wetlands at a ratio of 2:1 (estimated to be 143 acres<sup>22</sup> of compensation with the maximum urban development area) and restore an additional 20 acres of seasonal wetlands to contribute to species recovery (Table 5-17). Whenever possible, seasonal wetland restoration will be designed to support one or more covered invertebrates

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<sup>21</sup> Actual acreage of alkali wetland compensation required is expected to be much less than 62 acres because alkali wetland impacts and required compensation will be tracked based on jurisdictional boundaries in the field. This land cover type was mapped at a regional scale using wetland complexes rather than site-specific (and smaller) jurisdictional wetland boundaries.

<sup>22</sup> Actual acreage of seasonal wetland compensation is expected to be much less than 143 acres because seasonal wetland impacts and compensation will be tracked based on jurisdictional boundaries in the field. This land cover type was mapped at a regional scale using wetland complexes rather than site-specific (and smaller) jurisdictional wetland boundaries.

in habitats such as vernal pools. Northern claypan vernal pools are a unique type of seasonal wetland that occurs in unique hydrologic, soil, and geologic conditions that need to be carefully considered for any restoration effort. Restoration of vernal pools must occur within suitable areas that have been severely degraded. Restored vernal pools will be evaluated to determine if covered plants and vernal pool invertebrates are present at frequencies similar to natural vernal pool complexes.

**Ponds.** The Implementing Entity will create ponds in preserves at a ratio of 1:1 (estimated to be 8 acres of compensation with the maximum urban development area) and create an additional 8 acres of ponds to contribute to species recovery (Table 5-17). Ponds will be created to support breeding habitat for California red-legged frog, California tiger salamander, or western pond turtle. Created ponds will be sited away from busy roads to reduce the likelihood of mortality during periods when frogs, turtles, and salamanders move between ponds and uplands. Pond depth will be sufficient to provide suitable breeding habitat for red-legged frogs or tiger salamanders and to preclude dense growth of emergent aquatic vegetation. Pond size will vary depending on the availability of water and site and watershed conditions. Also, ponds will be created so that they can be drained if necessary to control bullfrogs and other invasive (exotic) animals.

In some cases, ponds can be created by installing small check dams along streams. However, this could cause the destruction of valued stream habitat. Identification of potential pond sites should include an appraisal of the existing stream habitat. Existing well-functioning stream habitat should not be used for pond creation, if the construction would lessen the functioning of the stream. For streams that are not well-functioning, stream restoration (see Conservation Measure 2.10) should be the first priority and pond creation should only be considered if no practical off-stream alternative exists. Any proposal to discharge fill into jurisdictional wetlands and waters could require permits from USACE, RWQCB, and CDFG (see Chapter 1). If pond creation is permitted, then the approved sediment management measures must be followed to maintain the pond in the long term. Upstream in-channel measures and small forebays can be used to reduce sediment delivery to the created ponds.

Ponds will be designed so that they either do not retain water long enough to support establishment of bullfrog, nonnative fish, or other predators of California red-legged frog and California tiger salamander, or can be artificially drained to deter such establishment. At the same time, they will be designed to remain ponded for sufficient duration to support successful breeding of California red-legged frog and/or California tiger salamander. Native emergent and aquatic vegetation will be planted in ponds to provide suitable breeding habitat for these covered species.

**Perennial wetlands.** The Implementing Entity will restore perennial wetlands in preserves at a ratio of 1:1 to replace all functions and values lost to covered activities (estimated to be 75 acres of compensation under the maximum urban development area) and restore an additional 10 acres of perennial wetlands to contribute to species recovery (Table 5-17). Restoration will occur on suitable

soils and in areas where perennial wetlands historically occurred and have since been drained or severely degraded. Restoration may include recreating the historic topography of the site and planting native freshwater emergent and aquatic plants. At least 25% of restored perennial wetlands will support breeding habitat for tricolored blackbird and will be sited within flight distance of blackbird foraging habitat. Credit will be given toward perennial wetland restoration for perennial wetlands established as a result of the creation of ponds described above (i.e., creation of ponds with emergent wetland vegetation).

**Sloughs/channels.** Impacts on sloughs and channels will be compensated by restoration of slough/channel at a ratio of 1:1, where feasible, or restoration of riparian woodland/scrub at a ratio of 1:1. There are limited opportunities for in-kind compensation of impacts to slough/channel in the HCP/NCCP Preserve System. Restoration of slough/channel to benefit giant garter snake will be considered within the Dutch Slough restoration project (Subzone 6a). If the Implementing Entity acquires land adjacent to Dutch Slough (see Conservation Measure 1.1), slough/channel restoration to benefit giant garter snake could also occur there.

If no opportunities exist for in-kind compensation, it is estimated that the Implementing Entity will restore an additional 72 acres of riparian woodland/scrub under the maximum urban development area scenario in existing streams and channels that historically supported riparian woodland/scrub vegetation (in addition to riparian vegetation restored to compensate for losses of riparian habitat) (Table 5-17). Lost sloughs or channels may be difficult to re-create because of the constraints of existing agricultural operations and the difficulty of creating the topographic and hydrologic conditions to support them. By replacing lost sloughs and channels with riparian woodland/scrub, there will be a net increase in high-quality habitat for covered species and biological diversity. Any sloughs or channels supporting giant garter snake will be addressed in accordance with Conservation Measure 3.6.

**Open water.** Impacts on open water (aquatic land cover) will be compensated by the creation of additional ponds at a ratio of 0.5:1 to support breeding habitat for California red-legged frog, California tiger salamander, western pond turtle, and tricolored blackbird. Restoration or creation of large bodies of open water is not required because this land cover type provides limited values to wildlife. Under the maximum urban development area, it is estimated that the Implementing Entity will create 6 acres of additional ponds to offset open water impacts.

## Grassland

### Conservation Measure 2.4. Manage Grassland

Native grasslands will be enhanced in the preserves by using techniques tailored to the grassland type (i.e., the vegetation alliance) and the site. All stands of grasslands with at least 25% relative cover of native species (grasses or forbs) will be mapped within the preserves to identify areas suitable for special

management practices to maintain and enhance the proportion of native grass cover. Each grassland stand will be classified to the alliance level according to the CNDDB vegetation classification scheme (California Natural Diversity Database 2002).

Grassland communities in the inventory area are complex and occur at all spatial scales. There is also uncertainty about the proper management regime necessary to maintain this complexity and enhance each grassland vegetation alliance. To determine the best management strategy, pilot studies will be initiated on small scales to determine the feasibility of enhancement activities on a larger scale. The pilot studies will utilize a research design that addresses management actions to promote native grassland species. The pilot studies will be conducted as part of the Monitoring and Adaptive Management Program (see Chapter 7).

If monitoring demonstrates that the treatments are effective at increasing the relative cover of native grasses and forbs, the preserve manager should evaluate whether these treatments can be applied to the entire stand of the grassland vegetation alliance to achieve enhancement objectives of grassland on a larger scale. In some cases, management regimes could be shifted in time, location, or intensity to achieve these objectives (or at least to partially achieve them). In other cases, large-scale application of the techniques may not be feasible due to their environmental impacts or hazard risk. This evaluation must be done on a case-by-case basis in which the expected benefits of the techniques to grassland are weighed against the environmental impact, risk, and increased cost of applying the technique on a larger scale. The biological goal and objectives are as follows:

**Goal: Enhance grassland to promote native biological diversity and habitat heterogeneity.**

- **Increase the relative cover of native grasses and forbs in native grassland vegetation alliances and other grassland types**
- **Increase structural diversity by creating and maintaining a mosaic of grassland types and conditions**
- **Reduce the biomass, cover, and extent of exotic plants (i.e., non-native invasive plants) in the Preserve System**

**Guidelines and Uncertainties in Applying Management Techniques**

Techniques that could be used to enhance grassland include but are not limited to those listed below.

- Livestock grazing, including variation in timing, frequency, intensity, grazer;
- Prescribed burning,
- Mowing and mulching,
- Supplemental seeding,
- Raking,

- Herbicide application (herbicide application is not a covered activity under the ESA permit),
- Grazing exclusion,
- Combination of techniques across different temporal or spatial scales.

Enhancing grasslands within HCP/NCCP preserves will likely require applying many of these management techniques simultaneously at different sites and on different scales in order to create a mosaic of grassland conditions. Applying different management techniques across different spatial and temporal scales will maximize habitat heterogeneity across the landscape and will tend to increase native biological and structural diversity (Fuhlendorf and Engle 2001). For example, the buildup of dead plant material, or thatch, has been implicated in the suppression of native annual forbs in unmanaged wet grasslands in California (Hayes and Holl 2003). Techniques to reduce thatch (e.g., livestock grazing, prescribed burning, raking) should be applied only where the treatment is expected to benefit native grassland species.

Managers must consider the impacts of management treatments on other covered species. For example, if burns occur within Alameda whipsnake habitat, burning in September, October, or November may be compatible with whipsnake protection goals (Jones & Stokes Associates 1992a; Swaim pers. comm.). Ongoing research within the inventory area includes experimental burns to determine the effects of this management tool on Alameda whipsnake (Swaim pers. comm.). Management treatments may affect covered plants in both positive and negative ways (Gillespie and Allen 2004), so it is important to monitor several life stages to determine the net effect of management actions.

Site conditions (both physical and biological) and land use history will be important in developing appropriate management techniques to attempt to enhance native grassland alliances (Hamilton et al. 2002). For example, in the Los Vaqueros Watershed, native grasslands occur primarily on steep north- or east-facing slopes where soil moisture tends to be higher (Jones & Stokes Associates 1989). Management strategy at these sites will differ from sites on more level topography and drier, south-facing slopes. Huntsinger et al. (1996) showed that different populations of purple needlegrass may respond differently to the same treatments of grazing or burning. Bunchgrass stands in areas that have been cultivated may require more intensive management than stands outside cultivated areas (Hamilton et al. 2002). Management techniques to increase the cover of native perennial grasses will likely be most successful in areas that already have a substantial proportion of native perennial grass cover.

Livestock grazing is an important management tool currently used in the inventory area on a regional scale by land management agencies (e.g., EBRPD) to enhance vegetation, and reduce the biomass and spread of exotic plants. Grazing is an important economic and cultural activity in the inventory area that can be consistent with good stewardship of grassland and oak woodland communities. In general, moderate livestock grazing can benefit many plants and animals, including covered species. After extensive fieldwork in the Los

Vaqueros Watershed, biologists have observed that many special-status wildlife species either benefit by grazing or are unaffected by it (Jones & Stokes Associates 1989, 1992a; Contra Costa Water District 1993; Brady & Associates 1996). For example, moderate intensities of livestock grazing tends to increase densities of California ground squirrels (Fitch 1948; Jones & Stokes 1992c), which in turn benefits San Joaquin kit fox, western burrowing owl, California tiger salamander, and California red-legged frog among other species.

The flora of the East Bay evolved under the influence of prehistoric herbivores, large herds of deer, elk, antelope, and other grazing animals. At present, livestock grazing utilizing cattle, sheep and goats can be useful as a vegetation-management tool to maintain and improve habitat conditions for resident plants and animals and to reduce fuel loads for wildfires. Animals have different preferences and abilities to be selective grazers and therefore have different impacts on vegetation. Sheep and goats are the most selective, followed by horses and then cattle. Management plans should take these differences into consideration. Livestock grazing may be compatible with the maintenance and even the enhancement of native plant communities, including some native grassland associations. For example, moderate grazing levels may help to maintain purple needlegrass (Menke 1992).

Grazing in certain native grassland communities, however, may be inappropriate or may need to be reduced to maintain or enhance these communities. For example, five approximately 0.2-acre grazing exclosures were established in 1991 in alkali vegetation communities and alkali scalds in the Los Vaqueros Watershed (Jones & Stokes 1992b). The results of this experiment suggest that alkali grasslands and meadows interspersed with barren scalds respond quickly to the exclusion of grazing through increases in native plant biomass, density, and species diversity.

Warm-season (late spring and fall) prescribed burning has been effective in some areas at increasing the cover of native species in grasslands and reducing the cover of exotic species (Menke 1992; Meyer and Schiffman 1999; Fehmi and Bartolome 2003; Gillespie and Allen 2004). Late fall (September–October) burning is recommended for native grassland enhancement plots on Los Vaqueros Watershed lands (Brady/LSA 1996, 1999).

Once native species cover is increased, repeated burning, or a combination of burning and mulching or grazing over several years, may be necessary to maintain the increased cover of native species (Parsons and Stohlgren 1989). Short-term winter grazing following burning may help to control exotic grasses as they germinate after winter rains (Brady/LSA 1999). Alternatively, mid-summer grazing may be effective because by then most native perennial grasses would be dormant and not substantially damaged by grazing. Herbicide application may be necessary in particularly heavy infestations of exotic plants (e.g., Transline herbicide is effective in controlling yellow star-thistle in the inventory area [Olson pers. comm.]; see also Conservation Measure 1.4).

Experimental treatments to increase the cover of native species could include supplementing the seed rain of native forbs to increase their opportunities to establish and outcompete the exotic grasses and forbs (Seabloom et al. 2002). Any seed supplements in native grasslands must use locally derived genetic stock. To maximize the success of seed addition, pretreatment (e.g., burning 1 year prior to seeding to reduce weed seeds on the surface and in litter) may be required (Brady/LSA 1996). Recent research conducted on serpentine grasslands in Santa Barbara suggests that seedlings of California native forbs can be excellent competitors when enough seeds are present to overcome the dominance in the seed pool of the exotic grasses and forbs (Seabloom et al. 2002). In a 5-year experiment, burning or mowing had no effect on the abundance or the proportion of native forbs without seeding. Experimental treatments could include testing this approach by seeding grasslands with native and locally collected seeds within the preserves.

### **Rationale**

Native grassland vegetation alliances are expected to be found within the preserves, but these grasslands are expected to be degraded (i.e., low relative cover of native species) due to past or current land uses practices and the spread of nonnative plants. California native grasslands have been identified as one of the most endangered ecosystems in the United States (Noss et al. 1995). Accordingly, their maintenance and enhancement within HCP/NCCP preserves should be a high priority.

Enhancing grasslands may benefit covered plants such as big tarweed, Mount Diablo fairy lantern, recurved larkspur, showy madia, Diablo helianthella, and Brewer's dwarf flax. Research on a rare plant endemic to the East Bay, large-flowered fiddleneck (*Amsinckia grandiflora*), has shown that native grasslands provide better habitat than grasslands dominated by exotic annual grasses (Carlsen et al. 2000).

Enhancement of native grassland alliances must be implemented using an experimental approach (i.e., adaptive management), because site-specific conditions of species composition, topography, and soils will determine which techniques will work best.

## **Conservation Measure 2.5. Manage Natural Burrow Availability and Prey Base in Grasslands**

California ground squirrels provide burrows that provide substantial benefits to several covered species, including San Joaquin kit fox (den sites), western burrowing owl (nesting and roosting habitat), and California red-legged frog and California tiger salamander (upland aestivation sites). Small mammals, particularly California ground squirrels, are important prey for San Joaquin kit fox, and are a component of the prey base for western burrowing owl, golden eagle, and Swainson's hawk. Preserved grasslands will be managed to enhance small mammal populations (e.g., voles, mice, rabbits). The biological goals and objectives are as follows:

**Goal: Increase availability of burrows within grassland for San Joaquin kit fox, California tiger salamander, California red-legged frog, and western burrowing owl**

- **Increase the number and distribution of California ground squirrel burrows**

**Goal: Increase the prey base for San Joaquin kit fox**

- **Increase California ground squirrel and other small mammal populations within suitable core habitat for San Joaquin kit fox**

**Establish Baseline Conditions**

On preserve lands where rodent control measures are being implemented, the Implementing Entity will conduct a baseline survey to estimate the distribution and abundance of ground squirrels. Follow-up monitoring will be conducted to determine the effect of removing control measures on ground squirrel abundance and distribution.

**Guidelines for and Uncertainties in Applying Management Techniques**

Management techniques that will be considered to achieve these objectives include the following:

- Livestock grazing,
- Eliminating or reducing rodent control in preserves,
- Creating debris piles or soil disturbance to encourage rodent colonization.

The Implementing Entity will minimize existing rodent control measures (e.g., poisoning, hunting, and trapping) in preserves. Minimizing existing ground squirrel control measures may be sufficient to increase squirrel populations in some areas. However, some rodent control measures will likely remain necessary in certain areas where dense rodent populations may compromise important infrastructure (e.g., pond berms, road embankments).

If ground squirrel populations do not increase using passive means, then active measures, such as creating soil or debris piles (while not promoting weed infestations), will be taken to encourage rodent use in the area. Where lands neighboring preserves require ground squirrel management to protect agricultural uses or public health, the Implementing Entity will establish a buffer zone in the preserve within which ground squirrel colonies will not be encouraged or may be controlled. The width of this buffer will be determined by the preserve manager in consultation with neighboring landowners and Implementing Entity scientists. The buffer width will depend on site conditions, the size and density of the local ground squirrel population, and the intensity of control methods used adjacent to the preserve. The use of rodenticides or other rodent control measures will be prohibited in preserves except as necessary to address adverse impacts on levees,

road-beds, railroad-beds, pond berms, or other essential structures within or immediately adjacent to preserves.

Other ecological factors, in addition to the size and density of rodent populations, may limit the populations of covered species in the inventory area. For example, the population of San Joaquin kit fox in the inventory area may be limited by mortality from road kill, poisoning, coyote predation, or competition from nonnative red foxes (U.S. Fish and Wildlife Service 1998). However, there is evidence in other parts of the kit fox range that the abundance of prey affects reproductive success (Egoscue 1975; White and Ralls 1993). Although research to date suggests that prey abundance is important, a lack of studies in the northern part of the kit fox range contributes to uncertainty about the efficacy of this conservation measure in the preserves. Because of this uncertainty, adaptive management and research studies are required to understand factors controlling kit fox population and to improve management techniques.

Pilot studies of management methods that enhance the rodent prey base, and particularly the populations of ground squirrels, will be conducted through the Adaptive Management Program (see Chapter 7), and effective management measures will be incorporated into grassland management actions (See Conservation Measures 1.2 and 2.4).

### **Rationale**

This measure is intended to supplement other conservation measures to increase the population size of several covered wildlife species. Enhanced rodent populations will increase the prey base for San Joaquin kit fox and covered raptor species and will increase the availability of potential den sites for San Joaquin kit fox, nest and roost sites for western burrowing owl, and aestivation sites for California tiger salamander and California red-legged frog. Historically, measures such as hunting and rodenticides have been used extensively in the inventory area to control rodents and reduce conflicts with livestock. This has greatly decreased the populations of rodents, reducing prey availability for their predators. In 1975, California ground squirrel, which is the main prey item for San Joaquin kit fox in Contra Costa County, was severely reduced countywide after extensive rodent eradication efforts (Bell et al. 1994; U.S. Fish and Wildlife Service 1998). California ground squirrel populations have been increasing in Contra Costa County since then; however, the extent of their regional recovery may still limit San Joaquin kit fox and western burrowing owl presence and abundance in the eastern portion of the County (Orloff and Johnson pers. comms.).

## Oak Woodland and Oak Savanna

### Conservation Measure 2.6. Manage Oak Woodland and Oak Savanna

Protecting and enhancing the major vegetation and structural components of these communities (i.e., tree canopies, grassland understory, dead and downed wood) will benefit the important guilds of wildlife species that use the oak woodlands and oak savannas. The Implementing Entity is required to acquire 900 acres of oak woodland and oak savanna (Table 5-7 or 5-8). However, several thousand acres of oak woodland and savanna are expected to be included in the Preserve System (possibly as much as 9,000 acres) because this land cover type is found throughout the inventory area and may be acquired in the course of satisfying other requirements. The Implementing Entity will maintain or enhance oak savanna and oak woodlands within preserves through a process of assessment, factor analysis, active management, and long-term monitoring. The biological goals and objectives are as follows.

**Goal: Maintain the current canopy coverage of oaks and other native overstory trees within oak woodland and oak savanna land cover types**

- **Ensure tree recruitment and age structure are adequate to replace lost trees and maintain canopy coverage**
- **Reduce competition between tree seedlings and other plants to enhance survival rates of tree seedlings and saplings**

**Goal: Enhance oak woodland and oak savanna to promote biological diversity and habitat heterogeneity**

- **Increase the proportion of native species in oak woodland and oak savanna understories**
- **Leave in place snags, dead trees, and downed wood**

#### **Establish Baseline Conditions**

Oak stands will be assessed in each preserve within 2 years of acquisition to identify factors that may be limiting ecological functions. Tree recruitment, percent canopy coverage and site-specific goals are discussed in Chapter 7 for the Oak Woodland natural community type. Oak stands in preserves will be evaluated in accordance with the decision-making process adopted by the California Department of Forestry and Fire Protection (Jones & Stokes Associates 1988) (Figure 5-12) and used for management of oak stands in the Los Vaqueros Watershed (Brady and Associates 1997). If canopy coverage is declining, stands will be surveyed to determine if recruitment is adequate to replace lost trees and meet canopy coverage goals. The age structure of the tree population should also be considered to determine if stands may be increasing or in decline. If surveys indicate that recruitment is insufficient, management actions will be implemented to improve recruitment.

### **Guidelines for and Uncertainties in Applying Management Techniques**

Appropriate management techniques will be determined on a site-specific basis and may include those listed below:

- Modifying livestock stocking rates, timing of grazing, grazer, or livestock access to certain areas (see Conservation Measures 1.2 and 3.9).
- Planting acorns or seedlings of locally collected stock of the species in decline within existing oak stands.
- Fencing seed trees or stands of juvenile oaks to exclude native herbivores such as California ground squirrels, rabbits, or black-tailed deer until trees grow above the browse line.
- Reducing the biomass of understory herbaceous vegetation around seed trees or seedlings to reduce competition for water and nutrients through livestock grazing, mowing, prescribed burning, or other techniques (see Conservation Measure 2.4).
- Population control of exotic herbivores such as wild pigs to reduce damage to oak seedlings.

At sites where the understory of oak savanna and oak woodland in preserves is dominated by annual grassland, the understory will be managed according to the principles and guidelines outlined in Conservation Measure 2.4, except that the health and recruitment of overstory trees will also be considered. Oak savannas and woodlands within preserves will be reevaluated periodically as described in Chapter 7. More intensive management actions will be conducted if a sudden decline in oak woodland or oak savanna stands is observed.

Wild pigs may be a serious threat to oak regeneration in the inventory area. A recent study of the effects of wild pigs in California showed that they can disturb up to 35–65% of the ground annually where they occur in high densities, and that they significantly reduce acorn survival (Sweitzer and Van Vuren 2002).

Many factors may influence the population dynamics of oaks (Pavlik et al. 1991). Accordingly, a site-specific assessment is required to determine the factors most important in stands within preserves. Based on the assessment of oaks in the Kellogg Creek watershed (Jones & Stokes Associates 1995), the factor that may be most limiting oaks in the inventory area is a lack of oak regeneration due to a high density of invasive weeds and nonnative plants in the understory. Some studies have found browsing by deer or livestock to be an important factor negatively impacting recruitment (Bartolome et al. 2002), while others have found that grazing by small mammals (Tyler et al. 2002) or large mammals (Borchert et al. 1989) is very detrimental. Fire may have negative or no effects on oak recruitment, depending on the timing, frequency, and intensity of the fire (Griffin 1977; Bartolome et al. 2002). Recruitment in many tree species, particularly oaks, can be highly cyclical and dependent on long-term rainfall patterns. Management techniques should be applied in the context of these long-term environmental factors.

Sudden oak death (SOD), caused by the pathogen *Phytophthora ramorum*, is a serious threat to oak woodlands and mixed evergreen forests in northern California. Several dominant and important trees in the inventory area have been identified as hosts to this pathogen: coast live oak, California black oak, bay laurel, madrone, California buckeye, and big-leaf maple (Davidson et al. 2003). The pathogen can kill adults of the oaks and madrone; bay laurel, buckeye, and maple host the pathogen without being killed by it. With the exception of coast live oak, these species are restricted to the mixed evergreen forest at higher elevations of the inventory area. Dominant oaks in the oak woodland and oak savanna land cover types, blue oak and valley oak, have not shown symptoms of the pathogen. As of July 25, 2006, there have been no confirmed cases of SOD in the inventory area<sup>23</sup>; however, recent occurrences have been documented in Alameda and Contra Costa Counties west of the inventory area. It is unknown if climatic or other factors will limit the spread of SOD into the inventory area. Because of the seriousness of this potential threat, oaks and other trees susceptible to the pathogen will be monitored regularly for SOD and other fungal diseases. Management under this measure may need to be adjusted to account for the effects of the pathogen if it spreads into the inventory area. See Chapter 7, *Monitoring and Adaptive Management Program*, for more details.

## **Conservation Measure 2.7. Compensate for Loss of Oak Savanna**

To compensate for impacts on oak savanna, up to 165 acres of oak savanna will be restored within preserves on annual grassland or ruderal land cover types with suitable site conditions for oak savanna establishment (Tables 5-16 and 5-7). Mitigation of impacts on oak savanna vegetation alliances will be accomplished in kind. For example, impacts on blue oak savanna will be mitigated by restoration of blue oak savanna, and impacts on valley oak savanna will be mitigated by restoration of valley oak savanna. Restoration of oak savanna under this measure is in addition to oak savanna preservation (see Conservation Measure 1.1). The biological goal and objectives specifically for oak savanna restoration are as follows:

### **Goal: Restore oak savanna to compensate for its loss from covered activities**

- **Replace oak savanna vegetation alliances (in kind) that are lost to covered activities at a ratio of 1:1**
- **Establish within 50 years of initiating restoration a sufficient number of blue or valley oak trees to provide a percent tree canopy cover equal to or up to 10% greater than the percent canopy cover in oak savanna stands removed by covered activities**

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<sup>23</sup> The closest confirmed occurrence of SOD to the inventory is approximately 2.5 miles west of Pleasant Hill, approximately 10 miles from the inventory area. See <http://kellylab.berkeley.edu/SODmonitoring/> for the latest data.

The time period for restoration establishment extends beyond the permit duration (30 years) to allow for oak growth and canopy development.

### **Guidelines for Selecting Restoration Sites**

Potential restoration sites will be evaluated on the basis of criteria including but not limited to those listed below, which are based on the procedures used in the mitigation program for the Los Vaqueros Reservoir project (Jones & Stokes 1991, 1993a) and modified by recommendations in recent monitoring reports (Contra Costa Water District 2001c). See these documents for additional details.

- Topographic, soil, groundwater, and surface water conditions suitable for the target oak savanna alliance (e.g., blue oak savanna, valley oak savanna).
- Existing ecological functions and values that could be adversely affected by restoration.
- Proximity to existing oak savanna stands.
- Areas with evidence of historic occurrences of oak savanna (e.g., historic photographic analysis or other records, tree stumps, evidence of clearance along property lines).
- Distance to the impact area.
- Parcel size (among parcels with similar restoration potential, preference will be afforded to larger parcels) and the ability to continue long-term management, maintenance, and monitoring.
- Proximity to other enhancement or restoration sites within preserves.
- Areas not used or rarely used by San Joaquin kit fox (to avoid reduction in suitable habitat for this species).
- Proximity to existing, approved, and proposed developments or other adjacent land uses that may degrade the intended values of mitigation stands.
- The amount and cost of site preparation needed, all else being equal (restoration costs should be weighed against the conservation benefits of restoring the subject site as opposed to other sites).

### **Site Restoration Plans**

Once restoration sites are selected, the Implementing Entity will prepare a site restoration plan that describes the following components.

- Percent canopy cover objectives to be reached in 5, 10, and 25 years in order to reach to the overall goal at year 50 described above. These objectives will be determined on the basis of initial plant height, site conditions, and expected growth rates of plantings.
- Restoration techniques (e.g., type, quantity, and density of planting material; weed and herbivory control methods and schedule; irrigation methods and schedule) required to achieve the objective.
- Monitoring program and performance objectives.

- Potential remedial measures that could be undertaken if performance objectives are not achieved.

Based on the restoration plans for each restoration site, construction specifications and drawings will be prepared to guide contractors who will implement restoration (e.g., Jones & Stokes Associates 1995, 1998).

### **Restoration Principles and Techniques**

To the extent practicable, restoration designs and specifications will adhere to the following principles and techniques in addition to the guidelines and techniques in Conservation Measure 2.6:

- Restoration projects will use water only as necessary to ensure successful establishment of oak seedlings.
- Source material for plantings will be collected from adjacent or nearby stands of oaks in different years and from as many different individual trees as is practical to ensure a wide representation of the local gene pool.
- Soil supporting the same tree species and a high density of mycorrhizal fungi will be collected to inoculate planting sites with the fungi.
- Mitigation plantings will be protected from native and exotic herbivores such as black-tailed deer, cattle, feral pigs, and rodents, by using heavy welded-wire cages or similar material.
- Mitigation plantings will be irregularly spaced to avoid creating orchard-like groves of oaks and to increase the structural diversity of the mitigation sites.

### **Rationale**

Compensation for loss of oak savanna is required to mitigate impacts on wildlife supported by this diverse natural community. Compensation will be achieved through preservation of oak savanna (see Conservation Measure 1.1) and restoration of oak savanna acreage at a 1:1 ratio to ensure no net loss of oak savanna.

The approach to oak savanna restoration described above is based largely on the approach to restoration used for the Los Vaqueros Reservoir project. The Los Vaqueros Reservoir project has been successful at establishing valley oaks in the Kellogg Creek watershed. Of 858 seedlings planted in 1995 in the Los Vaqueros Watershed, 695 (81%) survived to 2001 with an average height of 5.3 feet, average canopy diameter of 1.7 feet, and good vigor. Of 1,739 seedlings planted in 1998, 1,516 (87%) survived to 2001 with an average height of 3.6 feet, average canopy diameter of 2.0 feet, and good vigor (Contra Costa Water District 2001c). Restoration of oak savanna will provide habitat values for many species of wildlife that use preserve lands. Restored oak trees will provide food (e.g., acorns, catkins, leaves, buds, insects) used by many species of wildlife, such as woodpeckers, plain titmouse, wrens, western bluebird, towhees, white-breasted nuthatch, and black-tailed deer. Oak trees also provide perches for resting and foraging birds (e.g., hawks, owls) and nest sites for many species of songbirds and raptors, including cavity-nesting species (e.g., titmice and wrens).

## Chaparral/Scrub

### Conservation Measure 2.8. Manage Chaparral/Scrub

As described in Chapter 3, chaparral/scrub in the inventory area is dependent on periodic fires for regeneration and the maintenance of biological diversity. However, the natural fire frequency and intensity in chaparral/scrub in the inventory area is unknown. There is also uncertainty with regard to the efficacy of prescribed burning as a management tool in northern California chaparral and its effect on endangered animals such as Alameda whipsnake. Management of chaparral/scrub will seek to address these uncertainties through an adaptive management approach and through the monitoring program described in Chapter 7. The biological goal and objectives specifically for chaparral/scrub are as follows:

#### **Goal: Enhance chaparral/scrub to promote native biological diversity and habitat heterogeneity**

- **Maintain or mimic the natural fire regime**
- **Maintain a mosaic of stand ages and species composition across the landscape**
- **Promote canopy gaps within chaparral/scrub patches**

#### **Establish Baseline Conditions**

The historic extent, current environmental condition, and natural disturbance frequency of chaparral and coastal sage scrub stands within preserves will be assessed through vegetation sampling, interpretation of aerial photographs, and further analysis of historic records of fire in the area. The results of this study will be used to determine whether active management is required to maintain these stands in their current extent and condition.

#### **Guidelines for and Uncertainties in Applying Management Techniques**

Appropriate management techniques will be determined on a site-specific basis and may include those listed below:

- Prescribed burning,
- Mechanical or hand clearing,
- Pile burning,
- Livestock grazing or trampling,
- Limiting or restricting public access through chaparral/scrub patches.

Management of chaparral and coastal sage scrub in the last decade, including within the inventory area, has focused on the use of prescribed burning to enhance this community, restore the historic fire regime, and reduce the

unnatural buildup of fuel. Mount Diablo State Park has been implementing a prescribed burn program in chaparral and other fire-dependent vegetation types since 1986 (Nielson 2001). This management technique is based on three key assumptions: (1) the current fire-return interval in chaparral is longer than historic levels due to modern fire suppression, (2) vegetation density has increased as a result, and (3) this increase in vegetation density has increased the risk of high-intensity fire.

Many land management plans recommend rotational burning of chaparral and other shrublands to maintain a mosaic of stand ages, providing the maximum benefit to this community and to minimizing the chances of catastrophic wildfire. However, recent research suggests that the assumptions on which these policies are based are erroneous for chaparral communities in southern California (Keeley 2002b) and may also be wrong for chaparral communities in central and northern California<sup>24</sup>. The frequency of fire in southern California shrublands is as frequent or more frequent in the twentieth century than it was in the nineteenth century (prior to fire suppression activities) partly because fire suppression activities have been ineffective at reducing fire frequency in shrublands (Keeley et al. 1999; Keeley and Fotheringham 2001). Fire hazard in chaparral habitat appears to be either independent of or only weakly dependent on stand age for the first 20 years after fire (Moritz 1999; Schoenberg et al. 2003). The frequency of severe weather conditions (e.g., low humidity, high winds, and drought) and the number of people with access to stands (providing an ignition source) appear to play much more important roles than do vegetation conditions in determining fire risk. A recent survey of major fires in the East Bay shows that the majority of the inventory area has not burned since at least 1951 (based on fire data from 1951–1996; U.S. Fish and Wildlife Service 2002b). It is not clear, however, if this is due to successful fire suppression activities or the fact that the natural fire interval is more than 50 years.

Because we do not know if the natural fire regime in the inventory has been altered, prescribed burns should be used sparingly and strategically in this vegetation community. Prescribed burns will be used only when necessary to reduce extreme fire hazards in areas of likely fire risk or to enhance unoccupied habitat for Alameda whipsnake or habitat occupied by Mount Diablo manzanita. New trail construction will be prohibited within and directly adjacent to chaparral/scrub patches to reduce the chance of wildfire ignitions and to minimize disturbance to and mortality of Alameda whipsnakes (see Conservation Measure 1.5). Prescribed fires, if determined to be necessary, will be carefully planned and implemented with the cooperation of the California Department of

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<sup>24</sup> Most of the studies on the effects of burning and prescribed fires have been conducted in chaparral and coastal sage scrub in southern California, where these vegetation communities often dominate the landscape. It is therefore unclear if results from southern California apply to the chaparral and coastal sage scrub in the inventory area, where chaparral and coastal sage scrub form discrete, relatively small patches within large stands of annual grassland, oak woodland, or mixed evergreen forest. Management of chaparral and coastal sage scrub in the inventory area will be conducted using a cautious and adaptive approach. Prescribed burning will be used sparingly and only when necessary to reduce extreme fire hazards or obvious signs of stand decadence from fire suppression activities. If future research demonstrates more clearly the benefits of prescribed burning (or another active management technique), then management in preserves can be adjusted.

Forestry and Fire Protection and local fire agencies. A burn plan will be prepared for each prescribed fire event.

Prescribed burning in chaparral may reduce wildfire risk at some sites but this should be balanced with consequences of fires that are too frequent. Fires that occur too frequently in chaparral may reduce chaparral biological diversity by eliminating species not adapted to frequent burning (Zedler et al. 1983). Chaparral that experiences frequent fires is exposed to high rates of erosion and may damage watershed functions. It has also been assumed that prescribed fires are effective at reducing or controlling exotic plants. Prescribed fires in chaparral should be conducted in late fall or winter when weather conditions maximize the ability of fire crews to control the fire. Burns conducted at that time will exert little effect on the seed banks or reproductive capability of exotic plants. Fall and winter burns will be conducted carefully in order to minimize excessive mortality of native seed banks due to lengthy smoldering fires in wet soil conditions (Le Fer and Parker 2005).

The effects of prescribed fire on Alameda whipsnake are largely unknown. However, USFWS considers fire suppression one factor in the decline of Alameda whipsnakes because it may reduce the extent of early to mid-successional stages of this vegetation community, which whipsnakes prefer, and because it may increase the risk of catastrophic wildfire (U.S. Fish and Wildlife Service 1997, 2000). Moreover, the closed canopy that results from fire suppression can reduce the prey base for whipsnakes. Because of the uncertainty in the effects of prescribed fire on this species, its use will be limited to unoccupied habitat for whipsnake where practicable. Ongoing research within the inventory area includes experimental burns to determine the effects of prescribed burning on Alameda whipsnake (Swaim pers. comm.). Monitoring will be used to determine the status of habitat function for Alameda whipsnake and the need for active management measures in chaparral and scrub vegetation.

With little evidence that prescribed burning is effective at enhancing chaparral communities in the inventory area, this technique should be used only to reduce extreme fire risk or to enhance small areas for specific reasons (e.g., to create habitat for Alameda whipsnake) unless future research or adaptive management shows otherwise. Goals and objectives for this natural community will therefore be accomplished primarily with treatments like pile burning, mechanical or manual clearing, livestock grazing or trampling, or other means to promote habitat heterogeneity.

## **Streams and Riparian Woodland/Scrub**

### **Conservation Measure 2.9. Manage Streams and Riparian Woodland/Scrub**

All degraded streams and riparian woodland/scrub within the preserves will be improved to increase overall ecological functions and values (i.e., species

richness and diversity, vegetative cover, wildlife habitat function) and to enhance the ability of these habitats to support existing and new populations of covered species.

The biological goals and objectives for streams and riparian woodland/scrub are as follows:

**Goal: Enhance riparian woodland/scrub to promote native biological diversity and habitat heterogeneity**

- **Maintain or increase the cover, width, and connectivity of existing riparian vegetation consistent with current stream and habitat function**
- **Reduce the biomass, cover, and extent of exotic (i.e., non-native invasive) plants in the Preserve System**

**Goal: Maintain and enhance instream aquatic habitat for covered species and native fish**

- **Promote the natural disturbance regime (e.g., flooding, sediment deposition and scour)**
- **Reduce water temperature and temperature variation**
- **Increase inputs of organic matter where appropriate**
- **Reduce sediment input and downstream sediment transport/deposition, where appropriate**
- **Maintain and enhance instream structural diversity, where appropriate**
- **Improve stream flow and connectivity for native aquatic wildlife**
- **Control or reduce invasive, exotic animals including bullfrogs and fish**

**Establish Baseline Conditions**

The Implementing Entity will map riparian corridors within the preserves to identify stream segments suitable for enhancement measures.

**Guidelines for and Uncertainties in Applying Management Techniques**

Techniques that could be used to enhance streams and riparian woodland/scrub include but are not limited to those listed below:

*Exclude Livestock*

- **Install livestock exclusion fencing along designated stream segments and provide alternative water supplies for livestock.**

*Control Exotics*

- **Remove invasive nonnative plant species (e.g., *Arundo donax*) mechanically, by hand, or through application of herbicides.**

- Use nursery-grown plant material that is free of invasive exotic pests such as Argentine ants.

#### *Plant Native Vegetation*

- Plant appropriate native riparian woodland/scrub vegetation in gaps in existing riparian corridors or in sparse vegetation using locally collected material, as determined by the Implementing Entity land managers (planting in gaps larger than one tree canopy length is considered riparian restoration; see Conservation Measure 2.10).
- Plant riparian woodland/scrub vegetation along stream banks to expand the width of existing riparian vegetation.
- Install willow cuttings along the edge of the low-flow channel to increase overhead cover where it is lacking.
- Plant riparian woodland/scrub understory species in existing riparian corridors in areas where the understory has been denuded.

#### *Re-create Natural Structures, Processes, and Flow*

- Remove non-vegetative debris such as trash, garbage, or dumped fill material (e.g., concrete, asphalt) from the stream channel to facilitate stream flow.
- Install biotechnical bank-stabilization structures to arrest bank erosion and provide opportunities for planting native riparian woodland/scrub vegetation.
- Remove and/or modify barriers (e.g., culverts, low-flow crossings, diversion structures) to up- and downstream fish migration as long as nonnative species (e.g., bullfrogs, exotic fish) do not benefit.
- Where appropriate, install instream woody material, boulders, or rock structures (e.g., cross or V weirs) to create pools and/or narrow the low-flow channel.
- Where severely incised streams are degraded (resulting in erosion and high sediment loads, floodplain disconnection, bank destabilization, or groundwater subsidence), geomorphically appropriate check dams may be placed to stabilize the channel's longitudinal profile, reduce erosive flow velocities, arrest further channel incision, and encourage in-channel sediment storage.
- Where possible, reestablish the natural disturbance regime (e.g., flooding, sediment deposition and scour) to facilitate natural regeneration of riparian woodland/scrub and promote habitat diversity (Mount 1995).

Riparian enhancement measures will be integrated into the preserve management plans (see Conservation Measure 1.2).

Potential enhancement sites will be evaluated and management actions identified in coordination with the other local agencies or organizations active in riparian restoration in the inventory area (e.g., Contra Costa County Resource Conservation District, Contra Costa County Watershed Forum). Detailed

techniques will be developed for individual sites or stream reaches based on specific geomorphic, hydraulic, and hydrologic conditions; extent and quality of existing habitats (e.g., percent native vegetation and presence/absence of exotic wildlife such as bullfrogs or cowbirds); existing wildlife use; and the potential for adverse effects (e.g., disturbance and/or removal of existing wetland habitat). These management actions will include descriptions of plant material requirements (e.g., collected and propagated from local sources); planting and construction methods; and adaptive management and monitoring requirements.

### **Rationale**

Covered species that will benefit from the riparian enhancement program include California red-legged frog, California tiger salamander, foothill yellow-legged frog, western pond turtle, and Swainson's hawk. The program will also benefit other wildlife, including raptors, migratory and resident songbirds, and native insects (Warner and Hendrix 1984; National Research Council 2002).

Riparian areas can be impacted by uncontrolled livestock access. Invasive exotics can outcompete native plant species and decrease overall species diversity. Therefore animal exclosures and riparian plantings are two techniques that will contribute to stream and riparian enhancement. Planting riparian woodland and scrub vegetation where it will have a high likelihood of success within existing riparian corridors will increase the width, length, connectivity, and overall species diversity of existing habitat patches.

Installing bank stabilization structures in areas of actively eroding stream banks reduces sediment input and downstream sediment transport/deposition, and reduces adverse effects on instream habitat and water quality. In limited cases, installing instream structures will create pools and overhead cover, increase inputs of organic material, and enhance aquatic habitat for covered species. Removing barriers and/or constructing passage structures will facilitate up- and downstream migration of fish and enhance habitat for covered aquatic species as long as exotic invasive species such as bullfrogs and exotic fish are controlled.

## **Conservation Measure 2.10. Restore Streams and Riparian Woodland/Scrub to Compensate for Habitat Loss and to Increase Biodiversity**

Impacts to stream channel and riparian woodland/scrub will be addressed and mitigated separately because of the different functions of these habitat features.

Potential impacts on streams will be avoided and/or minimized through implementation of Conservation Measures 1.7 and 2.12 (Chapter 6). Where impacts on streams are unavoidable, mitigation will focus on restoration of stream channels within preserves through techniques such as biotechnical bank stabilization, stream meander restoration, or increasing instream structure and habitat complexity (see descriptions of suggested techniques below). Where mitigation within preserves is infeasible, stream restoration within existing protected areas (e.g., East Bay Regional Park District) may be allowed. Impacts

on streams without riparian woodland/scrub cover can be compensated through either restoration of riparian woodland/scrub vegetation on existing streams or restoration of seasonal or permanent wetlands on an acre-for-acre basis to replace some stream functions (see Conservation Measure 2.3). Stream restoration should be the highest priority. Where stream restoration is not feasible, riparian woodland/scrub will be restored. If sites for riparian woodland/scrub are not available, as a last priority seasonal/perennial wetlands can be restored. Impacts on streams with riparian woodland/scrub vegetation will be compensated at a ratio of 1:1 through a combination of stream restoration and restoration of riparian woodland/scrub vegetation. Stream restoration will be accomplished in kind where possible (i.e., impacts on perennial streams will be mitigated through restoration of perennial streams).

The Implementing Entity will restore riparian woodland and scrub habitats within preserves according to the ratios listed in Tables 5-16 and 5-17 for the initial and maximum urban development areas, respectively. Impacts on riparian woodland/scrub will be compensated through the restoration of riparian woodland/scrub habitat types at a ratio of 1:1. The Implementing Entity will also restore 20 acres of riparian woodland/scrub to enhance overall native biological diversity and to contribute to the recovery of covered species. All or most impacts on slough/channel are expected to be mitigated through restoration of up to 55 acres of additional riparian woodland/scrub (see Conservation Measure 2.3). Furthermore, encroachment on stream setbacks will also be mitigated through restoration of riparian woodland/scrub (see Conservation Measure 1.7 in Chapter 6).

The biological goal and objectives are as follows:

**Goal: Restore streams and riparian woodland/scrub to compensate for their loss from covered activities**

- **Restore at least 20 acres of riparian woodland/scrub in addition to that required above as compensation for habitat loss**
- **Replace riparian woodland/scrub at a ratio of 1:1 in the Preserve System (estimated to be 35 acres with maximum urban development area)**
- **Restore species richness and diversity, vegetative cover, wildlife habitat function and hydrologic function**

Restoration principles and rationales for the stream types that occur in the inventory area are described below.

**Perennial Streams.** Restoration will occur along perennial streams that have been degraded by past land use activities and that historically supported riparian woodland/scrub vegetation. Restoration of perennial streams will likely focus on the implementation of intensive measures such as excavating stream banks and floodplain surfaces because of the ecological benefits to covered species associated with permanent water. Combined with restoration of riparian woodland/scrub, implementation of these activities will provide shade and cover,

reduce water temperatures, increase channel complexity, and enhance instream aquatic habitat for fish and other aquatic organisms.

**Intermittent Streams.** Compensation for the loss of intermittent streams can be accomplished through restoration of intermittent or perennial streams. Restoration will occur along intermittent streams that have been degraded by past land use activities and that historically supported riparian woodland/scrub vegetation. Restoration of intermittent streams will likely involve measures similar to those implemented for perennial streams (e.g., stream bank and floodplain excavation, planting).

**Ephemeral Streams.** Restoration along ephemeral streams will primarily focus on planting upper terrace riparian species (e.g., oaks, bay laurel, California buckeye) that can tolerate drier site conditions. However, because there is some evidence that California red-legged frog may be adversely affected by bay laurel (Bobzien pers. comm. this species should be used sparingly. If the restoration of ephemeral streams is not feasible because of site conditions or other considerations, the Implementing Entity will be required to restore riparian woodland/scrub or seasonal or permanent wetland habitats on an acre-for-acre basis to replace lost stream functions.

### **Guidelines for Selecting Restoration Sites**

Potential restoration sites in the inventory area (e.g., Robins and Cain 2002; Walking et al. 2002) will be evaluated and measures identified in coordination with the other local agencies or organizations active in riparian restoration in the inventory area (e.g., Contra Costa County Resource Conservation District, Contra Costa Watershed Forum). As described in Conservation Measure 2.1, the Implementing Entity will likely be conducting most riparian restoration along Marsh Creek, Kellogg Creek, and in and adjacent to Dutch Slough (Figure 5-2 and 5-3). Restoration sites will be selected according to criteria that includes but are not limited to those listed below:

- The potential success of restoration activities, based on site-specific conditions (e.g., hydrology, soils).
- The ability of the site to support covered species after restoration.
- The proximity of the site to the area in which streams or riparian woodland/scrub were lost to covered activities.
- The proximity of the site to other intact riparian corridors that support, or are likely to support, covered species.
- The ability of the restored stream and/or riparian woodland/scrub to contribute to the conservation goals of habitat connectivity in this plan.

### **Site Restoration Plans**

Detailed restoration plans, including plans and specifications, will be developed for individual sites or stream reaches based on specific geomorphic, hydraulic, and hydrologic conditions; extent and quality of existing habitats; existing wildlife use; and the potential for adverse effects (e.g., disturbance and/or

removal of existing habitat or wetlands). Restoration plans will accomplish the following:

- Define restoration goals and objectives, performance indicators, and success criteria.
- Collect and analyze baseline data (e.g., soil type and suitability for riparian planting, low-flow conditions, past land use history/alterations).
- Identify suitable/feasible restoration measures.
- Develop conceptual restoration designs.
- Develop detailed restoration designs (plans and specifications) that identify and describe construction methods, planting areas and methods, planting species (including collection and propagation methods), and maintenance requirements.
- Prepare an adaptive management and monitoring plan that includes descriptions of responsible parties; monitoring methods and schedule; indicators (e.g., vegetative cover); success criteria (e.g., 20% cover by year 5); and adaptive management measures (e.g., replanting with different species).

### **Restoration Principles and Techniques**

Management actions that could be implemented to restore streams and riparian woodland/scrub include but are not limited to those listed below (U.S. Department of Agriculture 1999).

- Replacing existing hardscape bank protection structures (e.g., riprap, concrete, sakrete) with biotechnical bank stabilization structures, consistent with flood protection purposes. [stream restoration]
- Excavating and grading existing stream banks and/or floodplain surfaces to create suitable planting sites for riparian woodland/scrub vegetation, provide opportunities for the deposition of fine-grain materials and native seed stock, and enhance existing flood capacity (if needed to offset the loss of flood capacity from plantings). [stream restoration]
- Shifting or realigning straightened stream channels to restore meanders (e.g., usually on agricultural lands) and increase instream habitat complexity and quality for covered aquatic species. [stream restoration]
- Installing woody material, boulders, and/or instream structures to create pools, reduce the width of the low-flow channel, increase inputs of organic material, and improve habitat for covered aquatic species. [stream restoration]
- Planting riparian woodland/scrub vegetation in some stream reaches of newly excavated channel banks and floodplain surfaces to increase overhead cover and shaded bank/stream surface, thereby reducing water temperatures to improve aquatic habitat for covered amphibians. [riparian restoration]

- Planting appropriate native riparian woodland/scrub vegetation within large gaps in riparian corridors (planting in gaps smaller than a typical tree canopy diameter<sup>25</sup> is considered riparian enhancement; see Conservation Measure 2.9) to increase the width, length, connectivity, and overall species diversity of existing habitat patches. [riparian restoration]
- All restoration actions will avoid take of migratory birds and their eggs and nests according to the restrictions of the Migratory Bird Treaty Act. [riparian restoration]

## Cultivated Agriculture

### Conservation Measure 2.11. Enhance Cultivated Agricultural Lands to Benefit Covered Species

The Implementing Entity will acquire conservation easements (or fee title) on at least 250 acres of cultivated agricultural land in Zone 6 from willing sellers (see Conservation Measure 1.1 and Table 5-11). Conservation easements will require landowners to perform existing agriculture-related practices in a manner that maintains or enhances the value of agricultural lands for covered species (see Conservation Measure 1.3).

Management measures that could be implemented on agricultural lands to benefit covered species are presented in Table 5-19. Specific management practices that may be required for a particular parcel will depend on its location within the Preserve System relative to the distribution and needs of covered species, as well as the types of management actions that can be reasonably undertaken while maintaining ongoing and profitable farming operations. The Implementing Entity will develop an agricultural management plan for each conservation easement that describes the management measures to be implemented by the landowner. Requirements and terms of agricultural management plans are described in Conservation Measure 1.3.

#### Rationale

Cultivated agricultural lands are the dominant land cover type in Zone 6 and provide foraging habitat for Swainson's hawk, a key covered species. Croplands and pasture also provide secondary habitat for western burrowing owl (breeding and foraging) and tricolored blackbird (foraging). Consequently, the primary opportunity to enhance habitat for covered species in Zone 6 entails enhancing habitat on cultivated agricultural lands.

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<sup>25</sup> A typical tree canopy diameter should be used to determine this distance, which will vary depending on the type of habitat and site conditions. Well-developed cottonwood trees may have canopy diameters of up to 30 feet.

### 5.3.3 Species-Level Conservation Measures

Most species-specific conservation is accomplished by protecting, restoring, and managing habitat as described above. For some species, the management actions described in the natural-community conservation measures are sufficient to maintain and enhance the covered species in the preserve system. For those species, no additional conservation measures were developed. In other instances, additional measures have been created that are specific to individual covered species. These additional measures fill in small gaps in coverage in ways that were not specifically addressed at the natural-community level.

If specific biological goals and objectives were developed, they are listed at the beginning of each species narrative. Not all covered-species have species-level goals and objectives. Subsequently, a description of the overall landscape- and community-level conservation measures is provided to describe the benefits of these larger-scale measures on individual species.

#### Townsend's Western Big-Eared Bat

The biological goals and objectives for Townsend's western big-eared bat are listed below.

**Goal: maintain or increase population size and distribution of Townsend's western big-eared bat in the Preserve System**

- **Preserve hibernacula<sup>26</sup> and maternity roosts of Townsend's western big-eared bat**
- **Enhance roosting habitat by protecting any abandoned mine, cave, or building in the Preserve System and, if feasible, creating artificial hibernacula**

#### Benefits of Landscape- and Community-Level Conservation Measures

Many of the landscape-level and community-level conservation measures will directly benefit Townsend's western big-eared bat. Planning surveys will ensure that most impacts on this species from covered activities are avoided or minimized. The conservation strategy will preserve at least 15,600 acres of terrestrial vegetation, including alkali grassland, annual grassland, chaparral, oak savanna, and oak woodland (Table 5-7) that are expected to include suitable microhabitats for roosting bats, such as caves, mines, or other structures. Preserve management will also benefit Townsend's western big-eared bat. For example, several measures will increase watering habitat by restoring streams, wetlands, and associated riparian habitat in habitat preserves and increase prey base by controlling the use of insecticides in preserves (see Conservation Measures 1.8, 2.12, 2.2, 2.3, and 2.9). Acquisition of lands containing large trees

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<sup>26</sup> Hibernacula are hibernation sites for bats.

that provide cave-like conditions may provide night-roosting habitat (Fellers and Pierson 2002).

### **Conservation Measure 3.1. Protect and Enhance Roosting Habitat for Townsend's Western Big-Eared Bat**

Planning surveys for land acquisition and baseline surveys following acquisition will use bat detectors near suitable roosting sites to attempt to locate colonies of Townsend's western big-eared bat. Lands containing maternity roosts or hibernacula will be prioritized for acquisition. Any roost locations within the Preserve System will be documented and mapped; the results will be shared with USFWS and CDFG but otherwise kept confidential. Abandoned mines within the Preserve System will be stabilized, if feasible, and gated, when practicable, to enhance roosting habitat for these bats. Recreational access to caves within the Preserve System will be prohibited. In addition, the creation of artificial hibernacula will be investigated and implemented, if appropriate, in an adaptive management context.

#### **Rationale**

Townsend's big-eared bat is highly sensitive to disturbance at roost sites, and surveys in coastal California indicate that the species is roost limited (Pierson 1988). Although Townsend's big-eared bat is generally a cave-dwelling species, the western subspecies is usually found in buildings and mine shafts. Protection from human disturbance and enhancement of roosting sites are the most promising means of protecting populations of this species.

### **San Joaquin Kit Fox**

The biological goals and objectives for San Joaquin Kit Fox are listed below:

#### **Goal: Preserve the most important movement routes and core habitat for San Joaquin kit fox**

- **Preserve 2,400 acres of annual grassland in Deer, Horse, and Lone Tree Valleys (Subzones 2e, 2f, and 2h) to protect, to the extent feasible, the two most important movement routes for San Joaquin kit fox between Black Diamond Mines Regional Preserve and Cowell Ranch State Park**
- **Preserve an important movement route for San Joaquin kit fox between Alameda County and Contra Costa County by protecting habitat in Zone 5 between the County line, the Byron Airport Habitat Mitigation Lands, and the Los Vaqueros Watershed**
- **Preserve 5,300 acres of annual grassland and 750 acres of alkali grassland in Subzones 5a, 5c, and 5d as suitable core habitat under initial urban development scenario**

### **Goal: Increase the prey base for San Joaquin kit fox**

- **Increase California ground squirrel and other small mammal populations within suitable core habitat**

#### **Benefits of Landscape- and Community-Level Conservation Measures**

Many of the landscape-level and community-level conservation measures are designed specifically to benefit and contribute to the recovery of San Joaquin kit fox. Development guidelines will ensure that impacts on this species from covered activities are avoided or minimized (Conservation Measures 1.6 and 1.9). The conservation strategy will protect an estimated 17,164 acres of suitable core habitat and 1,820 acres of suitable low-use habitat for San Joaquin kit fox in the inventory area with the initial urban development area (Table 5-13). A network of core preserves will protect a critical linkage for San Joaquin kit fox between its range outside Contra Costa County and most known locations in Contra Costa County. For example, habitat linkages will be acquired and protected to ensure that kit foxes can continue to move between the Contra Costa–Alameda County line and Detachment Concord at the northwestern corner of the species’ range. This important regional connection will be made by connecting the existing large protected areas listed below that are known or suspected to support San Joaquin kit fox.

- Brushy Peak Regional Preserve and Bethany Reservoir State Recreation Area (Alameda County) with Vasco Caves Regional Preserve.
- Byron Airport conservation easements and the Los Vaqueros Watershed.
- Cowell Ranch/Los Vaqueros Watershed and Black Diamond Mines Regional Preserve.
- Black Diamond Regional Preserve and Detachment Concord.

There are four possible movement routes through annual grassland between Black Diamond Regional Preserve and Cowell Ranch/Los Vaqueros Watershed. The southernmost linkage is the narrowest (approximately 0.2 mile at its narrowest point), and its viability may be compromised by the planned expansion of the Los Vaqueros Reservoir. Two of the remaining 3 potential movement route linkages of annual grassland between Black Diamond Regional Preserve and Cowell Ranch/Los Vaqueros Watershed will be created to ensure that movement between these core protected areas can continue. Annual grassland within preserves will be managed to enhance small mammal populations (a prey base for kit fox) (Conservation Measure 2.5).

## **Tricolored Blackbird**

The biological goals and objectives for tricolored blackbird are listed below.

### **Goal: Enhance habitat for tricolored blackbird in the Preserve System**

- **Restore perennial wetlands so that at least 25% will provide breeding habitat**
- **Restore perennial wetlands to provide breeding habitat at least 1 mile from black-crowned night heron colonies and within flight distance of blackbird foraging habitat**

### **Benefits of Landscape- and Community-Level Conservation Measures**

Many of the landscape-level and community-level conservation measures are designed specifically to benefit tricolored blackbird. Development guidelines will ensure that impacts on this species from covered activities are avoided or minimized (see Conservation Measures 1.6, 1.9, and 1.10). The Preserve System will protect approximately 126 acres of modeled core habitat, 16,747 acres of primary foraging habitat, and 242 acres of secondary foraging habitat under the initial urban development area scenario (Table 5-13) (Conservation Measure 1.1). Surveys will be conducted to confirm habitat suitability and identify habitat occupied by tricolored blackbird in potential preserve lands; results of these surveys will be used to guide acquisition of preserves to include occupied habitat to the maximum extent practicable. Planning surveys for tricolored blackbird are not required for covered activities, although if tricolored blackbird is present, project proponents must comply with the Migratory Bird Treaty Act.

*Land Acquisition.* The Implementing Entity will preserve an estimated 126 acres of core habitat (i.e., breeding ponds and wetlands) and 16,747 acres of primary foraging habitat for tricolored blackbird within the HCP/NCCP Preserve System under the initial urban development area scenario (Table 5-13). The majority of the core and primary foraging habitat will be preserved in Zones 2 and 5, along with substantial additional primary foraging habitat in Zone 4. Agricultural land or conservation easements acquired in Zone 6 (Conservation Measure 1.1) may also benefit tricolored blackbird by providing additional foraging habitat. The Implementing Entity will acquire at least 250 acres of cropland or pasture in Zone 6 or along Marsh Creek under the initial urban development area scenario (Table 5-11).

*Restoration and Enhancement.* Conservation Measures 2.2 and 2.3 will benefit tricolored blackbird by enhancing, restoring, and creating suitable breeding habitat for this species adjacent to suitable foraging habitat (annual grassland).

*Preserve Management.* Several preserve management measures will benefit tricolored blackbird. Agricultural lands will be managed to maintain or enhance suitable foraging habitat for tricolored blackbird when close to breeding colonies (Conservation Measures 1.3, 1.4, and 2.11). Habitat enhancement on agricultural lands (e.g., planting blackberries or other vegetation along ditches and canals to provide suitable nesting sites) will also benefit tricolored blackbird.

## **Conservation Measure 3.2. Minimize Predation on Tricolored Blackbird Colonies**

At least 25% of the estimated 101 acres of wetland and pond created or enhanced will be designed to support breeding tricolored blackbirds (see Conservation Measure 2.3). To reduce predation risk to tricolored blackbird colonies, some sites will be located at least 1 mile from black-crowned night-heron rookeries. Aerial photos will be used to assess the potential presence of heron rookeries within 5 miles and surveys for heron rookeries will be conducted near wetland and pond sites under consideration for tricolored blackbird habitat creation.

### **Rationale**

Predation is a major cause of complete nesting failure at some tricolored blackbird colonies in the Central Valley. Historical accounts documented the destruction of nesting colonies by a diversity of avian, mammalian, and reptilian predators. Recently, especially in permanent freshwater marshes of the Central Valley, entire colonies have been lost to black-crowned night-herons, common ravens, coyotes, and other predators (Beedy and Hamilton 1999). Night-herons generally do not forage on tricolored blackbird colonies in upland sites (i.e., sites comprised of Himalayan blackberry, thistle, or nettle). By locating wetland restoration sites designed to support tricolored blackbirds away from black-crowned night-heron rookeries, predation by these native birds can be minimized. There are no known empirical data on how predation rates at colony sites vary with distance from night-heron rookeries; moreover, predation rates may be driven more by habitat (e.g., upland versus wetland as previously described) than by distance. Although black-crowned night-herons will fly several miles between nesting and foraging areas, most incidences of predation by night-herons on Tricolored Blackbirds appear to have occurred when night-herons nest within or adjacent to tricolored blackbird colonies in freshwater marshes (Beedy pers. comm. 2003). Therefore, it is assumed that a 1-mile minimum distance is adequate.

## **Golden Eagle**

The biological goals and objectives for golden eagle are listed below.

**Goal: Maintain or increase population size and distribution of golden eagles in the inventory area**

- **Acquire land in the Preserve System that includes occupied nests and suitable nest sites**
- **Retire wind turbine leases within the Preserve System, when feasible**

### **Benefits of Landscape- and Community-level Conservation Measures**

Many of the landscape-level and community-level conservation measures will benefit golden eagle. Conservation Measure 1.11 prohibits the direct take of

individual golden eagles. The Preserve System will protect an estimated 24,321 or 29,267 acres of modeled foraging habitat for golden eagle under the initial urban development area or maximum urban development area, respectively (Table 5-13), including a network of large blocks of high-quality grassland habitat. Nearly the entire Preserve System will provide suitable foraging and breeding habitat for golden eagles. New preserves will be linked to existing protected land, which will result in large areas of contiguous foraging habitat for golden eagles. Acquisition of at least 250 acres of agricultural conservation easements in cropland or pasture (Zone 6) will benefit the species by providing additional foraging habitat.

Several preserve management measures will benefit golden eagles. Preserves will be managed to enhance the prey base for raptors, including golden eagles (Conservation Measure 2.5). Annual grassland that is managed to decrease the cover and extent of exotic plants (Conservation Measure 1.4) and to increase the cover and extent of native grasslands (Conservation Measures 1.2 and 2.4) will benefit golden eagles by decreasing escape cover in grasslands. Management of agricultural lands will be designed to enhance and increase foraging and nesting habitat for covered species, including golden eagle (Conservation Measures 1.3 and 2.11). These measures contain specific techniques and goals that will be incorporated into agricultural management plans and conditions of the conservation easements purchased on agricultural lands.

### **Conservation Measure 3.3. Protect Golden Eagle Nest Sites within Preserve System**

Surveys in potential preserve lands will be conducted to determine habitat suitability and identify occupied and suitable golden eagle nest sites. Results of these surveys will be used to guide acquisition of occupied nesting habitat to the maximum extent practicable. The Implementing Entity will evaluate ongoing land uses in or adjacent to occupied habitat relative to future threats to nests or habitat. Occupied habitat that is considered threatened will be a high priority for acquisition and management.

#### **Rationale**

Although foraging habitat for golden eagle is common in the inventory area, occupied nest sites are rare. To contribute to the recovery of golden eagle, active or potential nest sites should be acquired within preserves to protect these important sites.

### **Western Burrowing Owl**

The biological goals and objectives for western burrowing owl are listed below.

**Goal: Maintain or increase population size and distribution of western burrowing owl**

- **Install artificial burrows and perches as temporary attractants, where appropriate**

### **Benefits of Landscape- and Community-Level Conservation Measures**

Many of the landscape-level and community-level conservation measures are designed specifically to benefit western burrowing owl. The conservation strategy will protect an estimated 16,675 or 19,844 acres of modeled suitable habitat for western burrowing owl under the initial urban development area or the maximum urban development area, respectively (Table 5-13). A network of core preserves will protect large blocks of grassland habitat. New linkages will be created in blocks of habitat suitable for western burrowing owl to facilitate dispersal and colonization throughout the Preserve System, colonization of the inventory area from adjacent areas, and dispersal from inside to outside the inventory area. New preserves will be established adjacent to or near existing protected land. This approach will result in large areas of protected, contiguous habitat. Large areas of contiguous habitat are likely to provide greater opportunities to meet the conservation objectives for this species. Planning and pre-acquisition surveys (see Chapter 6, *Conditions on Covered Activities*) will be conducted to identify suitable habitat. Results of these surveys will be used to minimize impacts and guide acquisition of occupied habitat to the maximum extent practicable.

Several preserve management and community-level measures will benefit western burrowing owl. For example, Conservation Measures 1.2, 1.3, 1.4, and 2.5 will enhance habitat quality for western burrowing owl in preserves by increasing nesting habitat and prey base.

### **Conservation Measure 3.4. Temporarily Create Artificial Burrows in Grasslands to Attract and Retain Burrowing Owls**

Under certain circumstances preserved grasslands may be enhanced for western burrowing owls by installing artificial burrows. Where natural burrows are limited in number in otherwise suitable habitat, the Implementing Entity may create artificial burrows. Artificial burrows may encourage western burrowing owls to use sites where natural burrows are absent or scarce, particularly when the artificial burrow is constructed close to a source population or occurrence (Trulio 1995). Artificial burrows should be used as a temporary measure to encourage use by western burrowing owls while long-term measures such as ground squirrel population enhancement are being developed (if these long-term measures are successful, the artificial burrows should be removed). Although it is unclear whether artificial burrows can directly enhance long-term productivity of burrowing owls (Haug et al. 1993), this technique has been successful in attracting burrowing owls to certain sites in northern California (Trulio 1995; Jones pers. comm.).

The effects of artificial nest burrows on reproductive success have not been well studied. Techniques for creating artificial burrows will be improved over time through the Monitoring and Adaptive Management Program. In addition, artificial burrows may be installed to attract owls from areas that are scheduled for development into preserved habitat. Periodic maintenance of artificial burrows will be required to ensure that the burrows provide suitable nest sites for burrowing owls. Maintenance activities will include removing vegetation around burrow entrances and unplugging and repairing burrow entrances, tunnels, and chambers as needed. Maintenance activities will occur before the nesting season.

### **Rationale**

Burrow availability limits the extent of year-round habitat available to burrowing owls in some areas. Because burrowing owls need other animals to dig their burrows, the loss of fossorial rodents (e.g., ground squirrels) from much of historical burrowing owl habitat and the ensuing reduction in burrow availability has reduced suitable habitat for this species.

## **Conservation Measure 3.5. Install Temporary Artificial Perches to Attract and Retain Burrowing Owls**

Under certain circumstances the Implementing Entity may install artificial perches in preserves that lack burrowing owl perch sites but that otherwise support suitable habitat to increase the probability of colonization by owls. The benefit of artificial perches in attracting and encouraging residency by owls, as well as conditions under which this management tool is appropriate, will be tested and improved through the adaptive management process. Initially, perches will be no more than 3 feet high to reduce their attractiveness to large raptors.

### **Rationale**

If burrow availability is limited, burrowing owls can often be enticed to remain at a set of burrows if suitable perches are erected to improve their vantage (Johnson pers. comm.).

## **Swainson's Hawk**

The biological goals and objectives for Swainson's hawk are listed below.

**Goal: Maintain or increase population size and distribution of Swainson's hawk in the inventory area**

- **Acquire land in the Preserve System that includes occupied nests and suitable nest sites**
- **Acquire at least 3,600 acres of modeled suitable foraging habitat for Swainson's Hawk near Kellogg Creek, near Marsh Creek, adjacent to Dutch Slough, or in suitable grassland areas**

### **Benefits of Landscape- and Community-Level Conservation Measures**

Many of the landscape-level and community-level conservation measures will benefit Swainson's hawk. The development guidelines will ensure that impacts on this species from covered activities are avoided or minimized (Conservation Measures 1.6 and 1.9). The Preserve System will protect an estimated 12 acres of modeled breeding habitat and 3,614 acres of modeled foraging habitat under the initial urban development area scenario (Table 5-13). Under the maximum urban development area scenario, the extent of preserved modeled foraging habitat increases to 4,451 acres.

Prior to acquisition of preserve lands, surveys (see Chapter 6, *Conditions on Covered Activities*) will determine nesting habitat suitability and identify Swainson's hawk nest sites. Nesting habitat will be a priority for acquisition. The loss of riparian woodland/scrub, all of which is considered suitable nesting habitat for Swainson's hawk, will be mitigated through in-kind protection of riparian woodland (Conservation Measure 1.1) and enhancement and restoration of riparian woodland/scrub within preserves (Conservation Measures 2.9 and 2.10).

The Implementing Entity will restore an estimated 12 to 16 acres of riparian woodland/scrub within preserves (Table 5-13) that provide suitable breeding habitat for Swainson's hawk. Up to 55 additional acres of riparian woodland/scrub will be restored within the preserves within the range of Swainson's hawk<sup>27</sup> (Table 5-17), providing additional high-quality breeding habitat for the species.

In addition to habitat acquisition and restoration, several preserve management measures will benefit Swainson's hawk. Preserves will be managed to enhance the prey base for raptors (Conservation Measure 2.5). Annual grassland that is managed to decrease the cover and extent of exotic plants (Conservation Measure 1.4) and to increase the cover and extent of native grasslands (Conservation Measures 1.2 and 2.4) will benefit Swainson's hawks by reducing overall vegetative cover and decreasing escape cover for prey. Management of agricultural lands will be designed to enhance and increase foraging and nesting habitat for Swainson's hawks (Conservation Measures 1.3 and 2.11). These measures contain specific techniques and goals that will be incorporated into agricultural management plans and conditions of the agricultural conservation easements purchased on these lands.

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<sup>27</sup> Most riparian restoration is expected to occur within the range of the Swainson's hawk; restoration that occurs in upper Marsh Creek (e.g., Subzone 4c) or along small drainages in the Willow Creek watershed near Pittsburg would not be within the range of Swainson's hawk.

## Silvery Legless Lizard

### Benefits of Landscape- and Community-Level Conservation Measures

Many of the landscape-level and community-level conservation measures will benefit silvery legless lizard. Development guidelines will ensure that impacts on this species from covered activities are avoided or minimized (see Conservation Measures 1.6, 1.9, and 1.10). The conservation strategy will protect an estimated 153 acres of modeled habitat for silvery legless lizard in the inventory area under the initial urban development area (Table 5-13). Acquisition of land adjacent to Dutch Slough may also preserve additional silvery legless lizard habitat. However, the suitability of modeled habitat for silvery legless lizard has not been verified in the field. Prior to acquisition of preserve lands, surveys (see Chapter 6) will be conducted to assess habitat suitability and identify occupied habitat. Results of these surveys will be used to guide acquisition of occupied or suitable habitat to the maximum extent practicable.

Several preserve, vegetation, and recreation management measures will be implemented to avoid or minimize impacts on silvery legless lizards and suitable habitat (particularly soils) in preserves. For example, restrictions on recreation in protected habitat will be implemented (Conservation Measure 1.5). These measures include limiting or prohibiting vehicle traffic in lizard habitat; limiting recreational activities allowed in protected habitat to hiking, bicycling, and horseback riding; and minimizing the number of trails in suitable habitat. Also, pesticide use, which threatens this species by affecting its insect prey base, will be controlled in preserves (Conservation Measure 1.2). Buffers between protected habitat and the urban edge will benefit silvery legless lizard by discouraging intrusion by domestic predators (Conservation Measures 1.8 and 1.9).

Existing landscape-level and community-level measures are sufficient to meet the biological goals and objectives for silvery legless lizard. No additional species-level measures are proposed for this species.

## Alameda Whipsnake

The biological goals and objectives for Alameda whipsnake are listed below.

**Goal: Contribute substantially to the recovery of Alameda whipsnake in the inventory area by protecting and enhancing chaparral/scrub**

- **Preserve an average of 70% of currently unprotected core and perimeter whipsnake habitat in Subzones 2a, 2b, 2c, 3a, and Zone 4**
- **Preserve whipsnake movement habitat between patches of whipsnake core habitat, including the linkage in Zone 2 and Subzone 3a between Black Diamond Mines Regional Preserve and Mount Diablo State Park**

■ **Maintain diverse canopy-coverage stages**

**Benefits of Landscape- and Community-Level Conservation Measures**

Many of the landscape-level and community-level conservation measures are designed specifically to benefit and contribute substantially to the recovery of Alameda whipsnake in the inventory area. Development guidelines will ensure that impacts on this species from covered activities are avoided or minimized (Conservation Measures 1.6 and 1.9). The Preserve System will protect an estimated 1,690 acres of core and perimeter habitat and 10,564 acres of upland movement habitat for Alameda whipsnake under the initial urban development area (Table 5-13).

The Plan requires land acquisition in Subzones 2a, 2b, 2c, and Zones 3 and 4 to preserve an average of 70% of unprotected suitable habitat for Alameda whipsnake. For example, in Subzone 3a the Implementing Entity will acquire at least 90% of the suitable core habitat for Alameda whipsnake to protect the largest block of chaparral/scrub in the inventory area outside public lands. Protecting 90% of this block and protecting movement habitat surrounding it will provide a key linkage between existing, protected Alameda whipsnake habitat in Mount Diablo State Park and Black Diamond Mines Regional Preserve. Land acquired in Subzones 2a, 2b, 2c, and 3a will contribute to the recovery of Alameda whipsnake by protecting important movement habitat between known populations and among patches of core habitat. Land acquisition requirements will result in the preservation of 90% of all core and perimeter habitat for this species in the inventory area (including existing public lands).

Several preserve management measures will benefit and/or minimize impacts to Alameda whipsnake. For example, movement habitat for Alameda whipsnake will be enhanced through better management of oak woodland, oak savanna, and annual grassland (Conservation Measures 1.2, 2.4, and 2.6). Control of exotic plants (Conservation Measure 1.4) and recreational uses (Conservation Measure 1.5) may also benefit or minimize impacts to Alameda whipsnake. Recreational controls include limiting vehicle and bicycle traffic in whipsnake habitat and minimizing the number of trails in suitable habitat<sup>28</sup>. Wildfire management measures such as vegetation management, fuel breaks, or prescribed burns will be designed to minimize impacts on and enhance habitat for Alameda whipsnake (see Conservation Measure 1.2).

Management of chaparral/scrub (Conservation Measure 2.8) will be conducted to minimize impacts on Alameda whipsnake but still provide the diversity of successional stages that are likely necessary to support the species. Alameda whipsnakes require canopy gaps in which to thermoregulate; these gaps will be maintained within core habitat to the maximum extent practicable through management of this land cover type.

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<sup>28</sup> Little is known about recreation impacts on Alameda whipsnake. Conservation Measure 1.5 is intended to prevent possible impacts on this species.

## Giant Garter Snake

The biological goals and objectives for giant garter snake are listed below.

### **Goal: Compensate for temporary and permanent loss of giant garter snake habitat**

- **Replace suitable upland and aquatic habitat at a ratio of 1:1 to 3:1 according to USFWS guidelines**
- **Emphasize the restoration of suitable habitat for giant garter snake on Dutch Slough**

### **Benefits of Landscape- and Community-Level Conservation Measures**

Some of the landscape-level and community-level conservation measures will benefit giant garter snake. Development guidelines will ensure that some impacts on this species from covered activities are avoided or minimized (Conservation Measures 1.6, 1.9, and 1.10). No records of giant garter snake have been documented within the inventory area<sup>29</sup>. However, suitable habitat occurs in the sloughs and drainage network associated with agricultural fields in the northeast and eastern section of the County (U.S. Fish and Wildlife Service 1999). Modeled foraging, movement, and core habitat occurs in agricultural lands in Zone 6; modeled habitat also occurs north of Zone 6 outside of Acquisition Analysis Zones. However, the suitability of modeled habitat for giant garter snake has not been verified in the field. Giant garter snake habitat suitability in these areas will be determined and mapped during planning and preconstruction surveys (see Chapter 6, *Conditions on Covered Activities*).

The Implementing Entity will acquire conservation easements (or fee title) on at least 250 acres of cropland or pasture within Zone 6. Land acquired near Dutch Slough will include sloughs and ditches that may provide suitable habitat for giant garter snake. Restoration activities are also prioritized for Dutch Slough and adjacent to Dutch Slough to benefit giant garter snake. The amount of restoration in these areas is undetermined, but up to 72 acres of slough/channel restoration could occur in the inventory area if suitable restoration sites are found. Much of this restoration would benefit giant garter snake.

Several preserve management measures are expected to benefit giant garter snake. For example, Conservation Measures 1.2, 1.3, and 1.5 will enhance movement or dispersal habitat for giant garter snake in preserves. The following conservation measure is required to meet the biological goals and objectives for this species.

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<sup>29</sup> The lack of records from the inventory area may be due to a lack of survey effort.

### **Conservation Measure 3.6. Compensate for Loss of Giant Garter Snake Habitat**

If impacts on giant garter snake habitat as a result of covered activities cannot be avoided, compensation for temporary and permanent losses of suitable habitat will be achieved using the standard USFWS compensation formulas as specified in the USFWS guidelines (U.S. Fish and Wildlife Service 1999). Mitigation for temporary impacts involves replanting and hydroseeding the disturbed area according to USFWS guidance and must include native plant species found in the area at reference sites. Mitigation required for permanent impacts is the following.

- For every acre of aquatic habitat lost, preserve 1 acre of aquatic habitat and at least 2 acres of upland habitat adjacent to the preserved aquatic habitat, and
- For every acre of upland habitat lost, preserve 1 acre of upland habitat (in addition to upland habitat preserved as a result of lost aquatic habitat).

The East Cypress Corridor Specific Plan in Oakley is expected to preserve about 230 acres of land on-site and include this in the HCP/NCCP Preserve System. Much of this land is suitable for giant garter snake, although no snakes have been found there to date. Wetland restoration will occur on the site, which may make the site more suitable for giant garter snakes. If giant garter snakes are found on this site within the HCP/NCCP Preserve System in the future as a result of restoration activities, the amount of suitable aquatic and upland habitat for this species can be credited against future impacts to suitable habitat under the Plan using the ratios above<sup>30</sup>. Similarly, other areas added to the Preserve System and found to support giant garter snake can be credited against future impacts to this species.

If giant garter snake habitat has not been preserved within the HCP/NCCP Preserve System in excess of that required to offset impacts, there are two options for implementing this compensation requirement: (1) by applicants selecting, acquiring, and managing in perpetuity a local mitigation site that is approved by USFWS for the sole purpose of compensating project impacts on giant garter snake, or (2) by applicants participating in a pre-existing, USFWS-approved mitigation bank with a service area that includes Contra Costa County. If a local mitigation site is selected, the site will be incorporated into the HCP/NCCP Preserve System and managed under the direction of the Implementing Entity to support or enhance habitat for giant garter snake.

### **Western Pond Turtle**

The biological goals and objectives for western pond turtle are listed below.

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<sup>30</sup> On the Cypress Corridor Specific Plan site, only giant garter snake habitat beyond that used to mitigate the impacts of the project can be credited against future impacts associated with the HCP/NCCP.

**Goal: Maintain or increase the population and distribution of western pond turtle**

- **Increase number and distribution of basking sites and underwater refugia in ponds**

**Benefits of Landscape- and Community-Level Conservation Measures**

Many of the landscape-level and community-level conservation measures will benefit western pond turtle. Development guidelines will ensure that impacts on this species from covered activities are avoided or minimized to the maximum extent practicable (Conservation Measures 1.6 and 1.10). The Preserve System will protect an estimated 675 or 873 acres of non-stream core habitat under the initial urban development area or maximum urban development area, respectively (Table 5-13). In addition, the Preserve System will protect an estimated 1,715 or 1,956 acres of upland movement habitat (Table 5-13). Six or 7 miles of core stream habitat and 80 or 92 miles of stream movement habitat will also be protected. Pre-acquisition surveys will be conducted to identify areas of suitable and/or occupied habitat for western pond turtle in potential preserve lands. Results of these surveys will be used to guide acquisition of occupied habitat.

To mitigate impacts on habitat for western pond turtle and other aquatic species, the Implementing Entity will acquire aquatic habitats in-kind within preserves according to the ratios in Table 5-5. Many of the acquired ponds are expected to be suitable habitat for western pond turtle. Mitigation will also include creation, restoration, or enhancement of aquatic land cover types, including creation of habitat for juvenile turtles, as described in Conservation Measures 2.2 and 2.3. Because western pond turtle requires both aquatic and upland habitats, enhancement of wetlands or ponds to compensate for loss of habitat will occur adjacent to suitable and accessible upland habitat (extending at least 300 feet from the edge of wetlands or ponds), which will also be protected.

Because population viability is largely tied to the quality and quantity of suitable and linked breeding habitat, the preservation of large areas of contiguous habitat helps meet the conservation objectives for this species. A network of core preserves will protect large blocks of upland breeding and migration habitat for western pond turtle. New preserves will be established adjacent to existing protected land to maintain contiguous wetland-upland complexes.

The following measure for western pond turtles will also be implemented to conserve this species.

**Conservation Measure 3.7. Enhance Habitat for Western Pond Turtle**

The Implementing Entity will install artificial basking substrate and add woody debris to ponds that otherwise lack suitable basking sites to enhance habitat for

western pond turtles. The artificial basking platforms are easily constructed and deployed and are being used successfully in the Los Vaqueros Watershed to attract and retain pond turtles in ponds. Woody debris and artificial basking substrate enhance habitat by providing areas for turtles to thermoregulate, an essential biological function. The platforms will be anchored to the pond bottom by nylon cord and a concrete weight and will float at an angle on the surface, rising and falling with the level of water (Alvarez in press). Basking platforms differ from woody debris in that they can be anchored, are durable, and will not be submerged by rising water levels. The basking platforms and added woody debris will also facilitate species-level monitoring by providing a consistent and stable point at which to count pond turtles.

### **Rationale**

Western pond turtles bask to thermoregulate, and safe basking sites within aquatic areas are a key habitat requirement. Woody debris and basking platforms provide a safe and semi-permanent habitat feature for turtles to use. In addition to improving habitat for western pond turtle, the woody debris and basking platforms can provide an easy means for monitoring the turtles and can attract nonnative species of emydid turtles for subsequent removal (Alvarez in press.).

## **California Tiger Salamander**

### **Benefits of Landscape- and Community-Level Conservation Measures**

Many of the landscape-level and community-level conservation measures are designed specifically to benefit California tiger salamander. The Preserve System will protect an estimated 96 or 111 acres of modeled breeding habitat under the initial or maximum urban development areas, respectively (Table 5-13). In addition, the Preserve System will protect an estimated 24,047 or 28,751 acres of migration/aestivation habitat under each permit scenario (Table 5-13). Pre-acquisition surveys will be conducted to identify areas of suitable and occupied habitat for California tiger salamanders in potential preserve lands. Results of these surveys will be used to guide acquisition of occupied habitat to the maximum extent practicable. Planning surveys for suitable breeding habitat will be conducted prior to submission of application packages for covered activities.

To compensate for loss of habitat for California tiger salamander and other aquatic species, the Implementing Entity will acquire aquatic habitats in kind within preserves at the ratios in Table 5-5. Many of the acquired ponds are expected to be suitable habitat for California tiger salamander. Mitigation will also include creation, restoration, or enhancement of aquatic land cover types as described in Conservation Measures 2.2 and 2.3. Creation, restoration, and enhancement will be designed to support the life-history requirements of California tiger salamander. In order to contribute to the recovery of covered aquatic species, the Implementing Entity will also create or restore key aquatic land cover types within preserves above and beyond the compensation requirements. These requirements are also described in Tables 5-16 and 5-17.

Because California tiger salamanders require habitat complexes that include both suitable breeding and upland habitat, areas preserved to achieve the biological goals and objectives for tiger salamander will include both habitat elements. For example, preservation, restoration, creation, or enhancement of wetlands or ponds to compensate for loss of breeding habitat will occur adjacent to suitable and accessible upland habitat that will also be protected. Likewise, upland habitat targeted for tiger salamander conservation must occur adjacent to a protected suitable breeding site.

A network of core preserves will protect large blocks of aestivation/migration habitat. New linkages will be created in blocks of suitable habitat to facilitate dispersal and colonization throughout the inventory area. New preserves will be established adjacent to existing protected land to maintain contiguous wetland-upland complexes. Because population viability is largely tied to the quality and quantity of suitable habitat, the preservation of large areas of contiguous habitat helps meet the conservation objectives for this species.

Several preserve management and community-level measures were designed to benefit California tiger salamander. For example, Conservation Measures 1.4, 1.8, 1.7, 2.1, 2.2, 2.3, 2.4, 2.5, and 2.12 will enhance habitat quality for California tiger salamander in preserves.

## California Red-Legged Frog

### Benefits of Landscape- and Community-Level Conservation Measures

Many of the landscape-level and community-level conservation measures are designed specifically to benefit and contribute to the recovery of California red-legged frog. Development guidelines will ensure that impacts on this species from covered activities are avoided or minimized (see Conservation Measures 1.6 and 1.10). The Preserve System will protect an estimated 28 or 36 acres of modeled breeding habitat with the initial or maximum urban development areas, respectively (Table 5-13; also see Conservation Measure 1.1). In addition, the Preserve System will protect up to 29,467 acres of migration/aestivation habitat. Surveys (see Chapter 6) will be conducted to confirm habitat suitability and identify habitat occupied by California red-legged frogs in potential preserve lands. Results of these surveys will be used to guide acquisition of preserves to include occupied habitat to the maximum extent practicable. Planning surveys will be conducted prior to submission of application packages for covered activities.

To mitigate impacts on aquatic habitat types, the Implementing Entity will acquire aquatic habitats in-kind within preserves at the ratios specified in Table 5-5. Many of the acquired ponds are expected to be suitable habitat for California red-legged frog. Mitigation will also include creation, restoration, or enhancement of aquatic land cover types as described in Conservation Measures 2.2 and 2.3. Creation, restoration, and enhancement will be designed to support the life-history requirements of California red-legged frog. Because red-legged

frogs require habitat complexes that include both suitable breeding and upland habitat, areas preserved to achieve the biological goals and objectives for California red-legged frog will include both habitat elements. For example, preservation, restoration, creation, or enhancement of wetlands or ponds to compensate for loss of breeding habitat will occur adjacent to suitable and accessible upland habitat that will also be protected. A network of core preserves will protect large blocks of aestivation/migration habitat. New linkages will be created in blocks of suitable habitat to facilitate dispersal and colonization throughout Zones 2 and 5 of the Preserve System. New preserves will be established adjacent to or near existing protected land and linked to such land. This approach will result in large areas of contiguous habitat and the potential to maintain contiguous wetland-upland complexes. Because population viability is tied to the extent and quality of habitat and connectivity among aquatic breeding sites, large areas of contiguous habitat will better meet the biological objectives for this species.

Several preserve-management measures were designed to benefit California red-legged frog. For example, Conservation Measures 1.4, 1.7, 1.8, 2.1, 2.2, 2.4, 2.5, and 2.12 will enhance habitat quality for California red-legged frog in preserves.

## **Foothill Yellow-Legged Frog**

The biological goals and objectives for foothill yellow-legged frog are listed below.

### **Goal: Protect, maintain, or increase populations of foothill yellow-legged frog**

- **Acquire land in Zone 4 along the upper reaches of Marsh Creek where high-quality breeding and dispersal habitat for foothill yellow-legged frog exists**

### **Benefits of Landscape- and Community-level Conservation Measures**

The landscape-level and community-level conservation measures will benefit foothill yellow-legged frog and achieve the biological goals and objectives for this species. Development guidelines will ensure that impacts on this species from covered activities are avoided or minimized (see Conservation Measures 1.6 and 1.10). Surveys (see Chapter 6) will be conducted to assess habitat suitability and identify habitat occupied by foothill yellow-legged frogs in potential preserve lands; results of these surveys will be used to guide acquisition of preserves to include occupied habitat to the maximum extent practicable. Planning surveys for foothill yellow-legged frog are not required for covered activities.

Preservation of streams will be accomplished according to stream type. Impacts on perennial streams, including suitable foothill yellow-legged frog habitat, will be mitigated at a preservation ratio of 2:1 (Table 5-5). Mitigation will also entail

stream restoration. Stream restoration will be attempted through the restoration of existing streams (e.g., creating meanders in channelized streams, removing concrete lining) but may be accomplished out of kind (see Conservation Measures 2.3 and 2.10). Maintaining natural stream flows is also important for yellow-legged frog populations. Restoration compliance for impacts on perennial streams can be accomplished through enhancement of riparian woodland/scrub; such restoration will be designed to support the life-history requirements of covered aquatic species, including foothill yellow-legged frog. In all cases, the Implementing Entity will restore more streams than required for mitigation in order to enhance habitat for and prevent the future listing of foothill yellow-legged frog. Importantly, land acquisition in Zone 4 will be focused along Marsh Creek, especially in the upper reaches, where modeled suitable breeding and dispersal habitat for yellow-legged frog is present. As much of the creek bed as possible and an adequate buffer zone will be acquired. The buffer zone acquired will be consistent with the requirements discussed in Chapter 6.

Several preserve-management measures will benefit foothill yellow-legged frog. For example, Conservation Measures 1.2, 1.4, 1.5, 1.7, 2.1, and 2.3 will enhance habitat for foothill yellow-legged frogs in preserves.

## **Longhorn Fairy Shrimp, Vernal Pool Fairy Shrimp, Midvalley Fairy Shrimp, and Vernal Pool Tadpole Shrimp**

The biological goals and objectives for covered shrimp species are listed below.

### **Goal: Compensate for loss of occupied covered shrimp habitat**

- **Preserve occupied habitat within the Preserve System at a ratio of 3:1 or dedicate an equivalent number of mitigation bank credits**
- **Restore suitable habitat within the Preserve System at a ratio of 2:1 or dedicate an equivalent number of mitigation bank credits**

### **Benefits of Landscape- and Community-level Conservation Measures**

Many of the landscape- and community-level conservation measures will benefit and contribute to recovery of longhorn fairy shrimp, vernal pool fairy shrimp, midvalley fairy shrimp, and vernal pool tadpole shrimp. Impacts on these species from covered activities are avoided or minimized (see Conservation Measure 2.12). The Preserve System will protect up to an estimated 172 acres of seasonal wetland complexes in the inventory area (Table 5-5b), much of which is likely suitable for covered invertebrates. Priority will be given to acquiring sites with suitable habitat for vernal pool invertebrates, including rock outcrops and basins that provide habitat for longhorn fairy shrimp and vernal pool fairy shrimp. Information used to develop species-habitat models was not sufficiently detailed to determine the distribution and quality of vernal pool and other suitable habitat

on lands considered for development or for preservation. Consequently, pre-acquisition surveys will be conducted to identify suitable habitat for covered shrimp species in potential preserve lands. Results of these surveys will be used to guide acquisition of suitable habitat to the maximum extent practicable. Prior to submission of an application package, planning surveys for suitable habitat for covered shrimp species will be conducted.

The Implementing Entity will attempt to restore up to an estimated 163 acres of seasonal wetland complexes in preserves (see Table 5-17 and Conservation Measure 2.2). Wherever feasible, seasonal wetland restoration will be designed to support one or more covered invertebrates. Restored vernal pools will be evaluated to determine if covered vernal pool crustaceans are present at frequencies similar to those in natural vernal pool complexes. If not, the Implementing Entity will assess the feasibility of transplanting inoculant species samples from occupied pools to restored pools to establish new populations. Such efforts will be conducted in the context of cautious experimental management and will utilize the best scientific information available.

The landscape-level and community-level measures are expected to protect some existing suitable habitat for covered shrimp species, as well as to minimize and compensate for impacts on all seasonal wetlands. However, the following measure is necessary to supplement those measures.

### **Conservation Measure 3.8. Compensate for Loss of Occupied Covered Shrimp Habitat**

Applicants who fill vernal pools must determine if the pools provide suitable habitat for covered shrimp. If surveys show absence of covered shrimp (see Section 6.3.3), applicants will mitigate for impacts according to Conservation Measure 2.3 for seasonal wetlands. If vernal pools are occupied by covered shrimp, applicants must first determine if the HCP/NCCP Implementing Entity has

- preserved 2 acres of occupied habitat for the same shrimp species for every acre impacted, and
- restored 1 acre of suitable habitat for the shrimp species for every acre impacted, and the restored habitat is occupied.

If the Implementing Entity has not accomplished these tasks, then the applicant must compensate for impacts to these vernal pools according to the requirements below. Applicants have the option of assuming presence of covered shrimp in lieu of conducting presence/absence surveys. Compensation for loss of occupied habitat will be achieved by implementing the following actions for every acre of impact.

- Preserve 2 acres of occupied habitat within the Preserve System or purchase an equivalent amount of vernal pool preservation credits in a USFWS-approved mitigation bank for each acre affected.
- Restore 1 acre of suitable habitat within the Preserve System or purchase an equivalent amount of vernal pool restoration credit in a USFWS-approved mitigation bank for each acre affected<sup>31</sup>.

Either component may be achieved by participating in a USFWS-approved mitigation bank<sup>32</sup>. If habitat is restored within the Preserve System, the vernal pool acreage can be credited to the requirement for seasonal wetland creation in Conservation Measure 2.2 (and vernal pool restoration, if applicable). Similarly, if vernal pool credits are purchased within an approved mitigation bank that is also within areas designated as high- or medium-priority for conservation by the Plan (see Chapter 5), then these credits can also offset any wetland fee for seasonal wetlands (see Chapter 9). Soils collected as described in Chapter 6 will be used to inoculate newly created seasonal wetlands on preserve lands with cysts of covered shrimp species.

### **Rationale**

Impacts on covered shrimp habitat include disturbances to seasonal wetlands, including vernal pools, and their adjacent uplands by covered activities both directly through project implementation or indirectly through human intrusion, introduced species, or pollution caused by the project. Impacts on a single wetland or pool could affect the hydrology of an entire wetland complex. The specified compensation ratios are based on existing mitigation standards applied to Contra Costa County through a programmatic Section 7 consultation with the U.S. Army Corps of Engineers (U.S. Fish and Wildlife Service 1996a). In this programmatic agreement, compensation ratios are higher if sites are used that are not part of a USFWS-approved bank (3:1 preservation and 2:1 creation). This option was not included because the HCP/NCCP Preserve System essentially functions as a large mitigation bank, and applicants should be encouraged to mitigate within the inventory area whenever feasible.

## **Conservation Measures for Multiple Plant Species**

The following conservation measures apply to all plant species or to subsets of plant species. Species-specific measures are listed after these general plant measures.

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<sup>31</sup> Note that fill of jurisdictional wetlands will also require permits from USACE and RWQCB. Those permits may require mitigation beyond that required by the HCP/NCCP.

<sup>32</sup> There are currently no USFWS-approved mitigation banks for vernal pool invertebrates in the inventory area, so mitigation for these species will either occur in new banks created in the inventory area or outside the inventory area (in banks with approved service areas that include the project site).

### **Conservation Measure 3.9. Conduct Experimental Management to Maintain or Enhance Covered Plant Populations**

The Implementing Entity will initiate a program within the Preserve System to experiment with different management techniques to benefit covered plants; this program will be conducted as part of the Adaptive Management Program. A pilot study will be designed and implemented for each covered plant to determine the best methods to either maintain or enhance its populations. Management techniques will be selected for application and manipulation based on the ecological requirements of the species and hypotheses about which ecological factors may be most important to the species. For example, conceptual ecological models could be developed for each species to identify ecological relationships, potential effects (positive or negative) of management techniques on each plant life stage, and gaps in current knowledge (Elzinga et al. 1998). This information will help guide the design of the pilot studies. Management treatments may include the following:

- Prescribed burning;
- Livestock grazing (e.g., continue existing grazing regime, reduce or eliminate grazing using an enclosure, change grazing patterns, or change type of grazing animals);
- Mechanical clearing of vegetation;
- Herbicide application to reduce the biomass of competitors.

Pilot studies will only be carried out on relatively large populations and treatments will be applied to only a portion of those populations to minimize potential adverse effects of the treatments. The results of these pilot studies will be used to inform preserve management techniques to maintain and, if possible, enhance populations of covered plants. Pilot studies should focus on addressing *key management questions* (BMP Ecosciences 2002). That is, studies should focus on addressing the issues of highest importance to the conservation of the species. The general questions below apply to all of the covered plants:

- What is a suitable microsite for the species?
- What is the abundance and distribution of these sites, and are they limiting population size? If so, can these microsites be created? If so, how?
- If unoccupied microsites are available, will the species colonize these sites naturally? If not, what techniques are available to facilitate colonization?
- What other factors may be limiting population size (e.g., disease, herbivory by native species or livestock, poor seed dispersal, low reproductive output, competition from exotic species) and what management techniques can be used to reduce or control these factors?

The Preserve Manager will work with local colleges and universities to encourage students and professors to conduct research on preserve lands to

address key management questions. Money in this HCP/NCCP budget earmarked for directed research can be used to help fund the collection of this information.

### **Rationale**

An important set of objectives of this HCP/NCCP directs that populations of covered plants within HCP/NCCP preserves will be maintained or enhanced to increase the long-term probability of survival of these species so that listing is unnecessary. However, as described in the species profiles, little is known about the ecological requirements of many covered plants. Furthermore, the effects of most proposed management techniques on these species are also unknown.

Experimentation is necessary to determine the best techniques to enhance covered plants within preserves. For example, intensive studies of one of the no-take species, *Amsinckia grandiflora*, have revealed many of the habitat requirements and several effective management techniques to enhance populations of this extremely rare plant (e.g., Pavlik et al. 1993; Carlsen et al. 2000). Alternatively, experimental results may indicate that covered plant populations are relatively stable and enhancement measures are not needed or not effective. Because the rarity characteristics of the covered plants are not understood (Rabinowitz 1981), further information on the abundance and distribution will be necessary before appropriate management techniques can be designed and implemented, if needed. Additional research and monitoring is necessary to better understand these species' ecological and management needs.

Livestock grazing is currently widespread in the inventory area, but its effects on covered plant populations are unknown. Some species or populations may benefit, while others may be harmed. Because livestock grazing will be one of the primary tools used to manage grassland vegetation communities, it is important to determine the effects of grazing on herbaceous plants so that the grazing program can be adjusted to maintain and benefit the covered species.

Creating new populations of rare plants in an experimental setting is very time consuming, expensive, and often unsuccessful (e.g., Pavlik et al. 1993). Well-designed pilot studies of existing populations of covered plants may yield results more quickly and more cost effectively than creating new populations, but limits must be placed on such pilot studies to minimize adverse effects.

A complementary strategy is to expand and enhance suitable habitat for covered plants. Increasing the availability of suitable habitat will allow plant populations to expand or at least to be maintained. Such an approach, however, presumes a body of knowledge regarding the physical and biological characteristics of suitable habitat for covered species that does not currently exist. The landscape-level and community-level conservation measures in this conservation strategy will likely increase suitable habitat for some covered plants (see species-specific discussions below), but additional research in protected areas (including HCP/NCCP preserves) will be necessary to determine the precise habitat requirements of covered species so that their long-term viability can be assured.

## Mount Diablo Manzanita

The biological objective for Mount Diablo Manzanita is listed below.

**Goal: Protect at least two occurrences of Mt. Diablo manzanita outside currently protected public lands**

### **Benefits of Landscape- and Community-Level Conservation Measures**

Many of the landscape-level and community-level conservation measures will directly benefit Mount Diablo manzanita. No impacts on known occurrences<sup>33</sup> of Mount Diablo manzanita are expected to result from covered activities. However, if a new population<sup>34</sup> is found that is expected to be removed by covered activities, the Implementing Entity, through the planning surveys discussed in Chapter 6, will ensure that a population as healthy as or healthier<sup>35</sup> than the one proposed for removal will be protected within HCP/NCCP preserves. (If the Implementing Entity cannot preserve the necessary populations, then the project applicant with impacts to this species will be required to do so in order to receive take authorization for any covered species.) The two known occurrences of Mount Diablo manzanita in the inventory area outside public lands will be protected by the Preserve System (Table 5-20 and Conservation Measure 1.1). Moreover, an estimated 414 acres of the modeled suitable range<sup>36</sup> for Mount Diablo manzanita will be protected within the Preserve System under the initial urban development area or 447 acres under the maximum urban development area (Table 5-12). This protected land constitutes 61% of the remaining modeled species range that is available for preservation.

Management of HCP/NCCP preserves will also benefit Mount Diablo manzanita. Conservation Measures 1.4 and 1.5 ensure that exotic plants and recreational use will be controlled within preserves. For example, visitors to parks within the EBRPD system may illegally harvest branches of manzanitas for decorative purposes (Olson pers. comm.). Public access to known populations of Mount Diablo manzanita within preserves will be controlled to avoid such illegal

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<sup>33</sup> A plant occurrence is defined in the same way as an *element occurrence* is defined by CDFG: a location record of a plant in the CNDDDB that is a population or group of populations within 0.25 mile and not separated by significant habitat discontinuities.

<sup>34</sup> A population is defined as a group of individuals that are separated biologically from other groups of individuals by topographic barriers, habitat barriers, or other important ecological features. Populations may be less than 0.25 mile apart, so they may or may not be the same as an occurrence. Known occurrences can be evaluated in the field as to whether they constitute one or more populations.

<sup>35</sup> See Conservation Measure 1.1 for definition of a “healthy” population.

<sup>36</sup> For covered plants, the species distribution models represent the potential range of the species within the inventory area, not necessarily the amount of suitable habitat present. Plants, especially rare plants, tend to occur in distinctive microhabitats (characterized, for example, by slope, aspect, plant association, soil type) that cannot be mapped at a regional scale. These variables were not incorporated into the species distribution models, so the models should be viewed as an estimate of the plant species’ potential range in the inventory area within which suitable habitat and plant populations would likely be found.

collection. Vegetation management actions, including prescribed burning (Conservation Measures 1.2 and 2.8), will ensure that the condition of the chaparral vegetation community that supports Mount Diablo manzanita will be maintained. Management in other areas has shown Mount Diablo manzanita produces high densities of seedlings following prescribed burning in late summer or fall (M. A. Showers, pers. comm.). If necessary, experimental management techniques will be applied to populations of this species within preserves to determine the best means to enhance population health and viability (Conservation Measure 3.9).

The biological objective for Mount Diablo manzanita is addressed through landscape- and community-level measures and measures that apply to all covered plants. No additional species-specific measures are required to meet the species goals and objectives.

## **Brittlescale**

The biological objective for brittlescale is listed below.

**Goal: Protect at least two occurrences of brittlescale outside currently protected public lands**

### **Benefits of Landscape- and Community-level Conservation Measures**

Many of the landscape-level and community-level conservation measures will directly benefit brittlescale. Impacts on one known population of brittlescale are expected from covered activities. The Implementing Entity, through the planning surveys discussed in Chapter 6, will ensure that populations as healthy as or healthier than the populations removed will be protected within HCP/NCCP preserves. (If the Implementing Entity cannot preserve the necessary populations, then the project applicant with impacts to this species will be required to do so in order to receive take authorization for any covered species.) It is likely that one known population of brittlescale will be affected by covered activities. Of the remaining four known occurrences of brittlescale in the inventory area that are presently not in protected lands, two will be brought under protection by the Preserve System under the initial urban development area. The remaining two population will be protected if the initial urban development area is exceeded (Table 5-20 and Conservation Measure 1.1). In addition, an estimated 577 or 697 acres of the modeled species range for brittlescale will be protected within the Preserve System under the initial urban development area and the maximum urban development area, respectively (Table 5-12). This protected land constitutes from 49% to 60%, respectively, of the modeled species range in the inventory area that is available for preservation.

Management of HCP/NCCP preserves will benefit brittlescale. For example, Conservation Measure 1.4 ensures that exotic plants will be controlled within preserves. Vegetation management and enhancement within alkali grassland and alkali wetlands (Conservation Measures 2.1, 2.2, 2.4, and 2.12) will benefit

brittlescale by maintaining or enhancing suitable habitat for this species. Approximately 61 to 67 acres of alkali wetlands will be restored within preserves (Tables 5-16 and 5-17). One objective of alkali wetland restoration is to restore suitable habitat for brittlescale (e.g., in alkali meadows).

The biological objective for brittlescale is addressed through landscape- and community-level measures and measures that apply to all covered plants. No additional species-specific measures are required to meet the species goals and objectives.

## San Joaquin Spearscale

### Benefits of Landscape- and Community-level Conservation Measures

Many of the landscape-level and community-level conservation measures will directly benefit San Joaquin spearscale. The only known population of San Joaquin spearscale outside public lands was recently found in Antioch during development of the Sand Creek Specific Plan (Mundie & Associates and City of Antioch 2002). This population may be extirpated by activities not covered by the plan. All remaining 31 known occurrences of this species are within the Los Vaqueros Watershed (Table 5-20). Although rare in California, the species is relatively common in the Los Vaqueros Watershed, where extensive surveys have been conducted (Jones & Stokes Associates 1989). It is expected that other populations will be found within the inventory area, particularly on alkali soils in Zone 5.

No species distribution model was developed for San Joaquin spearscale because of the difficulty in predicting the species' occurrence relative to conditions that could be mapped at a regional scale. This species often co-occurs with brittlescale, so it is anticipated that protection of suitable habitat for the species will be largely coincidental with protection of habitat suitable to support brittlescale.

Management of HCP/NCCP preserves will benefit San Joaquin spearscale. For example, Conservation Measure 1.4 ensures that exotic plants will be controlled within preserves. Vegetation management and enhancement within alkali grassland and alkali wetlands (Conservation Measures 2.1, 2.4, 2.2, and 2.12) will benefit San Joaquin spearscale by maintaining or enhancing suitable habitat for this species. Approximately 61–67 acres of alkali wetlands will be restored within preserves (Tables 5-16 and 5-17). One objective of alkali wetland protection is to protect additional suitable habitat for San Joaquin spearscale (e.g., in alkali meadows).

Conservation and management for San Joaquin spearscale are addressed through landscape- and community-level measures and the one measure that applies to all covered plants. No additional species-specific conservation measures are required.

## Big Tarplant

The biological objective for big tarplant is listed below.

**Goal: Protect at least five occurrences of big tarplant outside currently protected public lands**

### **Benefits of Landscape- and Community-level Conservation Measures**

Many of the landscape-level and community-level conservation measures will directly benefit big tarplant. One population of big tarplant is expected to be lost to covered activities. However, three of the remaining five known occurrences of big tarplant in the inventory area outside public lands will be protected by the Preserve System (Table 5-20) (Conservation Measure 1.1). In addition, an estimated 9,300 or 11,395 acres of the modeled species range will be protected within the Preserve System under the initial urban development area and the maximum urban development area, respectively (Table 5-12). This protected land constitutes from 48% to 59%, respectively, of the modeled species range in the inventory area available for preservation.

Management of HCP/NCCP Preserves will benefit big tarplant. For example, Conservation Measure 1.4 ensures that exotic plants will be controlled within preserves to minimize adverse impacts.

The biological objective for big tarplant is addressed through landscape- and community-level measures and measures that apply to all covered plants. No additional species-specific measures are required to meet the species goals and objectives.

## Mount Diablo Fairy Lantern

The biological objective for Mount Diablo fairy lantern is listed below.

**Goal: Protect at least one occurrence of Mount Diablo fairy lantern outside currently protected public lands**

### **Benefits of Landscape- and Community-level Conservation Measures**

Many of the landscape-level and community-level conservation measures will directly benefit Mount Diablo fairy lantern. No known populations of Mount Diablo fairy lantern are expected to be lost to covered activities. The one known occurrence of Mount Diablo fairy lantern in the inventory area outside public lands will be protected by the Preserve System, if this occurrence is still extant (Table 5-20) (Conservation Measure 1.1). If this population (in Subzone 4b) has been extirpated, completion of planning surveys will ensure that no other population will be removed until a new population is found within the preserves that is as healthy or healthier than the population lost (see Conservation Measure

1.1 for a definition of “healthy”). Moreover, an estimated 11,178 or 13,360 acres of the modeled species range will be protected within the Preserve System under the initial urban development area and the maximum urban development area, respectively (Table 5-12). This protected land constitutes from 43% to 54%, respectively, of the modeled species range in the inventory area available for preservation.

Management of HCP/NCCP preserves will benefit Mount Diablo fairy lantern. For example, Conservation Measure 1.4 ensures that exotic plants will be controlled within preserves to minimize possible competition with this species. Conservation Measure 1.5 ensures that public access will be controlled and monitored so that the species is not collected by visitors. Vegetation management and enhancement within native grassland (Conservation Measures 2.1 and 2.4), oak savanna/woodland (Conservation Measures 2.1 and 2.6), and chaparral (Conservation Measures 2.1 and 2.8) will benefit Mount Diablo fairy lantern by maintaining or enhancing suitable habitat for this species. Approximately 42–165 acres of oak savanna will be restored within preserves (Table 5-16 and 5-17 and Conservation Measure 2.7). One objective of oak savanna restoration is to provide additional suitable habitat for Mount Diablo fairy lantern.

The biological objective for Mount Diablo fairy lantern is addressed through landscape- and community-level measures and measures that apply to all covered plants. No additional species-specific measures are required to meet the species goals and objectives.

## Recurved Larkspur

The biological objective for recurved larkspur is listed below.

**Goal: Protect at least two occurrences of recurved larkspur outside currently protected public lands**

### **Benefits of Landscape- and Community-Level Conservation Measures**

Many of the landscape-level and community-level conservation measures will directly benefit recurved larkspur. Impacts on one known population of recurved larkspur are expected from covered activities. The Implementing Entity, through the planning surveys described in Chapter 6, will ensure that a population as healthy as or healthier than the population removed will be protected within HCP/NCCP preserves. (If the Implementing Entity cannot preserve the necessary populations, then the project applicant with impacts to this species will be required to do so in order to receive take authorization for any covered species.) The two remaining known occurrences of recurved larkspur in the inventory area outside public lands will be brought under protection by the Preserve System (Table 5-20) (Conservation Measure 1.1). Moreover, an estimated 389 or 1,064 acres of the modeled range for this species will be protected within the Preserve System under the initial urban development area

and the maximum urban development area, respectively (Table 5-12). This protected land constitutes from 23% to 62%, respectively, of the modeled species range available for preservation.

Management of HCP/NCCP Preserves will benefit recurved larkspur. For example, Conservation Measure 1.4 ensures that exotic plants will be controlled within preserves. Vegetation management and enhancement within alkali grassland and alkali wetlands (Conservation Measures 2.1, 2.4, 2.2, and 2.12) will benefit recurved larkspur by maintaining or enhancing suitable habitat for this species. Approximately 42-165 acres of oak savanna will be restored within preserves (Table 5-16 and 5-17 and Conservation Measure 2.7). One objective of alkali wetland restoration is to restore additional suitable habitat for recurved larkspur (e.g., in alkali meadows).

The biological objective for recurved larkspur is addressed through landscape- and community-level measures and measures that apply to all covered plants. No additional species-specific measures are required to meet the species goals and objectives.

## Round-Leaved Filaree

The biological objective for round-leaved filaree is listed below.

**Goal: Protect at least two occurrences of round-leaved filaree outside currently protected public lands**

### **Benefits of Landscape- and Community-level Conservation Measures**

Many of the landscape-level and community-level conservation measures will directly benefit round-leaved filaree. Impacts on two known occurrences of round-leaved filaree are expected from covered activities. Completion of planning surveys will help the Implementing Entity to ensure that a population as healthy as or healthier than the two occurrences removed will be protected within HCP/NCCP preserves. (If the Implementing Entity cannot preserve the necessary populations, then the project applicant with impacts to this species will be required to do so in order to receive take authorization for any covered species.) Two of the seven known occurrences of round-leaved filaree in the inventory area outside public lands will be brought under protection by the Preserve System (Table 5-20; Conservation Measure 1.1). Because the location of several of the seven documented occurrences are not well known and there have been few surveys for this species in the area, it is expected that more than two occurrences would be protected in the Preserve System. An estimated 2,877 or 2,997 acres of the primary modeled range for this species will be protected within the Preserve System under the initial urban development area and the maximum urban development area, respectively (Table 5-12). This protected land constitutes from 50% to 52%, respectively, of the primary modeled range in the inventory area available for preservation.

Management of HCP/NCCP Preserves will benefit round-leaved filaree. For example, Conservation Measure 1.4 ensures that exotic plants will be controlled within preserves; increases in the cover of exotic grasses may have contributed to the decline of round-leaved filaree. Vegetation management and enhancement within grasslands (Conservation Measure 2.4) will benefit round-leaved filaree by maintaining or enhancing suitable habitat for this species.

The biological objective for and conservation needs of round-leaved filaree are addressed through landscape- and community- level measures and measures that apply to all covered plants. No additional species-specific measures are required to meet the species objective.

## Diablo Helianthella

The biological objective for Diablo Helianthella is listed below.

**Goal: Protect at least two occurrences of Diablo helianthella outside currently protected public lands**

### **Benefits of Landscape- and Community-Level Conservation Measures**

Many of the landscape-level and community-level conservation measures will directly benefit Diablo helianthella. No impacts on known populations of Diablo helianthella are expected from covered activities. However, the Implementing Entity, through the planning surveys, will ensure that if a population is discovered within impact areas, a population as healthy as or healthier than that removed will be protected within HCP/NCCP preserves. (If the Implementing Entity cannot preserve the necessary populations, then the project applicant with impacts to this species will be required to do so in order to receive take authorization for any covered species.) Both known occurrences of Diablo helianthella in the inventory area outside public lands will be brought under protection by the Preserve System (Table 5-20) (Conservation Measure 1.1). Moreover, the Preserve System will protect an estimated 6,168 acres of the modeled suitable range for this species under the initial urban development area (Table 5-12). This protected land constitutes 46% of the modeled species range in the inventory area available for preservation (Table 5-12).

Management of HCP/NCCP preserves will benefit Diablo helianthella. For example, Conservation Measure 1.4 ensures that exotic plants will be controlled within preserves. Vegetation management and enhancement within oak savanna/woodland (Conservation Measures 2.1 and 2.6) and chaparral (Conservation Measures 2.1 and 2.8) will benefit Diablo helianthella by maintaining or enhancing suitable habitat for this species. Approximately 42-165 acres of oak savanna will be created or restored in the Preserve System (Tables 5-16 and 5-17). One objective of oak savanna restoration is to provide additional suitable habitat for Diablo helianthella.

The biological objective for Diablo helianthella is addressed through landscape- and community-level measures and measures that apply to all covered plants. No additional species-specific measures are required to meet the species goals and objectives.

## **Brewer's Dwarf Flax**

The biological objective for Brewer's dwarf flax is listed below.

**Goal: Protect at least three occurrences of Brewer's dwarf flax outside currently protected public lands**

### **Benefits of Landscape- and Community-level Conservation Measures**

Many of the landscape-level and community-level conservation measures will directly benefit Brewer's dwarf flax. No impacts on known populations of Brewer's dwarf flax are expected from covered activities (Table 5-20). The Implementing Entity, through the planning surveys, will ensure that if a population is discovered within impact areas, a population as healthy as or healthier than that removed will be protected within HCP/NCCP preserves. (If the Implementing Entity cannot preserve the necessary populations, then the project applicant with impacts to this species will be required to do so in order to receive take authorization for any covered species.) All three known occurrences of Brewer's dwarf flax in the inventory area outside public lands will be brought under protection by the Preserve System (Table 5-20) (Conservation Measure 1.1). Approximately 9,337 acres of the modeled suitable range for this species will be protected within the Preserve System under the initial permit area (Table 5-12). This protected land constitutes 48% of the modeled species range available for preservation.

Management of HCP/NCCP Preserves will also benefit Brewer's dwarf flax. For example, Conservation Measure 1.4 ensures that exotic plants will be controlled within preserves. Vegetation management and enhancement within native grassland (Conservation Measures 2.1 and 2.4), oak savanna/woodland (Conservation Measures 2.1 and 2.6), and chaparral (Conservation Measures 2.1 and 2.8) will benefit Brewer's dwarf flax by maintaining or enhancing suitable habitat for this species. Approximately 42-165 acres of oak savanna will be created or restored in the preserve system (Tables 5-16 and 5-17). (Conservation Measure 2.7). One objective of oak savanna restoration is to provide additional suitable habitat for Brewer's dwarf flax.

The biological objectives for Brewer's dwarf flax is addressed through landscape- and community-level measures and measures that apply to all covered plants. No additional species-specific measures are required to meet the species goals and objectives.

## Showy Madia

The goals and objectives for showy madia are listed below.

### **Goal: Protect populations of showy madia within oak woodland and grassland**

- **Identify and maintain or increase populations of showy madia in the inventory area**

### **Benefits of Landscape- and Community-level Conservation Measures**

Showy madia is not currently known to occur in the inventory area (Table 5-20), but suitable habitat exists. A historic occurrence of showy madia in Antioch was not relocated during recent surveys (Mundie & Associates and City of Antioch 2002). This species was considered for no-take status. The inventory area represents the northernmost edge of a fairly wide distributional range in California (see the species profile in Appendix D). Within its entire range, 32 occurrences have been documented, although the current status of these occurrences is unknown. Because the inventory area represents a relatively small portion of the species' range, impacts on new occurrences of this species could occur as long as an equal number of populations were preserved in the HCP/NCCP Preserve System. As for other plants, the preserved populations must be as healthy or healthier than the population lost. Until a population is found and protected in an HCP/NCCP preserve (by the Implementing Entity or the project applicant with impacts to this species), no impacts on this species will be allowed. No species distribution model was developed for showy madia because of the difficulty in predicting its occurrence relative to conditions that could be mapped at a regional scale.

Many of the landscape-level and community-level conservation measures will directly benefit showy madia if the species is found within HCP/NCCP preserves. Development conditions will ensure that impacts on this species from covered activities are avoided or minimized (see Chapter 6). Completion of planning surveys will ensure that botanical surveys will be conducted in potential impact areas and that high-quality populations will be avoided. Conservation Measure 1.4 ensures that exotic plants will be controlled within preserves. Vegetation management and enhancement within native grassland (Conservation Measures 2.1 and 2.4) and oak savanna (Conservation Measures 2.1 and 2.6) may also benefit showy madia by maintaining or enhancing suitable habitat for this species. Approximately 42-165 acres of oak savanna will be created or restored in the preserve system (Tables 5-16 and 5-17 and Conservation Measure 2.7). Oak savanna restoration may provide additional suitable habitat for showy madia.

Conservation and management for showy madia are addressed through landscape- and community-level measures and the one measure that applies to all covered plants. No additional species-specific conservation measures are required to meet the species goal and objective.

## Adobe Navarretia

The goals and objectives for adobe navarretia are listed below.

### **Goal: Protect populations of adobe navarretia within wetlands**

- **Identify, protect, and maintain populations of adobe navarretia in the inventory area**

### **Benefits of Landscape- and Community-Level Conservation Measures**

The only known records of this species in the inventory area are two historic collections in and near Antioch from 1888 and 1907 (Jepson Herbarium 2003). These populations are assumed to have been extirpated. This species was considered for no-take status. The inventory area is a small portion of a broad distributional range throughout the Central Valley (see the species profile in Appendix D). Within this range, 5 occurrences have been documented (Table 5-20), although the current status of these occurrences is unknown. Because the inventory area represents a relatively small portion of the species' range, it was determined that some impacts on the species could occur as long as the highest-quality populations were preserved if any are found. Until the historic populations are relocated or more populations are found and protected in HCP/NCCP preserves, no impacts on this species will be allowed (see Chapter 6). No species distribution model was developed for adobe navarretia because the suitable habitat of this species is poorly known.

Many of the landscape-level and community-level conservation measures will directly benefit adobe navarretia, if it is found in HCP/NCCP preserves. For example, development conditions will ensure that impacts on this species from covered activities are avoided or minimized (see Chapter 6). Completion of planning surveys will ensure that botanical surveys will be conducted in potential impact areas and that high-quality populations will be avoided. Conservation Measure 1.4 ensures that exotic plants will be controlled within preserves. Vegetation management and enhancement within native grassland (Conservation Measures 2.1 and 2.4) may benefit adobe navarretia by maintaining or enhancing suitable habitat for this species.

Conservation and management for adobe navarretia are addressed through landscape- and community-level measures and the one measure that applies to all covered plants. No additional species-specific conservation measures are required to meet the species goal and objective.

**Table 5-1.** Natural Community-level and Additional Species-specific Biological Goals and Objectives and Associated Conservation Measures

<b>Covered Species Expected to Benefit from Wetlands (and other Aquatic) Biological Goals and Objectives:</b>		
<p>Tricolored blackbird California red-legged frog California tiger salamander Giant garter snake Western pond turtle Vernal pool fairy shrimp</p>	<p>Vernal pool tadpole shrimp Longhorn fairy shrimp Midvalley fairy shrimp Adobe navarretia Brittlescale [Grassland]</p>	<p><b>Notes:</b></p> <ul style="list-style-type: none"> <li>Goals and objectives are organized by natural community type. Community-level goals and objectives that support multiple covered species are presented first within each section. Species-specific goals and objectives are developed and presented only when the community-level goals do not adequately address the species' needs.</li> <li>Habitat shown in brackets is the habitat with which the species is primarily associated; any specific Biological Goals and Objectives pertaining to this species are addressed in their primary habitat.</li> </ul>
<b>Wetlands (and other Aquatic) Biological Goals and Objectives</b>	<b>Conservation Measures</b>	
<p><b>Goal 1: Preserve wetlands and ponds in the inventory area</b></p> <p><b>Objective 1.1.</b> Acquire perennial wetlands at a ratio of 1:1 of wetted acres (estimated to be 75 wetted acres with the maximum urban development area) and protect as part of the Preserve System</p> <p><b>Objective 1.2.</b> Acquire seasonal wetlands at a ratio of 3:1 of wetted acres (estimated to be 177 acres of seasonal wetland complex with the maximum urban development area) and protect as part of the Preserve System</p> <p><b>Objective 1.3.</b> Acquire alkali wetlands at a ratio of 3:1 of wetted acres (estimated to be 96 acres of alkali wetland complex with the maximum urban development area) and protect as part of the Preserve System in Zones 2, 5, and 6</p> <p><b>Objective 1.4.</b> Acquire ponds at a ratio of 2:1 of wetted acres (estimated to be 16 wetted acres with the maximum urban development area) and protect as part of the Preserve System</p> <p><b>Objective 1.5.</b> Acquire at least seven of the 13 ponds in Subzone 2c to provide suitable breeding habitat for tricolored blackbird, California tiger salamander, California red-legged frog, and/or western pond turtle</p> <p><b>Objective 1.6.</b> Acquire slough/channel at a ratio of 0.5:1 of wetted acres (estimated to be 36 wetted acres with the maximum urban development area) and protect as part of the Preserve System</p> <p><b>Objective 1.7.</b> Acquire aquatic (open water) at a ratio of 1:1 of wetted acres (estimated to be 17 wetted acres with the maximum urban development area) and protect as part of the Preserve System</p> <p><b>Objective 1.8.</b> Preserve and maintain contiguous wetland-upland complexes</p>	<p><b>Conservation Measure 1.1.</b> Acquire Lands for Preserve System</p> <p><b>Conservation Measure 1.3.</b> Prepare and Implement Agricultural Management Plans for Cultivated Agricultural Lands</p>	

Wetlands (and other Aquatic) Biological Goals and Objectives	Conservation Measures
<p><b>Goal 2: Maintain and enhance hydrogeomorphic and ecological function of wetlands and ponds to promote covered species, native biological diversity, and habitat heterogeneity</b></p> <p><b>Objective 2.1.</b> Maintain or increase native emergent vegetation where appropriate</p> <p><b>Objective 2.2.</b> Reduce sediment deposition and transport where appropriate</p> <p><b>Objective 2.3.</b> Maintain or increase wetland and pond capacity and water duration as appropriate.</p> <p><b>Objective 2.4.</b> Maintain or increase flows to and connectivity among wetlands and wetland complexes as appropriate</p> <p><b>Objective 2.5.</b> Eliminate or reduce non-native animals</p> <p><b>Objective 2.6.</b> Eliminate or reduce exotic plants</p> <p><b>Objective 2.7.</b> Maintain or enhance upland habitat in close proximity to wetlands and ponds to support the life-history requirements of wetland-dependent covered species</p>	<p><b>Conservation Measure 1.2.</b> Prepare and Implement an Exotic Plant Control Program for the Preserve System</p> <p><b>Conservation Measure 1.3.</b> Prepare and Implement Management Plans for Cultivated Agricultural Lands</p> <p><b>Conservation Measure 2.2.</b> Manage Wetlands and Ponds</p>
<p><b>Goal 3: Restore wetlands and create ponds in Preserve System to compensate for permanent loss of these habitats</b></p> <p><b>Objective 3.1.</b> Restore perennial wetlands in-kind at a ratio of 1:1 of wetted acres (estimated to be 75 wetted acres with the maximum urban development area)</p> <p><b>Objective 3.2.</b> Restore alkali wetlands in-kind at a ratio of 2:1 of wetted acres (estimated to be 64 acres of alkali wetland complex with the maximum urban development area)</p> <p><b>Objective 3.3.</b> Restore seasonal wetlands in-kind at a ratio of 2:1 of wetted acres (estimated to be 118 acres of seasonal wetland complex with the maximum urban development area)</p> <p><b>Objective 3.4.</b> Create ponds in-kind at a ratio of 1:1 (estimated to be 8 acres with the maximum urban development area) to support California tiger salamander, California red-legged, and/or western pond turtle</p> <p><b>Objective 3.5.</b> Compensate for loss of slough/channel by either restoring slough/channel at a ratio of 1:1 where feasible or restoring riparian woodland/scrub in Zone 6 at a ratio of 0.5:1</p> <p><b>Objective 3.6.</b> Compensate for loss of aquatic (open water) by creating ponds at a ratio of 0.5:1 (estimated to be 9 acres of ponds with the maximum urban development area) to support California tiger salamander, California red-legged, and/or western pond turtle</p> <p><b>Objective 3.7.</b> Compensate for loss of aquatic (open water) by creating ponds at a ratio of 0.5:1 (estimated to be 9 acres of ponds with the maximum urban development area) to support California tiger salamander, California red-legged, and/or western pond turtle</p>	<p><b>Conservation Measure 2.3.</b> Restore Wetlands and Create Ponds</p>

<b>Wetlands (and other Aquatic) Biological Goals and Objectives</b>	<b>Conservation Measures</b>
<p><b>Goal 4: Restore wetlands and create ponds in the Preserve System to contribute to recovery of covered species</b></p> <p><b>Objective 4.1.</b> Restore 10 wetted acres of perennial wetlands</p> <p><b>Objective 4.2.</b> Restore 5 wetted acres of alkali wetlands</p> <p><b>Objective 4.3.</b> Restore 20 wetted acres of seasonal wetlands</p> <p><b>Objective 4.4.</b> Create 8 acres of ponds to support California tiger salamander, California red-legged, and/or western pond turtle</p>	<p><b>Conservation Measure 2.3.</b> Restore Wetlands and Create Ponds</p>
<p><b>Goal 5: Enhance habitat for tricolored blackbird in the Preserve System</b></p> <p><b>Objective 5.1.</b> Restore perennial wetlands so that at least 25% will provide breeding habitat</p> <p><b>Objective 5.2.</b> Restore perennial wetlands to provide breeding habitat at least 1 mile from black-crowned night heron colonies and within flight distance of blackbird foraging habitat</p>	<p><b>Conservation Measure 2.2.</b> Manage Wetlands and Ponds</p> <p><b>Conservation Measure 2.3.</b> Restore Wetlands and Create Ponds</p> <p><b>Conservation Measure 3.2.</b> Minimize Predation on Tricolored Blackbird Colonies</p>
<p><b>Goal 6: Compensate for temporary and permanent loss of giant garter snake habitat</b></p> <p><b>Objective 6.1.</b> Replace suitable upland and aquatic habitat at a ratio of 1:1 to 3:1 according to USFWS guidelines</p> <p><b>Objective 6.2.</b> Emphasize the restoration of suitable habitat for giant garter snake on Dutch Slough</p>	<p><b>Conservation Measure 3.6.</b> Compensate for Loss of Giant Garter Snake Habitat</p>
<p><b>Goal 7: Maintain or increase the population and distribution of western pond turtle</b></p> <p><b>Objective 7.1.</b> Increase number and distribution of basking sites and underwater refugia in ponds</p>	<p><b>Conservation Measure 3.7.</b> Enhance Habitat for Western Pond Turtle</p>
<p><b>Goal 8: Compensate for loss of occupied covered shrimp habitat</b></p> <p><b>Objective 8.1.</b> Preserve occupied habitat within the Preserve System at a ratio of 3:1 or dedicate an equivalent number of mitigation bank credits</p> <p><b>Objective 8.2.</b> Restore suitable habitat within the Preserve System at a ratio of 2:1 or dedicate an equivalent number of mitigation bank credits</p>	<p><b>Conservation Measure 3.8.</b> Compensate for Loss of Occupied Covered Shrimp Habitat</p>
<p><b>Goal 9: Protect populations of adobe navarretia within wetlands</b></p> <p><b>Objective 9.1.</b> Identify, protect, and maintain populations of adobe navarretia in the inventory area</p>	<p><b>Conservation Measure 1.1.</b> Acquire Lands for Preserve System</p>

**Covered Species Expected to Benefit from Grassland Biological Goals and Objectives**

San Joaquin kit fox	Recurved larkspur
Townsend’s big-eared bat	Round-leaved filaree
Western burrowing owl	Showy madia [Oak woodland]
Golden eagle	Swainson’s hawk [Streams and Riparian woodland/scrub]
Silvery legless lizard	Tricolored blackbird [Wetlands]
Big tarplant	Alameda whipsnake [Chaparral/scrub]
San Joaquin spearscale	Western pond turtle [Wetlands]
Brittlescale	California tiger salamander [Wetlands]
	California red-legged frog [Wetlands]

**Grassland Biological Goals and Objectives**

**Conservation Measures**

**Goal 10: Preserve sufficient habitat in the inventory area to maintain viable populations of grassland-dependent covered species**

- Objective 10.1.** Preserve 13,000 acres of annual grassland and 900 acres of alkali grassland
- Objective 10.2.** Protect native grassland alliances within the Preserve System

**Conservation Measure 1.1.** Acquire Lands for Preserve System

**Goal 11: Enhance grassland to promote native biological diversity and habitat heterogeneity**

- Objective 11.1.** Increase the relative cover of native grasses and forbs in native grassland vegetation alliances and other grassland types
- Objective 11.2.** Increase structural diversity by creating and maintaining a mosaic of grassland types and conditions
- Objective 11.3.** Reduce the biomass, cover, and extent of exotic plants (i.e., non-native invasive plants) in the Preserve System

**Conservation Measure 1.4.** Prepare and Implement an Exotic Plant Control Program for the Preserve System

**Conservation Measure 2.4.** Manage Grassland

**Goal 12: Increase availability of burrows within grassland for San Joaquin kit fox, California tiger salamander, California red-legged frog, and western burrowing owl**

- Objective 12.1.** Increase the number and distribution of California ground squirrel burrows

**Conservation Measure 2.5.** Manage Natural Burrow Availability and Prey Base in Grasslands



Grassland Biological Goals and Objectives	Conservation Measures										
<p><b>Goal 17: Protect in the Preserve System at least 11 unprotected occurrences of grassland-dependent covered plants</b></p> <p><b>Objective 17.1.</b> Protect populations of covered plants that are at least as large and as healthy* as populations lost to covered activities</p> <p><b>Objective 17.2.</b> Protect at least two occurrences of brittlescale outside currently protected public lands</p> <p><b>Objective 17.3.</b> Protect at least three occurrences of big tarplant outside currently protected public lands</p> <p><b>Objective 17.4.</b> Protect at least two occurrences of recurved larkspur outside currently protected public lands</p> <p><b>Objective 17.5.</b> Protect at least two occurrences of round-leaved filaree outside currently protected public lands</p>	<p><b>Conservation Measure 1.1.</b> Acquire Lands for Preserve System</p>										
<p><b>Goal 18: Enhance populations of grassland-dependent covered plants</b></p> <p><b>Objective 18.1.</b> Increase population size and distribution of grassland-dependent covered plants, where feasible and biologically desirable</p>	<p><b>Conservation Measure 3.9.</b> Conduct Experimental Management to Enhance Covered Plant Populations</p>										
<p><b>Covered Species Expected to Benefit from Oak Woodland Biological Goals and Objectives:</b></p> <table border="0"> <tr> <td>Showy madia</td> <td>California tiger salamander [Wetlands]</td> </tr> <tr> <td>San Joaquin kit fox [Grassland]</td> <td>Western pond turtle [Wetlands]</td> </tr> <tr> <td>Golden eagle [Grassland]</td> <td>Mt. Diablo fairy lantern [Chaparral/scrub]</td> </tr> <tr> <td>Silvery legless lizard [Grassland]</td> <td>Diablo helianthella [Chaparral/scrub]</td> </tr> <tr> <td>California red-legged frog [Wetlands]</td> <td>Brewer's dwarf flax [Chaparral/scrub]</td> </tr> </table>		Showy madia	California tiger salamander [Wetlands]	San Joaquin kit fox [Grassland]	Western pond turtle [Wetlands]	Golden eagle [Grassland]	Mt. Diablo fairy lantern [Chaparral/scrub]	Silvery legless lizard [Grassland]	Diablo helianthella [Chaparral/scrub]	California red-legged frog [Wetlands]	Brewer's dwarf flax [Chaparral/scrub]
Showy madia	California tiger salamander [Wetlands]										
San Joaquin kit fox [Grassland]	Western pond turtle [Wetlands]										
Golden eagle [Grassland]	Mt. Diablo fairy lantern [Chaparral/scrub]										
Silvery legless lizard [Grassland]	Diablo helianthella [Chaparral/scrub]										
California red-legged frog [Wetlands]	Brewer's dwarf flax [Chaparral/scrub]										
Oak Woodland Biological Goals and Objectives	Conservation Measures										
<p><b>Goal 19: Preserve oak woodland and oak savanna in the inventory area.</b></p> <p><b>Objective 19.1.</b> Protect 900 acres of oak woodland and oak savanna</p>	<p><b>Conservation Measure 1.1.</b> Acquire Lands for Preserve System</p>										
<p><b>Goal 20: Maintain the current canopy coverage of oaks and other native overstory trees within oak woodland and oak savanna land-cover types</b></p> <p><b>Objective 20.1.</b> Ensure tree recruitment and age structure are adequate to replace lost trees and maintain canopy coverage</p> <p><b>Objective 20.2.</b> Reduce competition between tree seedlings and other plants to enhance survival rates of tree seedlings and saplings</p>	<p><b>Conservation Measure 1.4.</b> Prepare and Implement an Exotic Plant Control Program for the Preserve System</p> <p><b>Conservation Measure 2.6.</b> Manage Oak Woodland and Oak Savanna</p>										

Oak Woodland Biological Goals and Objectives	Conservation Measures						
<p><b>Goal 21: Enhance oak woodland and oak savanna to promote biological diversity and habitat heterogeneity</b></p> <p><b>Objective 21.1.</b> Increase the proportion of native species in oak woodland and oak savanna understories</p> <p><b>Objective 21.2.</b> Leave in place snags, dead trees, and downed wood</p>	<p><b>Conservation Measure 2.6.</b> Manage Oak Woodland and Oak Savanna</p>						
<p><b>Goal 22: Restore oak savanna to compensate for its loss from covered activities</b></p> <p><b>Objective 22.1.</b> Replace oak savanna vegetation alliances (in kind) that are lost to covered activities at a ratio of 1:1</p> <p><b>Objective 22.2</b> Establish within 50 years of initiating restoration a sufficient number of blue or valley oak trees to provide a percent tree canopy cover equal to or up to 10% greater than the percent canopy cover in oak savanna stands removed by covered activities</p>	<p><b>Conservation Measure 1.1.</b> Acquire Lands for Preserve System</p> <p><b>Conservation Measure 2.7.</b> Compensate for loss of Oak Savanna</p>						
<p><b>Goal 23: Protect populations of showy madia within oak woodland and grassland.</b></p> <p><b>Objective 23.1.</b> Identify and maintain or increase populations of showy madia in the inventory area</p>	<p><b>Conservation Measure 1.1.</b> Acquire Lands for Preserve System</p> <p><b>Conservation Measure 3.9.</b> Conduct Experimental Management to Enhance Covered Plant Populations</p>						
<p><b>Covered Species Expected to Benefit from Chaparral/Scrub Biological Goals and Objectives</b></p> <table border="0" style="width: 100%;"> <tr> <td style="width: 50%;">Alameda whipsnake</td> <td style="width: 50%;">Diablo helianthella</td> </tr> <tr> <td>Mount Diablo manzanita</td> <td>Brewer’s dwarf flax</td> </tr> <tr> <td>Mount Diablo fairy lantern</td> <td></td> </tr> </table>		Alameda whipsnake	Diablo helianthella	Mount Diablo manzanita	Brewer’s dwarf flax	Mount Diablo fairy lantern	
Alameda whipsnake	Diablo helianthella						
Mount Diablo manzanita	Brewer’s dwarf flax						
Mount Diablo fairy lantern							
Chaparral/Scrub Biological Goals and Objectives	Conservation Measures						
<p><b>Goal 24: Preserve chaparral/scrub in the inventory area</b></p> <p><b>Objective 24.1.</b> Protect 550 acres of chaparral/scrub that support a diversity of native plant alliances including chaparral, California sage scrub, and black sage scrub</p>	<p><b>Conservation Measure 1.1.</b> Acquire Lands for Preserve System</p>						
<p><b>Goal 25: Enhance chaparral/scrub to promote native biological diversity and habitat heterogeneity</b></p> <p><b>Objective 25.1.</b> Maintain or mimic the natural fire regime</p> <p><b>Objective 25.2.</b> Maintain a mosaic of stand ages and species composition across the landscape</p> <p><b>Objective 25.3.</b> Promote canopy gaps within chaparral/scrub patches</p>	<p><b>Conservation Measure 2.8.</b> Manage Chaparral/Scrub</p>						

Chaparral/Scrub Biological Goals and Objectives	Conservation Measures
<p><b>Goal 26: Contribute substantially to the recovery of Alameda whipsnake in the inventory area by protecting and enhancing chaparral/scrub</b></p> <p><b>Objective 26.1.</b> Preserve an average of 70% of currently unprotected core and perimeter whipsnake habitat in Subzones 2a, 2b, 2c, 3a, and Zone 4</p> <p><b>Objective 26.2.</b> Preserve whipsnake movement habitat between patches of core whipsnake habitat, including the linkage in Zone 2 and Subzone 3a between Black Diamond Mines Regional Preserve and Mount Diablo State Park</p> <p><b>Objective 26.3.</b> Maintain diverse canopy-coverage stages</p>	<p><b>Conservation Measure 1.1.</b> Acquire Lands for Preserve System</p> <p><b>Conservation Measure 2.8.</b> Manage Chaparral/Scrub</p>
<p><b>Goal 27: Protect in the Preserve System at least eight occurrences of chaparral-dependent covered plants</b></p> <p><b>Objective 27.1.</b> Protect populations of covered plants that are at least as large and as healthy* as populations lost to covered activities</p> <p><b>Objective 27.2.</b> Protect at least two occurrences of Mt. Diablo manzanita outside currently protected public lands</p> <p><b>Objective 27.3.</b> Protect at least two occurrences of Diablo helianthella outside currently protected public lands</p> <p><b>Objective 27.4.</b> Protect at least three occurrences of Brewer’s dwarf flax outside currently protected public lands</p> <p><b>Objective 27.5.</b> Protect at least one occurrence of Mount Diablo fairy lantern outside currently protected public lands</p>	<p><b>Conservation Measure 1.1.</b> Acquire Lands for Preserve System</p>
<p><b>Covered Species Expected to Benefit from Streams and Riparian Woodland/Scrub Biological Goals and Objectives</b></p>	
<p>Swainson’s hawk</p>	<p>Western pond turtle [Wetlands]</p>
<p>Foothill yellow-legged frog</p>	<p>California red-legged frog [Wetlands]</p>
Streams and Riparian Woodland/Scrub Biological Goals and Objectives	Conservation Measures
<p><b>Goal 28: Preserve streams and riparian woodland /scrub in the inventory area</b></p> <p><b>Objective 28.1.</b> Protect a minimum of 5 linear miles of stream to compensate for permanent loss of habitat</p> <p><b>Objective 28.2.</b> Acquire riparian/scrub at a ratio of 2:1 (estimated to be 70 acres for maximum urban development area) and protect as part of the Preserve System</p>	<p><b>Conservation Measure 1.1.</b> Acquire Lands for Preserve System</p>

Streams and Riparian Woodland/Scrub Biological Goals and Objectives	Conservation Measures
<p><b>Goal 29: Enhance riparian woodland/scrub to promote native biological diversity and habitat heterogeneity</b></p> <p><b>Objective 29.1.</b> Maintain or increase the cover, width, and connectivity of existing riparian vegetation consistent with current stream and habitat function</p> <p><b>Objective 29.2.</b> Reduce the biomass, cover, and extent of exotic plants in the Preserve System</p>	<p><b>Conservation Measure 1.4.</b> Prepare and Implement an Exotic Plant Control Program for the Preserve System</p> <p><b>Conservation Measure 2.9.</b> Manage Streams and Riparian Woodland/Scrub</p> <p><b>Conservation Measure 2.10.</b> Restore Streams and Riparian Woodland/Scrub to Compensate for Habitat Loss and to Increase Biodiversity</p>
<p><b>Goal 30: Maintain and enhance instream aquatic habitat for covered species and native fish</b></p> <p><b>Objective 30.1.</b> Promote the natural disturbance regime (e.g., flooding, sediment deposition, and scour)</p> <p><b>Objective 30.2.</b> Reduce water temperature and temperature variation</p> <p><b>Objective 30.3.</b> Increase inputs of organic matter where appropriate</p> <p><b>Objective 30.4.</b> Reduce sediment input and downstream sediment transport and deposition, where appropriate</p> <p><b>Objective 30.5.</b> Maintain and enhance instream structural diversity, where appropriate</p> <p><b>Objective 30.6.</b> Improve stream flow and connectivity for native aquatic wildlife</p> <p><b>Objective 30.7.</b> Control or reduce non-native animals including bullfrogs and fish</p>	<p><b>Conservation Measure 2.9.</b> Manage Streams and Riparian Woodland/Scrub</p> <p><b>Conservation Measure 2.10.</b> Restore Streams and Riparian Woodland/Scrub to Compensate for Habitat Loss and to Increase Biodiversity</p>
<p><b>Goal 31: Restore streams and riparian woodland/scrub</b></p> <p><b>Objective 31.1.</b> Restore at least 20 acres of riparian woodland/scrub in addition to that required above as compensation for habitat loss</p> <p><b>Objective 31.2.</b> Replace riparian woodland/scrub at a ratio of 1:1 in the Preserve System to compensate for its loss from covered activities (estimated to be 30 acres with maximum urban development area)</p> <p><b>Objective 31.3.</b> Restore species richness and diversity, vegetative cover, wildlife habitat function and hydrologic function</p> <p><b>Goal 32: Maintain or increase population size and distribution of Swainson’s hawk in the inventory area</b></p> <p><b>Objective 32.1.</b> Acquire land in the Preserve System that includes occupied nests and suitable nest sites</p> <p><b>Objective 32.2.</b> Acquire at least 3,750 acres of modeled suitable foraging habitat for Swainson’s Hawk near Kellogg Creek, near Marsh Creek, adjacent to Dutch Slough, or in suitable grassland areas</p>	<p><b>Conservation Measure 2.9.</b> Manage Streams and Riparian Woodland/Scrub</p> <p><b>Conservation Measure 2.10.</b> Restore Streams and Riparian Woodland/Scrub to Compensate for Habitat Loss and to Increase Biodiversity</p> <p><b>Conservation Measure 1.1.</b> Acquire Lands for Preserve System</p>

Streams and Riparian Woodland/Scrub Biological Goals and Objectives	Conservation Measures
<p><b>Goal 33: Protect, maintain, or increase populations of foothill yellow-legged frog</b></p> <p><b>Objective 33.1.</b> Acquire land in Zone 4 along the upper reaches of Marsh Creek where high-quality breeding and dispersal habitat for foothill yellow-legged frog exists</p>	<p><b>Conservation Measure 1.1.</b> Acquire Lands for Preserve System</p>

\* Healthy populations of plants are defined by physical condition, age structure, reproductive success, diversity and availability of suitable habitat, long-term observation of population.

**Table 5-2.** Relationship of Conservation Measure Type to Conservation Scale

Type of Conservation Measure	Scale of Conservation Measure		
	Landscape-level	Community-level	Species-level
Land Preservation	✓		
Habitat Enhancement	✓	✓	
Habitat Restoration		✓	
Habitat Creation		✓	
Population Enhancement			✓
Avoidance/Minimization Measures (see Chapter 6)	✓	✓	✓

**Table 5-3. Land-Cover Types in Acquisition Analysis Zones**

Land Cover Type	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5	Zone 6	Total
<b>Terrestrial Land Cover Types*</b>							
Annual grassland	7,016	10,168	573	3,576	10,734	167	32,235
Alkali grassland	0	4	0	0	1,053	467	1,523
Rock outcrop	1	2	0	0	2	0	5
Ruderal	104	179	162	147	749	1,050	2,391
Subtotal Grassland Vegetation Community**	7,122	10,353	735	3,723	12,537	1,683	36,154
Oak savanna	221	845	183	1,900	7	0	3,157
Oak woodland	390	2,755	962	7,708	16	0	11,831
Subtotal Oak Woodland Vegetation Community**	611	3,600	1,145	9,609	23	0	14,988
Chaparral/scrub	0	145	209	435	0	0	789
Riparian woodland/scrub	33	0	0	110	21	41	205
<b>Wetlands, Ponds, and Streams</b>							
Wetland (undetermined)	7	33	1	10	38	220	308
Alkali wetland	0	21	0	0	59	88	168
Seasonal wetland	16	15	0	1	15	49	95
Aquatic	0	0	0	0	44	79	123
Pond	2	21	2	26	13	17	80
Slough/channel	0	0	0	0	0	137	137
Streams (miles)***	32.7	51.4	9.0	43.7	36.3	10.9	184.0
Subtotal	25	90	2	37	168	591	912
Subtotal All Natural Land Cover Types	7,791	14,188	2,091	13,914	12,749	2,315	53,048

Land Cover Type	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5	Zone 6	Total
<b>Cultivated Land Cover Types</b>							
Cropland	4	16	0	12	0	18,933	18,965
Pasture	0	0	0	0	41	4,395	4,435
Orchard	0	124	0	49	0	3,014	3,187
Vineyard	0	0	0	5	1	1,059	1,064
Subtotal	4	140	0	66	41	27,401	27,652
<b>Other Land Cover Types</b>							
Aqueduct	0	0	0	0	37	139	176
Landfill	322	0	0	0	0	0	322
Nonnative woodland	0	2	0	0	0	3	5
Wind turbines	0	0	0	0	150	0	150
Turf	0	0	0	0	0	0	0
Urban	496	252	83	358	178	3,055	4,423
Subtotal	818	254	83	358	366	3,197	5,076
<b>Total</b>	<b>8,613</b>	<b>14,583</b>	<b>2,174</b>	<b>14,338</b>	<b>13,156</b>	<b>32,913</b>	<b>85,776</b>

\* Numbers may not add exactly due to rounding

\*\* Excludes wetland or other waters land cover types

\*\*\* Stream data not included in Subzone totals because it is an overlay data set (i.e., it overlaps with the land cover type data and is measured in linear miles rather than acres)

**Table 5-4.** Land Acquisition Requirements by Acquisition Analysis Zone

Land Cover	HCP/NCCP Requirements Can Be Met in						
	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5	Zone 6	UDA <sup>1</sup>
Annual grassland	•	•	•	•	•		
Alkali grassland		•			•	•	
Oak savanna	•	•	•	•	•		
Oak woodland	•	•	•	•	•		
Riparian woodland/scrub	•	•	•	•	•	•	•
Chaparral/scrub		•	•	•			
Wetlands, Ponds, Streams							
Alkali wetland					•	•	
Seasonal wetland	•	•	•	•	•	•	
Ponds	•	•	•	•	•		
Perennial wetlands	•	•	•	•	•	•	
Slough/channel						•	
Streams	•	•	•	•	•	•	•
Open water	•	•	•	•	•	•	
Cultivated agriculture							
Cropland						•	•
Pasture						•	•

Notes:

<sup>1</sup> Land acquisition within the UDA is limited to parcels along Marsh Creek or adjacent to Dutch Slough. See land acquisition requirements for Zone 6 for details.

**Table 5-5a.** Required Preservation Ratios and Estimated Acquisition Requirements for Aquatic Land-Cover Types under Initial Urban Development Area

Aquatic Land Cover Type	Estimated Impact <sup>1</sup> (acres)	Required Preservation Ratio	Estimated Preservation Requirement <sup>1</sup> (acres)	Minimum Available in Acquisition Analysis Zones <sup>2</sup> (acres)
Riparian woodland/scrub	30	2:1	60	205
Wetlands and Ponds				
Perennial wetlands <sup>3</sup>	74	1:1	74	231
Seasonal wetlands <sup>3,4</sup>	43	3:1	129	172 <sup>5</sup>
Alkali wetland <sup>4</sup>	28	3:1	84	168
Ponds	7	2:1	14	80
Slough/channel	72	0.5:1	36	137
Aquatic (open water)	12	1:1	12	123
Total Aquatic Land Cover Types (acres)	266		409	1,117
Perennial streams (miles) <sup>6</sup>	0.3	2:1	0.6	18 <sup>7</sup>
Intermittent streams (miles) <sup>6</sup>	0.3	1:1	0.3	184 <sup>7</sup>
Ephemeral streams (miles)	4	1:1	4	184 <sup>7</sup>

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Notes:

- <sup>1</sup> Impact estimates are based on the initial urban development area (Table 4-2). Actual acquisition requirements will be based on field-delineated resources at impact sites and application of the required preservation ratios in this table. Restoration, creation, and enhancement of aquatic land cover is required in addition to preservation of aquatic land cover as compensation for impacts. See Conservation Measures 2.1.1 and 2.2.2 for these requirements.
  - <sup>2</sup> Many land cover types were underestimated in the mapping conducted for this HCP/NCCP, so these figures represent minimum acreages of what is available for preservation. See Chapter 3 for a discussion of the mapping limitations.
  - <sup>3</sup> Undetermined wetlands could be seasonal wetlands or perennial wetlands (e.g., freshwater marsh). Seasonal wetlands will be mitigated at a preservation ratio of 3:1; perennial wetlands will be mitigated at a preservation ratio of 1:1. This table assumes 75% of undetermined wetlands are perennial wetlands and 25% are seasonal wetlands.
  - <sup>4</sup> Seasonal and alkali wetland acreage was quantified as the minimum polygon encompassing clusters of seasonal pools or drainages (i.e., wetland complexes). Impacts and land acquisition requirements will be tracked by jurisdictional wetland boundary, so estimates in this table overstate the expected impacts to and preservation of these land cover types. Impact restrictions and preservation ratios apply only to wetted acres.
  - <sup>5</sup> The actual amount of seasonal wetlands available for preservation in the inventory area is unknown because of a lack of field surveys. The allowable impact to seasonal wetlands by covered activities will be capped at the amount required to preserve seasonal wetlands at the required 3:1 ratio. For example, if only 30 acres are preserved, allowable impacts will be capped at 10 acres.
  - <sup>6</sup> Maximum allowable impacts for perennial and intermittent streams could not be separately estimated. Cumulative impacts for these two categories were estimated at 0.6 miles. For the purposes of this table, it is assumed that the impacts are evenly split between the two categories.
  - <sup>7</sup> The approximate length of all streams of all types in the Acquisition Analysis Zone is 184 miles.
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**Table 5-5b.** Required Preservation Ratios and Estimated Acquisition Requirements for Aquatic Land-Cover Types under Maximum Urban Development Area

Aquatic Land Cover Type	Estimated Impact <sup>1</sup> (acres)	Required Preservation Ratio	Estimated Preservation Requirement <sup>1</sup> (acres)	Minimum Available in Acquisition Analysis Zones <sup>2</sup> (acres)
Riparian woodland/scrub	35	2:1	70	205
Wetlands and Ponds				
Perennial wetlands <sup>3</sup>	75	1:1	75	232
Seasonal wetlands <sup>3,4</sup>	56	3:1	168	172 <sup>5</sup>
Alkali wetland <sup>4</sup>	31	3:1	93	168
Ponds	8	2:1	16	80
Slough/channel	72	0.5:1	36	137
Aquatic (open water)	12	1:1	12	123
Total Aquatic Land Cover Types (acres)	289		470	1,117
Perennial streams (miles) <sup>6</sup>	0.4	2:1	0.8	184 <sup>7</sup>
Intermittent streams (miles) <sup>6</sup>	0.4	1:1	0.4	184 <sup>7</sup>
Ephemeral streams (miles)	5	1:1	5	184 <sup>7</sup>

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Notes:

- <sup>1</sup> Impact estimates are based on the initial urban development area (Table 4-2). Actual acquisition requirements will be based on field-delineated resources at impact sites and application of the required preservation ratios in this table. Restoration, creation, and enhancement of aquatic land cover is required in addition to preservation of aquatic land cover as compensation for impacts. See Conservation Measures 2.1.1 and 2.2.2 for these requirements.
  - <sup>2</sup> Many land cover types were underestimated in the mapping conducted for this HCP/NCCP, so these figures represent minimum acreages of what is available for preservation. See Chapter 3 for a discussion of the mapping limitations.
  - <sup>3</sup> Undetermined wetlands could be seasonal wetlands or perennial wetlands (e.g., freshwater marsh). Seasonal wetlands will be mitigated at a preservation ratio of 3:1; perennial wetlands will be mitigated at a preservation ratio of 1:1. This table assumes 75% of undetermined wetlands are perennial wetlands and 25% are seasonal wetlands.
  - <sup>4</sup> Seasonal and alkali wetland acreage was quantified as the minimum polygon encompassing clusters of seasonal pools or drainages (i.e., wetland complexes). Impacts and land acquisition requirements will be tracked by jurisdictional wetland boundary, so estimates in this table overstate the expected impacts to and preservation of these land cover types. Impact restrictions and preservation ratios apply only to wetted acres.
  - <sup>5</sup> The actual amount of seasonal wetlands available for preservation in the inventory area is unknown because of a lack of field surveys. The allowable impact to seasonal wetlands by covered activities will be capped at the amount required to preserve seasonal wetlands at the required 3:1 ratio. For example, if only 30 acres are preserved, allowable impacts will be capped at 10 acres.
  - <sup>6</sup> Maximum allowable impacts for perennial and intermittent streams could not be separately estimated. Cumulative impacts for these two categories were estimated at 0.8 miles. For the purposes of this table, it is assumed that the impacts are evenly split between the two categories.
  - <sup>7</sup> The approximate length of all streams of all types in the Acquisition Analysis Zone is 184 miles.
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**Table 5-6.** Minimum Distance from Dense Urban Development Required for Aquatic Land-Cover Types to Count Toward Land Acquisition or Restoration/Creation Requirements

Land-Cover Type	Minimum Distance from Dense Urban Development Required for Credit	Rationale and Sources
Permanent wetland	750 feet	Perennial wetlands may support a variety of covered species including tricolored blackbird, California red-legged frog, and western pond turtle. Tricolored blackbirds may be sensitive to disturbance and predation from urban pets, so a relatively large buffer is required. 750-feet is the approximate distance below which available upland habitat for pond-breeding covered species begins to diminish substantially (Reese 1996 [Western pond turtle]; Trenham 2001[California tiger salamander]; Semlitsch and Bodie 2003 [amphibians]).
Seasonal wetland	100 feet if wetland is up-gradient from development; 500 feet if wetland is down-gradient of development	Seasonal wetlands may support a variety of covered species including alkali plants and covered invertebrates. Buffer requirements for these habitats and species are unknown, but habitat function may decline if wetlands are located within 100 feet of dense urban development. Hydrologic effects of development can be severe if seasonal wetland is located down-gradient.
Alkali wetland	50 feet or the wetland watershed boundary, whichever is less  250 feet if wetland is down-gradient of development	Alkali wetlands in the inventory area support unique vegetation communities but few covered species (only recurved larkspur, San Joaquin spearscale, and brittlescale at wetland margins). Alkali wetland function for plants can be maintained in relatively close proximity to urban development as long as access controls in the conservation strategy are maintained.
Pond	750 feet from pond edge	This is the approximate distance below which available upland habitat for pond-breeding covered species begins to diminish substantially (Reese 1996 [Western pond turtle]; Trenham 2001[California tiger salamander]; Semlitsch and Bodie 2003 [amphibians]).
Stream <sup>1</sup>	150 feet from top of bank	This setback is recommended by many authors to maintain stream physical properties (e.g., sediment and nutrient reduction, moderation of stream temperature, channel complexity), salmonid habitat, plant diversity, and other functions (see Table 5-17 for citations).
Riparian woodland/scrub <sup>2</sup>	150 feet from vegetation dripline	The minimum stream buffer required in Conservation Measure 1.7 (Chapter 6) is 75 feet. The land acquisition credit limit accounts for the loss of riparian habitat function within this buffer and the estimated loss of some value for riparian birds and amphibians beyond it (see Table 5-17).

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Notes

- <sup>1</sup> Applies to land acquisition requirement only. Stream restoration can be accomplished within urban areas at any distance from dense urban development for stream restoration credit under the HCP/NCCP.
  - <sup>2</sup> Riparian woodland/scrub acquired or restored in urban areas according to the terms of the HCP/NCCP (e.g., along Marsh Creek) can be credited towards HCP/NCCP restoration regardless of the distance from dense urban areas.
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**Table 5-7.** Land Acquisition Requirements for Terrestrial Land-cover Types under the Initial Urban Development Area Scenario (acres)

	Total in Inventory Area	Inside Parks and Open Space <sup>1</sup> (%)	Outside Parks and Open Space	Estimated and Allowable Impact <sup>2</sup> (% outside parks and open space)	Remain Outside Parks and Open Space	HCP/NCCP Preservation Requirement for Compensation and Recovery <sup>3</sup> (% Remaining Outside Parks & Open Space)	Minimum Preserved <sup>4</sup> (% of Total after Impacts)
Annual grassland	58,840	23,987 (41%)	34,853	2,533 (7%)	32,320	13,000 (40%)	36,987(66%)
Alkali grassland	1,997	379 (19%)	1,618	115 (7%)	1,503	900 (60%)	1,279 (68%)
Oak savanna	5,894	2,690 (46%)	3,204	42 (1%)	3,163	500 (16%)	3,190 (55%)
Oak woodland	24,198	12,284 (51%)	11,914	21 (<0%)	11,892	400 (3%)	12,684 (52%)
Chaparral/scrub	3,016	2,225 (74%)	791	0 (0%)	791	550 (70%)	2,775 (92%)
Cropland and pasture	25,007	1,149 (5%)	23,858	4,050 (17%)	19,808	250 (1%)	1,399 (7%)
Total	118,953	42,715 (36%)	76,238	6,762 (9%)	69,476	15,600 (22%)	58,315 (52%)

<sup>1</sup> Refers to permanently protected parks and open space. See text and Table 2-2 for more information.

<sup>2</sup> Assumes the initial urban development area. The percentage is the proportion of the land cover type outside public lands and open space.

<sup>3</sup> These acreage requirements represent the minimum required under the HCP/NCCP to compensate for impacts of covered activities and contribute to the recovery of covered species. Actual acquisition of these land cover types may be greater than the minimum requirements because the Plan also includes connectivity and other requirements that will result in additional acquisitions and because parcels purchased to meet a specific requirement will contain additional acres of non-target land cover types.

<sup>4</sup> Min. preserved = HCP/NCCP requirement + existing parks and open space. More of each land cover type is expected to be preserved due to need to acquire parcels rather than specific areas of each land cover type. The percentage is the proportion of the land cover type preserved in existing public lands and HCP/NCCP Preserves after full HCP/NCCP implementation (i.e., after impacts have occurred).

**Table 5-8.** Land Acquisition Requirements for Terrestrial Land-cover Types under the Maximum Urban Development Area Scenario (acres)

	Total in Inventory Area	Inside Parks and Open Space <sup>1</sup> (%)	Outside Parks and Open Space	Estimated and Allowable Impact <sup>2</sup> (% outside parks and open space)	Remain Outside Parks and Open Space <sup>2</sup>	HCP/NCCP Preservation Requirement for Compensation and Recovery <sup>3</sup> (% Remaining Outside Parks & Open Space)	Minimum Preserved <sup>4</sup> (% of Total after Impacts)
Annual grassland	58,840	23,987 (41%)	34,853	4,152 (12%)	30,701	16,500 (54%)	40,487 (74%)
Alkali grassland	1,997	379 (19%)	1,618	115 (7%)	1,503	1,250 (83%)	1,629 (87%)
Oak savanna	5,894	2,690(46%)	3,204	165 (5%)	3,040	500 (16%)	3,190 (56%)
Oak woodland	24,198	12,284 (51%)	11,914	73 (1%)	11,841	400 (3%)	12,684 (53%)
Chaparral/scrub	3,016	2,225 (74%)	791	2 (<1%)	789	550 (70%)	2,775 (92%)
Cropland and pasture	25,007	1,149 (5%)	23,858	5,011 (21%)	18,847	400 (2%)	1,549 (8%)
Total	118,953	42,715 (36%)	76,238	9,518 (12%)	66,720	19,600 (29%)	62,315 (57%)

<sup>1</sup> Refers to permanently protected parks and open space. See text and Table 2-2 for more information.

<sup>2</sup> Assumes the maximum urban development area. The percentage is the proportion of the land cover type outside public lands and open space.

<sup>3</sup> These acreage requirements represent the minimum required under the HCP/NCCP to compensate for impacts of covered activities and contribute to the recovery of covered species. Actual acquisition of these land cover types may be greater than the minimum requirements because the Plan also includes connectivity and other requirements that will result in additional acquisitions and because parcels purchased to meet a specific requirement will contain additional acres of non-target land cover types.

<sup>4</sup> Min. preserved = HCP/NCCP requirement + existing parks and open space. More of each land cover type is expected to be preserved due to need to acquire parcels rather than specific areas of each land cover type. The percentage is the proportion of the land cover type preserved in existing public lands and HCP/NCCP Preserves after full HCP/NCCP implementation (i.e., after impacts have occurred).

**Table 5-9.** Estimated Minimum and Maximum Size of Preserve System under each Urban Development Area Scenario (acres)

Zone	Initial Urban Development Area		Maximum Urban Development Area	
	Est. Minimum <sup>1</sup>	Est. Maximum <sup>1</sup>	Est. Minimum <sup>1</sup>	Est. Maximum <sup>1</sup>
1	2,100	2,850	2,250	3,150
2	7,500	9,550	7,500	9,550
3	400	750	400	750
4	4,900	6,150	6,050	8,350
5	6,100	7,200	9,050	11,450
6	450	550	800	1,100
<b>Total</b>	<b>21,450</b>	<b>27,050</b>	<b>26,050</b>	<b>34,350</b>

Notes:

<sup>1</sup> Rounded to the nearest 50 acres.

**Table 5-10.** Land Acquisition Requirements for Zone 4 for Natural Land-Cover Types (acres)

Subzone	Subzone Size	Min. Acquisition Requirement with Initial Urban Development Area <sup>1</sup> (%)	Min. Acquisition Requirement with Maximum Urban Development Area <sup>1</sup> (%)
4a	2,266	1,700 (75%)	1,700 (75%)
4b	1,731	0 ( 0%)	0 ( 0%)
4d	1,588	953 (60%)	953 (60%)
4h	1,055	791 (75%)	791 (75%)
4c	4,160	See below	See below
4e	740	See below	See below
4f	2,138	See below	See below
4g	659	See below	See below
Subtotal of 4c, 4e, 4f, 4g	7,697	1,400 <sup>2</sup> (18%)	3,000 <sup>2</sup> (39%)
Total	14,338	4,844	6,444

Notes:

<sup>1</sup> Only natural land cover types count towards acquisition requirements in these zones (i.e., orchard, pasture, urban land cover types do not count).

<sup>2</sup> This requirement can be met within Subzones 4c, 4e, 4f, or 4g and applies to the four Subzones as a whole.

**Table 5-11.** Land Acquisition Requirements in Zones 5 and 6 under Each Urban Development Area (acres)

Zone and Land Cover Type	Amount in Zone	Land Acquisition or Conservation Easement Requirement with Initial Urban Development Area	Land Acquisition or Conservation Easement Requirement with Maximum Urban Development Area <sup>1</sup>
<b>Zone 5</b>			
Annual grassland			
Subzone 5a or 5d	--	4,300 <sup>2</sup>	--
Subzone 5a, 5b, or 5d	--	--	7,100 <sup>2</sup>
Subzone 5c	--	1,000 <sup>3</sup>	1,000 <sup>3</sup>
Grassland subtotal	10,734	5,300	8,100
Alkali grassland	1,053	750 <sup>4</sup>	900 <sup>4</sup>
Alkali wetland	59	40 <sup>4</sup>	40 <sup>4</sup>
Subtotal	11,846	6,090	9,040
<b>Zone 6</b>			
Alkali grassland	467	100 <sup>5</sup>	300 <sup>5</sup>
Alkali wetland	88	20 <sup>5</sup>	40 <sup>5</sup>
Cropland or pasture	22,328	250 <sup>6</sup>	400 <sup>6</sup>
Subtotal	23,883	370	740

Notes:

- 1 Beyond the initial urban development area, land acquisition requirements for each land cover type within each Zone will increase in proportion to the amount of additional urban development permitted under the HCP/NCCP; see text for details.
- 2 Requirements for annual grassland acquisition must be met within Subzones 5a or 5d with the initial urban development area and in 5a, 5b, or 5d with the maximum urban development area.
- 3 Annual grassland acquired in Subzone 5c must also be suitable foraging habitat for Swainson's hawk according to the species model in Appendix D.
- 4 Alkali grassland and alkali wetland acquisition requirements can be met in any Subzone in Zone 5.
- 5 Acquisition of alkali grassland and alkali wetland in Zone 6 will occur in Subzones 6d or 6e.
- 6 Acquisition of cropland or pasture will occur along Marsh Creek, Kellogg Creek (Subzones 6b, 6c, or 6f), or adjacent to Dutch Slough (Subzone 6a); see text for details.

**Table 5-12.** Estimates of the Range of Selected Covered Plant Species Included in HCP/NCCP Preserves (acres)

Species	Est. Impact <sup>1</sup>	Available for Preservation <sup>2</sup>	Estimated Range <sup>4</sup> Included in Preserve System	
			Initial Urban Development Area <sup>3</sup>	Maximum Urban Development Area <sup>3</sup>
<b>Mount Diablo manzanita</b>				
Modeled habitat	2	737	414	447
<b>Brittlescale</b>				
Modeled habitat	81	1,169	577	697
<b>Big tarplant</b>				
Modeled habitat	2,248	19,376	9,300	11,395
Low-potential habitat	1,999	14,495	5,859	6,645
Total	4,247	33,871	15,160	18,040
<b>Mount Diablo fairy lantern</b>				
Modeled habitat	788	24,646	11,178	13,360
<b>Recurved larkspur</b>				
Modeled habitat	25	1,815	389	1,064
<b>Round-leaved filaree</b>				
Primary habitat	888	5,762	2,877	2,997
Secondary habitat	560	3,567	542	633
Total	1,448	9,329	3,420	3,630
<b>Diablo helianthella</b>				
Modeled habitat	85	13,460	6,168	7,250
<b>Brewer's dwarf flax</b>				
Modeled habitat	255	19,441	9,337	10,704

Notes:

- <sup>1</sup> Estimated maximum impacts with the maximum urban development area.
- <sup>2</sup> Land within preserve Acquisition Analysis Zones based on models developed for the HCP/NCCP.
- <sup>3</sup> Estimated range for covered plant species based on the median proportion of each Subzone that would be preserved to meet land acquisition requirements described in Conservation Measure 1.1.
- <sup>4</sup> For covered plants, the species distribution models represent the potential range/habitat of the species within the inventory area, not necessarily the amount of suitable habitat present. Plants, especially rare plants, tend to occur in distinctive microhabitats (e.g., slope, aspect, plant association, soil type) that cannot be mapped at a regional scale. These variables were not incorporated into the species distribution models, so the models should be viewed as an estimate of the plant species' potential *range* in the inventory area within which suitable habitat and plant populations would likely be found.

**Table 5-13.** Estimates of Modeled Habitat for Covered Wildlife Species Included in HCP/NCCP Preserve System

Species	Units	Estimated Habitat in Preserves under Initial Urban Development Area Scenario <sup>1</sup>	Estimated Habitat in Preserves under Maximum Urban Development Area Scenario <sup>1</sup>
<b>San Joaquin kit fox</b>			
Core habitat	acres	17,164	20,465
Low-use habitat	acres	1,820	2,580
Total	acres	18,984	23,045
<b>Tricolored blackbird</b>			
Core habitat	acres	126	164
Primary foraging habitat	acres	16,747	20,138
Secondary foraging habitat	acres	242	365
Total	acres	17,115	20,666
<b>Golden eagle</b>			
Foraging habitat	acres	24,321	29,267
<b>Western burrowing owl</b>			
Breeding and foraging habitat	acres	16,675	19,844
Low-use habitat	acres	345	703
Total	acres	17,021	20,547
<b>Swainson's hawk</b>			
Breeding habitat	acres	12 <sup>2</sup>	16 <sup>2</sup>
Foraging habitat	acres	3,614	4,451
Total	acres	3,626	4,467
<b>Silvery legless lizard</b>			
Modeled habitat	acres	153	166
<b>Alameda whipsnake</b>			
Core and perimeter habitat	acres	1,690	1,817
Movement habitat (upland)	acres	10,564	12,166
Total	acres	12,301	13,983
<b>Giant garter snake</b>			
Core habitat (streams)	miles	1 <sup>3</sup>	3 <sup>3</sup>
Movement and foraging habitat (upland)	acres	136 <sup>3</sup>	342 <sup>3</sup>

Species	Units	Estimated Habitat in Preserves under Initial Urban Development Area Scenario <sup>1</sup>	Estimated Habitat in Preserves under Maximum Urban Development Area Scenario <sup>1</sup>
Western pond turtle			
Core habitat (non-stream)	acres	675	873
Core habitat (streams)	miles	6	7
Movement habitat (upland)	acres	1,715	1,956
Movement habitat (streams)	miles	80	92
Total (excluding streams)	acres	2,389	2,829
California tiger salamander			
Breeding habitat	acres	96	111
Migration/aestivation habitat	acres	24,047	28,751
California red-legged frog			
Breeding habitat (non-streams)	acres	28	36
Breeding habitat (streams)	miles	85	98
Movement habitat (upland)	acres	24,455	29,467
Movement habitat (streams)	miles	2	2
Total (excluding streams)	acres	24,483	29,326
Total	acres	24,143	28,861

## Notes:

- 1 Estimates of habitat for covered wildlife species based on the median proportion of each Subzone that would be preserved to meet land acquisition targets or actual acquisition targets for some species in some Subzones, whichever is greater.
- 2 Does not include restoration of riparian woodland, which would add up to 50 acres of suitable breeding habitat for Swainson's hawk under the initial urban development area or up to 55 acres under the maximum urban development area.
- 3 Values represent preservation of giant garter snake habitat without any impact occurring to this species under the Plan. Impacts require additional preservation of habitat by applicant according to accepted USFWS procedures (see Conservation Measure 3.6 for details). Additional preservation ratios range from 1:1 to 3:1.

**Table 5-14.** Minimum Land Acquisition Requirements for Annual Grassland in Zone 2 (acres)

Subzone	Subzone Size	Annual Grassland in Subzone	Min. Annual Grassland Acquisition Requirement (acres)
2a	1,841	1,202	850 (71%)
2b	1,782	740	450 (61%)
2c	1,105	575	400 (70%)
2d	1,953	1,127	800 (71%)
2e	1,173	1,013	800 (79%)
2f	1,757	1,267	1,000 (79%)
2g	315	275	0* (0%)
2h	1,200	937	600 (64%)
2i	3,459	3,033	0* (0%)
Total	14,583	10,168	4,900 (48%)

\* Although there is no requirement for annual grassland acquisition in Subzones 2g or 2i, any annual grassland acquired within these Subzones can count towards overall annual grassland requirements in Tables 5-7 and 5-8.

**Table 5-15. Jump-Start Guidelines**

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Land Cover Type	Jump Start Guidelines for Land Acquisition (acres)	Special Conditions
Annual grassland	300	Should be suitable core habitat for San Joaquin kit fox <sup>1</sup>
Chaparral	30	Should be suitable core habitat for Alameda whipsnake <sup>1</sup>
Ponds	5	Should be suitable habitat for California red-legged frog or California tiger salamander or both these species
Other land cover types	165	Should contribute to requirements of HCP/NCCP
Total	500	

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Notes:

<sup>1</sup> As defined in HCP/NCCP habitat models.

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**Table 5-16.** Restoration and Creation Requirements for Land-Cover Types under Initial Urban Development Area Scenario

Land cover type	Required Compensation Ratio (in addition to preservation)		Estimated Impact (acres)	Estimated Compensatory Restoration or Creation (acres)	Restoration or Creation Required to Contribute to Recovery (acres)	Estimated Total Restoration or Creation (acres)
	Restoration	Creation				
Oak savanna	1:1	–	42	42	0	42
Riparian woodland/scrub	1:1	–	30	30	20	50
Wetlands and Ponds						
Perennial wetland <sup>1</sup>	1:1	–	74	74	10	84
Seasonal wetland <sup>1,2</sup>	2:1	–	42	84	20	104
Alkali wetland <sup>2</sup>	2:1	–	28	56	5	61
Ponds	–	1:1	7	7	8	15
Slough/channel	1:1 or riparian <sup>3</sup>	–	72	72	0	72
Aquatic (open water)	–	0.5:1 (ponds <sup>3</sup> )	12	6 (ponds)	0	6 (ponds)
Total			308	361	63	436
Perennial streams (miles)	1:1 <sup>4</sup>	1:1 (if restoration not feasible)	0.3 <sup>5</sup>	0.3 <sup>5</sup>	0	0.3 <sup>5</sup>
Intermittent streams (miles)	1:1 <sup>4</sup>	1:1 (if restoration not feasible) <sup>4</sup>	0.3 <sup>5</sup>	0.3 <sup>5</sup>	0	0.3 <sup>5</sup>
Ephemeral streams (miles)	1:1 <sup>4</sup>	1:1 (if restoration not feasible) <sup>4</sup>	4	4	0	4

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Notes:

- <sup>1</sup> Undetermined wetlands are either seasonal wetlands or perennial wetlands. Mitigation of seasonal wetlands will be accomplished through restoration at 2:1. Mitigation of perennial wetlands will be accomplished through in-kind creation at 1:1. This table assumes 75% of the undetermined wetlands are perennial wetlands and 25% are seasonal wetlands.
  - <sup>2</sup> Seasonal and alkali wetland acreage was quantified as the minimum polygon encompassing clusters of seasonal pools or drainages (i.e., wetland complexes). Impacts and restoration requirements will be tracked by jurisdictional wetland boundary, so estimates in this table overstate the expected impacts to these land cover types. Impact restrictions and compensation ratios apply only to wetted acres.
  - <sup>3</sup> Loss of slough/channel will be compensated by either restoring slough/channel at a 1:1 ratio or restoring riparian woodland/scrub at a 1:1 ratio (see text). These calculations assume all slough/channel impacts will be compensated through riparian woodland/scrub restoration because of the limited opportunities for slough/channel creation. Loss of open water will be compensated by creating ponds (see text).
  - <sup>4</sup> Streams will be restored where feasible. Where stream restoration is not feasible, out-of-kind creation of seasonal wetlands or permanent wetlands will be required to replace some of the functions of the lost stream. See Conservation Measure 2.10 for more details.
  - <sup>5</sup> Maximum allowable impacts for perennial and intermittent streams could not be separately estimated. Cumulative impacts for these two categories were estimated at 0.6 miles. For the purposes of this table, it is assumed that the impacts are evenly split between the two categories.
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**Table 5-17.** Restoration and Creation Requirements for Land-Cover Types under Maximum Urban Development Area Scenario

Land cover type	Required Compensation Ratio (in addition to preservation)		Estimated Impact (acres)	Estimated Compensatory Restoration or Creation (acres)	Restoration or Creation Required to Contribute to Recovery (acres)	Estimated Total Restoration or Creation (acres)
	Restoration	Creation				
Oak savanna	1:1	–	165	165	0	165
Riparian woodland/scrub	1:1	–	35	35	20	55
<b>Wetlands and Ponds</b>						
Perennial wetland <sup>1</sup>	1:1	–	75	75	10	85
Seasonal wetland <sup>1,2</sup>	2:1	–	56	143	20	163
Alkali wetland <sup>2</sup>	2:1	–	31	62	5	67
Ponds	–	1:1	8	8	8	16
Slough/channel	1:1 or riparian <sup>3</sup>	–	72	72	0	72
Aquatic (open water)	–	0.5:1 (ponds <sup>3</sup> )	12	6 (ponds)	0	6 (ponds)
<b>Total</b>			<b>454</b>	<b>535</b>	<b>63</b>	<b>598</b>
Perennial streams (miles)	1:1 <sup>4</sup>	1:1 (if restoration not feasible)	0.4 <sup>5</sup>	0.4 <sup>5</sup>	0	0.4 <sup>5</sup>
Intermittent streams (miles)	1:1 <sup>4</sup>	1:1 (if restoration not feasible) <sup>4</sup>	0.4 <sup>5</sup>	0.4 <sup>5</sup>	0	0.4 <sup>5</sup>
Ephemeral streams (miles)	1:1 <sup>4</sup>	1:1 (if restoration not feasible) <sup>4</sup>	5	5	0	5

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Notes:

- <sup>1</sup> Undetermined wetlands are either seasonal wetlands or perennial wetlands. Mitigation of seasonal wetlands will be accomplished through restoration at 2:1. Mitigation of perennial wetlands will be accomplished through in-kind creation at 1:1. This table assumes 75% of the undetermined wetlands are perennial wetlands and 25% are seasonal wetlands.
  - <sup>2</sup> Seasonal and alkali wetland acreage was quantified as the minimum polygon encompassing clusters of seasonal pools or drainages (i.e., wetland complexes). Impacts and restoration requirements will be tracked by jurisdictional wetland boundary, so estimates in this table overstate the expected impacts to these land cover types. Impact restrictions and compensation ratios apply only to wetted acres.
  - <sup>3</sup> Loss of slough/channel will be compensated by either restoring slough/channel at a 1:1 ratio or restoring riparian woodland/scrub at a 1:1 ratio (see text). These calculations assume all slough/channel impacts will be compensated through riparian woodland/scrub restoration because of the limited opportunities for slough/channel creation. Loss of open water will be compensated by creating ponds (see text).
  - <sup>4</sup> Streams will be restored where feasible. Where stream restoration is not feasible, out-of-kind creation of seasonal wetlands or permanent wetlands will be required to replace some of the functions of the lost stream. See Conservation Measure 2.10 for more details.
  - <sup>5</sup> Maximum allowable impacts for perennial and intermittent streams could not be separately estimated. Cumulative impacts for these two categories were estimated at 0.8 miles. For the purposes of this table, it is assumed that the impacts are evenly split between the two categories.
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**Table 5-18.** Requirements for Enhancement, Restoration, and Creation of Land-Cover Types

Land Cover Type	Enhancement	Restoration	Creation		For Details, See Measures
			In-kind	Out-of-kind/ like-function	
Native grassland (within annual grassland)	●				2.4, 2.5
Alkali grassland	●				2.4, 2.5
Oak savanna	●	●			2.6, 2.7
Oak woodland	●				2.6
Chaparral	●				2.8
Riparian woodland/scrub	●	●			2.9, 2.10
Wetlands, Ponds, and Streams					
Perennial wetlands	●	●			2.2, 2.3
Seasonal wetland	●	●			2.2, 2.3
Alkali wetland	●	●			2.2, 2.3
Ponds	●		●		2.2, 2.3
Slough/channel	●			●	2.3
Streams	●	●		●	2.9, 2.10
Aquatic (open water)	●		●		2.2, 2.3

**Table 5-19.** Partial List of Potential Management Measures to Enhance Covered Species Habitat on Cultivated Agricultural Lands

<b>Covered Species</b>	<b>Potential Management Measures</b>
Golden eagle, western burrowing owl, San Joaquin kit fox	1. Eliminate or reduce the application of rodenticides on agricultural lands that are adjacent to large tracts of grasslands and other natural foraging habitats preserved under the HCP/NCCP to increase prey abundance.
Swainson’s hawk	1. Eliminate or reduce the application of rodenticides on enrolled lands to increase prey availability.  2. Establish and maintain cover strips along field margins, ditches, canals, roads, and other infrastructure to provide escape cover for rodents to maintain or enhance rodent abundance and increase prey availability for raptors.  3. On lands that lack nesting sites but are within 1 mile of suitable foraging habitat, plant isolated trees or groves along field margins or interior roads to provide nesting sites. Groves could also serve as windbreaks for farming operations.
Tricolored blackbird	1. On agricultural lands that are within flight distance of nesting colonies: <ul style="list-style-type: none"> <li>▪ delay harvest of all or a portion of forage crops until after young have fledged</li> <li>▪ where feasible, reduce or avoid use of pesticides that are known to be toxic to the species during the nesting period</li> </ul> 2. Where conditions permit, establish stands of emergent vegetation, blackberry, or other vegetation along ditches and canals to provide suitable nesting structure on agricultural lands that support forage crops within the dispersal range of existing colonies but lack vegetation for nesting
Giant garter snake	On cultivated agricultural lands that support habitat connected to occupied habitat: <ul style="list-style-type: none"> <li>▪ avoid maintenance or other ground/vegetation disturbing activities within 200 feet of canals and ditches that support habitat</li> <li>▪ when feasible and consistent with maintaining delivery and drainage of irrigation water, encourage the establishment of emergent vegetation in canals and ditches to enhance cover</li> </ul>

**Table 5-20.** Protection Requirements for Covered Plants

Species	Number of Known Occurrences <sup>1</sup>	Number of Occurrences in Public Lands or Open Space	Number of Occurrences Protected by HCP/NCCP <sup>2</sup>	Known Occurrences that May Be Removed by Covered Activities <sup>3</sup>	Occurrence Impact Limit if No More Occurrences Are Found <sup>4</sup>
Mount Diablo manzanita	12	10	2	0	0
Brittlescale	9	4	2 (4) <sup>5</sup>	1	0
San Joaquin spearscale	32	31	0	0	0
Big tarplant	12	7	3	1	1
Mount Diablo fairy lantern	12	11	1 <sup>6</sup>	0	0 <sup>6</sup>
Recurved larkspur	4	1	2	1	0
Round-leaved filaree	8	1	2	2	2
Diablo helianthella	30	28	2	0	0
Brewer's dwarf flax	20	18	1	0	0
Showy madia	0 <sup>7</sup>	0	0 <sup>7</sup>	0	0 <sup>7</sup>
Adobe navarretia	5	2	1	1	1
Total	144	113	16	6	4

## Notes:

- 1 Known occurrences within the inventory area are based on CNDDDB data and recent surveys of large tracts (e.g., Jones & Stokes 1989; Mudie & Associates and City of Antioch 2002); occurrences shown in the CNDDDB within large urban areas are assumed to be extirpated and are excluded from this table. All remaining occurrences are assumed to be extant, except where noted. Occurrence records may or may not be the same as individual populations.
- 2 Assumes that willing sellers are available.
- 3 The potential impacts to known occurrences of covered plants are the same under the preliminary draft initial permit area and the preliminary draft maximum permit area.
- 4 This column provides the limit of impacts, by number of occurrences, on plant species allowable under the HCP/NCCP. The occurrence impact limit assumes that no new occurrences of the species are discovered in HCP/NCCP Preserves (Preserves) and that occurrences removed are of lower health than those protected within Preserves, as defined by Conservation Measure 1.1.2. If additional occurrences are discovered within Preserves and these occurrences are of higher conservation value than occurrences in the permit area, then the impact limit may, following approval by USFWS and CDFG, be increased proportionally to the number of new occurrences found. The impact limit of covered plant occurrences is the same under the preliminary draft initial permit area and the preliminary draft maximum permit area.
- 5 With the initial urban development area, at least two occurrences of brittlescale will be preserved. As soon as permitted urban development exceeds this, four occurrences of brittlescale must be preserved.

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Notes (Continued):

- <sup>6</sup> The status of the one occurrence of Mount Diablo fairy lantern outside public lands, in Subzone 4b, is uncertain. If this population is still extant, it will be protected under this HCP/NCCP. If not, no take of this species will be allowed under the HCP/NCCP until a new, high-quality population is found within Preserves.
- <sup>7</sup> A historic record of showy madia listed in the CNDDDB in Antioch was not re-located during recent surveys (Mudie & Associates and City of Antioch 2002). Until more populations are found and protected in HCP/NCCP Preserves, no impacts on this species will be allowed.
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**Table 5-21.** Interim Conservation in the Inventory Area

Description of Property	Size (acres)	Subzone	Ownership	Funding Source	Conservation Instrument	May Be Credited Toward Requirements of HCP/NCCP?
Bailey Estates Open Space, Pittsburg	44	1a & 1e	Faria Land Investors & Bailey Estates LLC	Mitigation for Bailey Estates Development	Easement (pending)	Yes, once easement is recorded
Vista Del Mar Open Space, Pittsburg	75	1e	Alves Ranch	Mitigation for Vista Del Mar Development	Easement (pending)	Yes, once easement is recorded
Diablo Point Open Space, Clayton	5	N/A Adjacent to 3b	Lemke Construction	Mitigation for Diablo Point Development	Easement (pending)	Yes, once easement is recorded
Lentzer Property, between Black Diamond Mines and Clayton Ranch properties	299	2b & 2c	EBRPD	EBRPD and mitigation funds from development in inventory area	EBRPD owns, but no legal instrument assures conservation	Easement portion: Yes; Non-easement portion: Yes, once conservation and management is ensured <sup>1</sup>
Fox Ridge Manor Open Space (Deer Valley Road area east of Brentwood)	197	2d & 2e	Donald & Kimberly Parscal	County condition of approval for a minor subdivision	To be grant-deeded to EBRPD, but no legal instrument assures conservation	Yes, once conservation and management is ensured <sup>1</sup>
CCWD addition to Los Vaqueros Watershed	83	5a	CCWD	CCWD	CCWD owns, but no legal instrument assures conservation	Yes, once conservation and management is ensured <sup>1</sup>
Vaquero Farms Property (east of Los Vaqueros)	1,029	5a & 5d	Vaquero Farms INC	Mitigation for Bailey Estates Development	Easement (pending)	Yes, once easement is recorded
Souza Property (north of Vasco Caves)	651	5d	EBRPD	EBRPD and mitigation funds from development in inventory area	Easement for mitigation portion; no legal instrument assures conservation of remainder	Easement portion: Yes; Non-easement portion: Yes, once conservation and management is ensured <sup>1</sup>
Total	2,383					

<sup>1</sup>Managment according to the terms of the HCP/NCCP through a binding agreement that includes the landowner. See Chapter 8, Section 8.6 for more information.