Chapter 3
Physical and Biological Resources

3.1 Introduction

This chapter presents the physical and biological setting of the HCP/NCCP inventory area. It describes the baseline physical and biological conditions upon which the impact analyses (Chapter 4) and conservation strategy (Chapter 5) are based. The chapter describes how existing and new data were collected to create the baseline inventory. The setting of the inventory area is described in the context of the subject areas listed below.

- Physical resources.
- Existing land cover types.
- Historic conditions.
- Natural communities.
- Jurisdictional wetlands and waters.
- Covered species.

Biological resources have been considered at several scales (i.e., the regional landscape, watershed, subwatershed, habitat, and species level) to address the regulatory requirements of ESA, CESA, NCCPA, Sections 401 and 404 of the CWA, the Porter-Cologne Water Quality Control Act, and Section 1601 of the California Fish and Game Code. These scales are not mutually exclusive; for example, many wetlands and streams are also habitat for covered species, and many ecosystem functions support biological diversity and habitat for covered species.

3.2 Data Collection

3.2.1 Physical Features

Sources used to map and describe the physical setting of the inventory area included U.S. Geological Survey (USGS) data on topography and hydrology; geologic maps of the area (California Department of Conservation 1990; U.S.

Geological Survey 1994); soil survey information (Soil Conservation Service 1977); and other published information (Hickman 1993; Alt and Hyndman 2000). Topography, hydrology, and soil data were downloaded from agency web sites and imported into ArcInfo, where files were clipped and converted into the projection for the inventory area.

3.2.2 Land Cover Mapping

One of the primary data sources for this Plan is a detailed GIS-based map of land cover types within the inventory area (see below for data sources). Land cover type is defined as the dominant character of the land surface discernible from aerial photographs, as determined by vegetation, water, or human uses. Land cover types are the most widely used units in analyzing ecosystem function, habitat diversity, covered natural communities, wetlands and streams, and covered species habitat. Data sources, mapping standards, and the classification and interpretation of land cover types are discussed below.

Data Sources

The primary sources of information for the land cover mapping in the inventory area were:

- orthorectified black-and-white aerial photographs (provided by Contra Costa County; flown in May 2000) for the entire inventory area (scale in rural areas is 1 inch = 400 feet [pixel size of 1 foot]; scale in urban areas is 1 inch = 200 feet [pixel size of 6 inches]);
- orthorectified color aerial photographs (provided by Contra Costa County; flown in March 2003) for the entire inventory area (pixel size of 2 feet);
- orthorectified color aerial photographs (provided by Contra Costa County; flown in April 2004) for the entire inventory area (pixel size of 6 inches);
- color infrared photographs (scale 1:6,000) taken in June 1987 and 1988; covered inventory area except southeastern corner (provided by Contra Costa Water District);
- National Wetlands Inventory Maps (scale 1:65,000) based on color-infrared photographs taken in 1985;
- USGS streams, wetlands, and roads data (USGS digital line graph data—various dates);
- Detailed stream data from the *Contra Costa Watershed Atlas* (Contra Costa County 2003); and
- Contra Costa County and California Department of Water Resources Land Use Data (1995).

The ancillary data sources listed below were used to obtain information not available in the primary sources and to check the mapped information for accuracy.

- *East Alameda–Contra Costa Biodiversity Study* (Conservation opportunity mapping in eastern Contra Costa County) (Jones & Stokes Associates 1996).
- Habitat mapping within the Los Vaqueros Reservoir watershed (Jones & Stokes Associates 1994).
- Color aerial photographs (scale 1:6000) taken in February 1987; covered southeastern corner of inventory area (Jones & Stokes file data).
- Soil survey mapping (Soil Conservation Service 1977).
- Vegetation maps of CCWD interim service area (Contra Costa Water District 2000).
- Geologic maps of the San Francisco–San Jose Quadrangle (California Department of Conservation 1990).
- *Draft Environmental Impact Report for the Cowell Ranch Project General Plan Amendment and Related Actions* (Contra Costa County 1996a).
- Recent delineations of jurisdictional wetlands and waters verified by USACE within the inventory area (e.g., Darwin Myers Associates 2003, U.S. Army Corps of Engineers 2003).
- Current residential development maps (provided by Contra Costa County).
- Personal communications with knowledgeable specialists (Chapter 12).

In addition to using existing data sets, Jones & Stokes biologists conducted field visits. An initial field visit was conducted on December 7, 2001, to develop the land cover classification and to perform preliminary verification of aerial photograph signatures. Two other field visits, on January 10 and May 26, 2002, were conducted to verify land cover types and consistency of mapping and to collect additional data for land cover type descriptions. Initial mapping was verified by visual inspection from locations accessible by public roads. Areas were selected for field verification on the basis of the land cover types present and the accessibility of the area. Once field visits were conducted, land cover mapping was revised on the basis of field findings.

Comments of the HCP/NCCP Scientific Advisory Panel on the draft land cover maps indicated the need for follow-up field surveys to add detail to the data set. In particular, the panel identified the need to collect data on the occurrence and extent of "small-scale features," such as rock outcrops, caves, serpentine areas, small ponds, and vernal pools, that may have been missed during the initial mapping effort. Field surveys were also recommended to increase the accuracy of mapped locations of alkali grasslands and wetlands and to update the mapping from the 2000 air photos. These intensive follow-up field surveys were conducted on April 29, April 30, May 1, and May 13, 2003; on February 17, 2004; and over 4 days between May 5 and June 2, 2004.

Mapping Procedures

Land cover types were mapped onto hard copies of the black-and-white photographs (scale 1 inch = 400 feet) by using the available signatures and supplementing them with information derived from the other primary sources discussed above as appropriate. A 10-acre minimum mapping unit was used for all land cover types, except for riparian, wetland, wind turbine, and rock outcrop land cover types; these features were originally mapped in 2001 with a 1-acre minimum mapping unit. These features were revised during the small-scale features mapping in spring 2003 and were mapped to the smallest scale possible (<0.25 acre) using the 2000 air photos and extensive field surveys where sites could be accessed from public roads (see additional methods described below). When the 2003 and 2004 color aerial photographs became available, additional mapping refinements were performed.

Maps were digitized using AutoCad Release 14. Following the completion of all digitizing, the AutoCad file was converted to a GIS coverage using ArcInfo. ArcInfo was used to edit the coverage and calculate acreage for each land cover type. The final hard copies of the land cover maps were then produced using ArcMap.

Ancillary information was used to supplement land cover information acquired by aerial photograph interpretation. Color infrared aerial photographs (1987 and 1988) and color aerial photographs (February 1987) were used to spot check land cover signatures. Additional spot checking of small-scale landcover features (e.g., wetlands, small patches of chaparral and scrub) was performed as the 2003 and 2004 color aerial photographs became available. Soil Conservation Service (SCS) soils maps were used to identify areas with alkaline soils (Soil Conservation Service 1977). Streams in the inventory area were mapped by staff of the Contra Costa County Community Development and Public Works Departments. Mapping was done County-wide to support the concurrent development of a County watershed atlas (Contra Costa County 2003). See the description of the stream land cover type below for more details on mapping methods. Land use maps, permitted development maps, and interviews with city and County staff were used to further refine agricultural and urban land cover types.

Mapped signatures for specific land cover types were also compared with field-verified maps prepared for the Los Vaqueros reservoir project (Jones & Stokes Associates 1996) and for large projects in the inventory area (e.g., Contra Costa County 1996a; Mundie & Associates and City of Antioch 2002) to verify the accuracy of the current mapping effort. If the land cover type was not easily identifiable to the lowest classification level from the photographs or other available information, it was mapped at the higher classification level. Wetlands that could not be classified by type (seasonal or otherwise), for example, were mapped at the highest classification level (i.e., wetlands). Wetland mapping was compared with recent wetland delineations verified by the USACE (Darwin Myers Associates 2003; USACE 2003) to further refine photointerpretation methods.

Jones & Stokes biologists conducted extensive field surveys of the inventory area over 4 days between April 29 and May 13, 2003; February 17, 2004; and over 4 days between May 5 and June 2, 2004. The surveys were designed to substantially improve the original land cover data set by accomplishing the objectives listed below.

- Updating the land cover map to reflect current conditions (i.e., to incorporate changes occurring since the May 2000 date of the air photos), particularly for irrigated agricultural and urban land cover types.
- Locating additional alkali grasslands and alkali wetlands based on field conditions (rather than by soil type as mapped by SCS) and verifying the location of previously mapped alkali grasslands and wetlands.
- Locating small wetlands (e.g., vernal pools, perennial wetlands, seasonal wetlands) and ponds that may have been missed during the original mapping.
- Locating additional riparian woodland/scrub in the field that may have been missed due to the difficulty of discerning that habitat type's signature in air photos.
- Locating additional patches of rock outcrops (also difficult to locate on air photos).
- Refining the mapping of ruderal, cropland, pasture, and grassland land cover types in the field.

To keep pace with rapid land use changes in the inventory area, urban and future urban land cover types were updated in May 2005 and February 2006, based on parcel maps and information provided by planning departments about approved projects.

Land Cover Type Classification

A classification system for land cover types (Table 3-1) was developed for the inventory area based on Jones & Stokes (1996), Holland (1986), Sawyer and Keeler-Wolf (1995), Mayer and Laudenslayer (1988, 1999), and field visits by Jones & Stokes senior biologists. The classification system was also developed to support the analysis of impacts on covered species and the inclusion of wetland permitting in the Plan. Each land cover type was identified on the basis of distinct image signatures on the aerial photographs, the false-color infrared aerial photographs or in the field. Brief descriptions and specific mapping methods used to delineate each land cover type are provided in the setting section below. A comparison between land cover types and common vegetation classification systems is presented in Table 3-2.

3.3 Setting

3.3.1 Physical Characteristics

This section describes the physical setting of the inventory area, and includes general discussions of topography, soils, hydrology, and floodplains.

The inventory area is located in the San Francisco Bay Area and San Joaquin Valley subregions in eastern Contra Costa County (Hickman 1993). These physiographic subregions are characterized by maritime and Mediterranean climates, respectively. Precipitation in the inventory area falls mostly as rain during the late fall, winter, and early spring months, although the higher elevations can receive infrequent snowfalls during the winter months, with snow sometimes lasting for 2–3 days on Mount Diablo (Soil Conservation Service 1977).

The climate in the inventory area is strongly influenced by its location and topography. In the summer, a steady marine wind blows through the Golden Gate and up the Carquinez Strait. The eastern part of the inventory area is not influenced by this marine air to same the extent as the western part; consequently, temperatures in the eastern part of the inventory area are generally warmer than in the western part.

Topography

Topography in the inventory area comprises three general physiographic regions: highlands of the Coast Ranges, intermountain valleys, and the Sacramento–San Joaquin Delta. These regions have been shaped by a complex geologic history. Because of this complexity, elevations in the inventory area range from Delta islands that are at or below sea level near Brentwood and Oakley to the 3,849-foot peak of Mount Diablo, the highest point in the inventory area (Figure 3-1). Most of the mountain valleys are geologically young. The foothills generally have gentle to steeply sloping topography.

Geologic features in the inventory area include a part of the Coast Ranges, which trend northwest–southeast. These ranges formed over millions of years as a result of uplift along the San Andreas Fault and several of its subsidiary faults, including the San Pablo and Hayward Faults (Alt and Hyndman 2000). Movement along the faults continues today, subjecting the area to moderate to large earthquakes.

The dominant geologic features in the inventory area are the Franciscan Complex and the Great Valley Sequence. The Franciscan Complex is a poorly understood assortment of sedimentary and other rocks that were deposited along with basalt flows on the ocean floor. The Great Valley Sequence, which is better understood, is characterized by oceanic sediments of the same age as the rocks of

the Franciscan Complex. Both features are characterized by tilting and uplifting, but the Franciscan Complex has also been deformed under pressure from faulting. This complex geologic history has resulted in extremely diverse soils, hydrology, and topography.

Soils

Soils in the inventory area are highly variable due to the complex geology, topography, and hydrology in the area. The Contra Costa County general soils map (Soil Conservation Service 1977) identifies 14 soil associations (distinctive patterns of soils in defined proportions) in the county. The inventory area contains all these soil associations except the Joice-Reyes association, which consists of saline mucks and silty clays in saltwater marshes and tidal flats. Most of the soils in the inventory area formed from alluvial, sedimentary, and meta-sedimentary sources and have been formed in concert with the complex geologic history of the area. Many areas on the lower terraces have been urbanized and/or altered to produce crops.

Hydrology

The inventory area contains all or portions of eight major watersheds (Figure 3-2). Because of the Mediterranean climate and its characteristic lack of rainfall during the summer months, ephemeral and intermittent streams are the dominant hydrologic features in the inventory area. Total precipitation falls mostly as winter rain and is variable from an average of 13 inches per year at Antioch to almost 23 inches at Mount Diablo (Soil Conservation Service 1977). The range of precipitation reflects variations in elevation and proximity to the coast.

Surface flow in ephemeral streams is generally supplied by rainfall; these streams flow only during and immediately following rain events. Surface flow in intermittent or seasonal streams is supplied by a combination of rainfall runoff and groundwater; accordingly, these streams generally flow throughout the rainy season and into the late spring or early summer. Perennial streams in the inventory area are also supported by rainfall runoff and groundwater, but unlike seasonal streams they run year-round with major dry-season inputs from both natural and artificial sources (e.g., upwelling springs, surface or subsurface flows from local irrigation, respectively).

Major perennial streams in the inventory area include portions of upper and lower Marsh Creek, lower Sand Creek and Deer Creek, Donner Creek, and lower Kirker Creek. Evidence suggests that the perennial reaches of lower Marsh, Sand, and Deer Creeks were not historically perennial and that the current hydrological conditions are controlled by agricultural and urban inputs (Natural Heritage Institute and Delta Science Center 2002). Marsh Creek drains the largest area of any stream originating within the inventory area. Figure 3-2

shows major streams present in the inventory area. All streams drain into branches of the San Joaquin River or into Suisun Bay.

The natural hydrology of many of the major streams in the urban areas has been altered for flood control or to convey irrigation water. Most streams have been disconnected from their historic floodplains by levees and channelization. Many of these streams are maintained as flood control channels that support little or no riparian vegetation. Outside the urbanized areas, most drainages remain relatively natural and occupy at least a portion of their historic floodplains. Most of these features are ephemeral or intermittent, however, and generally support narrow floodplains with limited riparian habitat.

Most of the low-lying lands within the western Sacramento–San Joaquin Delta have been reclaimed by protective dikes and converted to agricultural uses. As a result, portions of the northeastern corner of the inventory area have substantially subsided and are currently at or below sea level.

3.3.2 Existing Land Cover Types

Land cover types in the inventory area are shown in Figure 3-3. Table 3-3 lists the amount of each land cover type in the inventory area. The areal extent of specific land cover types is based on data derived from the May 2000 aerial photographs. These data were updated from intensive ground surveys conducted in spring 2003 and 2004, new color aerial photographs taken in the spring of 2003 and 2004, and updates to urban land cover in May 2005 and February 2006. Accordingly, land cover data should reflect current conditions in most of the inventory area as of spring 2004 and for urban land cover types as of February 2006. The following discussions summarize the characteristics of each land cover type in the inventory area.

Grassland

Grassland consists of herbaceous vegetation dominated by grasses and forbs. Grassland land cover includes annual grassland, alkali grassland, and ruderal land cover types. Most of the grassland in the inventory area was historically or is currently disked (Jones & Stokes Associates 1996) to improve foraging value for livestock or for dry land farming, and most is currently grazed by livestock. Grassland was classified into four types: annual grassland; native grassland; alkali grassland; and ruderal.

Annual Grassland

Annual grassland was mapped where grasses and forbs dominate the land cover and where trees and shrubs comprise less than 5% canopy cover. The dominant grasses generally consist of introduced annual grasses, including wild oats

(*Avena* spp.), brome grasses (*Bromus* spp.), and annual fescues (*Vulpia* spp.). The associated herbaceous cover includes native and nonnative forbs and native wildflowers. Remnant stands of native, perennial grasslands that could not be distinguished from the larger grassland matrix on aerial photographs were mapped as annual grassland.

Characteristic wildlife species in annual grassland include reptiles such as western fence lizard (*Sceloporus occidentalis*), common garter snake (*Thamnophis sirtalis*), and western rattlesnake (*Crotalis viridis*); mammals such as black-tailed jackrabbit (*Lepus californicus)*, California ground squirrel (*Spermophilus beecheyi*), Botta's pocket gopher (*Thomomys bottae*), western harvest mouse (*Reithrodontomys megalotis*), California vole (*Microtus californicus*), American badger (*Taxidea taxus*), and coyote (*Canis latrans*); and birds such as burrowing owl (*Athene cunicularia*), short-eared owl (*Asio flammeus*), horned lark (*Eremophila alpestris*), and western meadowlark (*Sturnella neglecta*). Annual grassland also provides important foraging habitat for turkey vulture (*Cathartes aura*), northern harrier (*Circus cyaneus*), American kestrel (*Falco sparverius*), white-tailed kite (*Elanus leucurus*), and red-tailed hawk (*Buteo jamaicensis*).

Grassland is by far the most common land cover in the inventory area, occupying 58,840 acres (34%). Grassland occupies a continuous band along the foothills of the Coast Ranges and is the dominant land cover in the valleys at higher elevations.

Native Grassland

Native grasslands in the inventory area generally occur either as pockets within the larger annual grasslands or as subdominant populations, with ground coverage as high as 40%. In eastern Contra Costa County, native grassland contains a subdominant cover of Sandberg bluegrass (*Poa secunda*), a native perennial grass, or purple needlegrass (*Nassella pulchra*), a native perennial bunchgrass. Additional native grasses commonly associated with this land cover type include blue wildrye (*Elymus glaucus*), California fescue (*Festuca californica*), and California melic (*Melica californica*). Native grasslands exhibit a high degree of variation in the inventory area depending on the dominant native species. CDFG, in collaboration with the California Native Plant Society (CNPS), is currently revising the descriptions of all vegetation communities in California (termed vegetation *alliances*) (California Department of Fish and Game 2003a)[1]. The native grassland alliances listed below may be found in the inventory area (California Native Plant Society 2003).

- Purple needlegrass grassland.
- Blue wildrye grassland.
- Creeping ryegrass grassland.

[1] For the latest classification, see http://www.dfg.ca.gov/whdab/pdfs/natcomlist.pdf

- Wildflower fields.
- Squirreltail grassland.
- One-sided bluegrass grassland.
- Serpentine bunchgrass grassland.

Although native grassland was once extensive in the greater Bay Area and Central Valley, invasion by exotic annual grasses, drought, and improper livestock grazing (e.g., overstocking during drought conditions) has lead to its decline. As a result, native grasslands typically contain an abundance of nonnative annual grasses mixed with native grasses and forbs (Sawyer and Keeler-Wolf 1995). All the native grassland alliances listed above are considered rare in California. Due to the limited extent and dominance by annual grasses, native grassland could not be distinguished from annual grassland on aerial photographs of the inventory area. Consequently, this land cover type was mapped as annual grassland.

Existing stands of native grassland in the inventory area include 284 acres known from the Los Vaqueros Watershed (Jones & Stokes 1989). Of this area, 124 acres exhibit less than 25% cover of native bunchgrasses[2]. Surveys of the Los Vaqueros Watershed in 2003 found an increase in the extent of native grassland from by over 40 acres from 1989, likely due to improved management of livestock grazing (McCarten pers. comm.).

Alkali Grassland

Alkali grasslands were mapped using a two-step process. First, a GIS model was developed to predict the presence of alkali grasslands where grasslands overlay alkaline soils (Soil Conservation Service 1977). Alkali grasslands generally occur on alkaline soil units within the Marcuse, Pescadero, Sacramento, and Solano soil series. Second, predicted occurrences of alkali grasslands were field-verified.

Dominant grasses in alkali grassland include saltgrass (*Distichlis spicata*) and wild barley (*Hordeum* spp.). The associated herb cover consists of halophytes, including saltbush (*Atriplex* spp.), alkali heath (*Frankenia salina*), alkali weed (*Cressa truxillensis*), alkali mallow (*Malvella leprosa*), and common spikeweed (*Centromadia pungens*). Saltgrass grassland is an alkali grassland vegetation alliance that occurs in the inventory area, while alkali sacaton grassland is an alkali grassland vegetation alliance that may occur in the inventory area (California Department of Fish and Game 2003a; California Native Plant Society 2003). Alkali grassland can also include small stands of alkali sink scrub (also known as Valley sink scrub) dominated by iodine bush (*Allenrolfea occidentalis*), as well as scattered individuals of iodine bush. Many of the

[2] Todd Keeler-Wolf, vegetation ecologist for CDFG, suggests 15% as the cover threshold for native grassland (McCarten pers. comm.).

wildlife species that occur in annual grassland also occur in alkali grassland (e.g., western fence lizard, black-tailed jackrabbit, coyote, horned lark).

Alkali grassland is relatively rare in the inventory area. It is found on 1,997 acres (1%) in the southeast corner of the inventory area in scattered patches between Byron and the Contra Costa–Alameda County line, south of Discovery Bay, and immediately west and south of Clifton Court Forebay. Several small patches of alkali grassland and alkali sink scrub are found southwest and south of Brentwood within Cowell Ranch State Park (Wagstaff and Associates 1996). Additional stands of alkali sink scrub are found east of the Byron Highway south of Byron and adjacent to Clifton Court Forebay.

Ruderal

Areas mapped as ruderal are disturbed areas characterized by sparse nonnative, typically weedy vegetation. Most ruderal areas are vacant parcels surrounded by developed areas. Additional areas mapped as ruderal include an aggregate mining site near Byron; abandoned gravel mines; closed landfills; and several areas outside of Antioch and Brentwood that have been cleared of most vegetation but for unknown purposes (i.e., areas that did not have evidence of agriculture, subdivision, or street layouts). Some areas mapped as ruderal in the northeast portion of the inventory area may actually be cropland that has been left fallow for a year or more. Ruderal areas that have not experienced substantial disturbance (e.g., disking) for a number of years may develop into annual grasslands. The minimum mapping unit for the ruderal land cover type was 10 acres.

Where vegetation is present, ruderal land cover is dominated by a mixture of nonnative annual grasses and weedy species, such as black mustard (*Brassica nigra*), thistles (*Cirsium* spp.), and wild radish (*Raphanus sativa*), that tend to colonize quickly after disturbance.

Wildlife common to ruderal habitats can include species closely associated with urban development, such as house sparrow (*Passer domesticus*), European starling (*Sturnus vulgaris*), rock dove (*Columba livia*), western scrub-jay (*Aphelocoma californica*), black-tailed jackrabbit, raccoon (*Procyon lotor*), opossum (*Didelphis virginiana*), striped skunk (*Mephitis mehpitis*), and house mouse (*Mus musculus*).

This land cover type is relatively common in the inventory area (6,188 acres; 4%) and generally occurs on the edges of or within developed areas. The active aggregate mine of the Unamin Quarry, a large area of ruderal land cover, is found away from urban development west of Byron. Another large area of ruderal habitat is found at the closed landfill immediately south of Antioch.

Chaparral and Scrub

Chaparral and sage scrub land cover was identified on the aerial photographs based on its dark, homogeneous signature and location on steep hillsides and mountaintops. The minimum mapping unit for this land cover type was 10 acres, though smaller patches were mapped where possible when new color aerial photographs became available in 2003 and 2004. In cases where small (less than 10 acres) stands of scattered trees occurred adjacent to patches of chaparral or scrub, the scattered trees were mapped as part of the chaparral or scrub patch. In addition, there are patches of sage scrub smaller than 10 acres within the inventory area, primarily near Mount Diablo. Because of their small size and similarity to chaparral on aerial photographs, patches of sage scrub could not be mapped using the available data; accordingly, they were not differentiated from chaparral.

Chaparral and scrub consists of woody vegetation dominated by shrubs. Scattered trees and small stands of trees, such as foothill pine (*Pinus sabiniana*) and oaks (*Quercus* spp.), are present, but they are not the dominant vegetative cover. The dominant species include chamise (*Adenostoma fasciculatum*), manzanita (*Arctostaphylos* spp.), and buckbrush (*Ceanothus* spp.). California sagebrush (*Artemisia californica*), black sage (*Salvia mellifera*), and bush monkeyflower (*Mimulus aurantiacus*) occur as associates in chaparral and in small, nearly pure patches of scrub.

Common wildlife species that use chaparral and scrub habitats include gopher snake (*Pituophis melanoleucus*), western rattlesnake, western fence lizard, brush rabbit (*Sylvilagus bachmani*), California pocket mouse (*Perognathus californicus*), Botta's pocket gopher, California ground squirrel, spotted skunk (*Spilogale gracilis*), mule deer (*Odocoileus hemionus*), coyote, and bobcat (*Lynx rufus*). Common bird species include mourning dove (*Zenaida macroura*), California quail (*Callipepla californica*), Anna's hummingbird (*Calypte anna*), western scrub-jay, Bewick's wren (*Thryomanes bewickii*), California towhee (*Pipilo crissalis*), lesser goldfinch (*Carduelis psaltria*), fox sparrow (*Passerella iliaca*), white-crowned sparrow (*Zonotrichia leucophrys*), dark-eyed junco (*Junco hyemalis*), and hermit thrush (*Catharus guttatus*).

Chaparral and scrub is uncommon, occurring on 3,016 acres of the inventory area (2%). It is found in scattered large and small patches in the higher elevations of the western and southwestern portions of the inventory area near Mount Diablo.

Oak Savannah

Oak savannah was defined as grassland with a tree canopy cover of 5–10%. Because the majority of oak woodlands in the inventory area have a canopy cover of nearly 100%, the definition of oak savannah is specifically focused on distinguishing between it and grasslands. The body of scientific literature does not provide a universal definition for savannah; accordingly, the definition used

in this Plan was based on locally important ecological functions (Huntley and Walker 1982; Saramiento 1983; Archibold 1995; Allen-Diaz et al. 1999). Oak savannah can represent a transition zone between grassland and woodland; such transition zones are ecologically important for a number of covered species for roosting, migration, and/or aestivation. For example, the upland component of California tiger salamander habitat consists of grassland and oak savannah. This species typically aestivates in burrows either in open grassland or under isolated oaks, and is less commonly found in oak woodlands. Thus, the 5–10% threshold enables the impact analysis and conservation strategy to distinguish between grasslands and areas of low and high tree density and canopy cover.

Oak trees were easily identifiable on aerial photographs. An acetate reference grid with simulated tree canopies at 5% and 10% cover was used to distinguish between grassland (<5% oak canopy cover), oak savannah, and oak woodland. Oak savannah and oak woodland were mapped by following the outer edge of mapped aerial photographic signatures. Oak savannah and oak woodlands include annual grassland and chaparral stands less than 10 acres in size.

Oak savannah consists of grassland with a low canopy cover of trees, primarily blue oak (*Quercus douglasii*), valley oak (*Q. lobata*), and scattered interior live oaks (*Q. wislizenii*). Shrubs are generally scarce and may include scattered individuals or occasional aggregations of chaparral species. Herbaceous species commonly found include many of the species listed in the discussion of annual grassland. Wildlife associated with oak savannah include many species common to the grassland land cover type; additionally, oak woodland associate species such as acorn woodpecker (*Melanerpes formicivorous*), wild turkey (*Meleagris gallopavo*), and mule deer are found here. Red-tailed hawks and great horned owls (*Bubo virginianus*) may nest in the oaks and forage in the grassland.

This land cover type occurs both in the transition zone between annual grasslands and oak woodlands and in patches within annual grassland. Oak savannah is uncommon, found on 5,894 acres in the inventory area (3%).

Oak Woodland

As discussed above, oak woodland was defined as grassland with a tree canopy cover of more than 10%; however, the majority of oak woodland in the inventory area is characterized by a canopy cover of nearly 100%. The minimum mapping unit for this land cover type was 10 acres. Typical oak species common to oak woodland in the inventory area include blue oak, interior live oak, valley oak (*Quercus lobata*), and coast live oak (*Q. agrifolia*). Other trees, such as California bay (*Umbellularia californica*), California buckeye (*Aesculus californica*), and foothill pine, may be codominant. At higher elevations these codominant trees become dominant and the oaks constitute less relative cover. This land cover type is commonly referred to as mixed evergreen forest (see below). Due to the difficulty in distinguishing oak woodland from mixed evergreen forest on the aerial photos, these land cover types were not mapped separately. Depending on availability of water and other factors such as light,

substrate, disturbance history, slope, and aspect, the understory of oak woodland varies from an open community dominated primarily by grasses and forbs to a dense shrub layer.

Oak woodlands provide food and cover for many species of wildlife. Common reptiles include gopher snake and western fence lizard. Common mammals include deer mouse (*Permyscus maniculatus*), western gray squirrel (*Sciurus griseus*), mule deer, and coyote. Representative birds in this cover type include red-tailed hawk, American kestrel, barn owl (*Tyto alba*), great horned owl, acorn woodpecker, Nuttall's woodpecker (*Picoides nuttallii*), northern flicker (*Colaptes auratus*), white-breasted nuthatch (*Sitta carolinensis*), California quail, spotted towhee (*Pipilo maculatus*), Bewick's wren, and bushtit (*Psaltriparus minimus*).

This vegetation type includes patches of annual grassland and small chaparral stands. Oak woodland is very common in the inventory area, occupying 24,198 acres (14%) in the mid- to high-elevation zones in the southwestern portion. Oak woodlands also occur along ephemeral and intermittent drainages, where riparian woodland may be present but not dominant. In these areas coast live oak is often associated with California buckeye, big-leaf maple (*Acer macrophyllum*), and California Bay.

Mixed Evergreen Forest

The mixed evergreen forest is dominated by evergreen trees such as California bay, madrone (*Arbutus menziesii*), and foothill pine. In addition to these evergreen species, a few deciduous species such as California buckeye and big-leaf maple often occur. The species that dominate this land cover type are often codominants in oak woodlands and become the dominant canopy cover at higher elevations as the oaks decrease in abundance. Aspect and slope also play a role in determining the distribution of mixed evergreen forest and oak woodlands. Because the transition between oak woodland and mixed evergreen forest is gradual, evergreen oaks such as coast live oak, interior live oak, and canyon live oak (*Quercus chrysolepis*) are often common codominants. Like that of oak woodlands, the understory community of the mixed evergreen forest varies from dense shrub thicket to areas dominated by sparse grass and forb cover. Water availability in these systems appears to be the prime factor controlling density of understory vegetation. Other factors noted above in the discussion of oak woodland understory also play a role in understory vegetation composition and structure.

Wildlife utilization is similar to that of the oak woodland land cover type. Due to the functional similarity of these two land cover types for wildlife habitat and the difficulty in discerning between the two types in aerial photographs, stands of mixed evergreen forest are contained in the oak woodland land cover type.

Riparian Woodland/Scrub

The riparian woodland/scrub land cover type is dominated by phreatophytic woody vegetation associated with streams and permanent water sources. Riparian woodland is dominated by trees and contains an understory of shrubs and forbs. Riparian scrub is dominated by young trees and shrubs, typically representing an early successional stage of riparian woodland. This land cover type was identified on the basis of its specific signature in the photographs and proximity to streams, drainages, and lakes or reservoirs. On infrared photographs, riparian areas were discernible by their light signatures. These light-colored signatures indicate areas of rapid vegetative growth. Riparian areas were mapped based on this signature type, topographic location, and canopy density. Generally, riparian areas occupy narrow corridors in the inventory area, with a canopy only several trees or shrubs wide. Because riparian scrub is an early successional stage of riparian woodland, and because it was difficult to distinguish on aerial photos, the two categories were combined as the riparian woodland/scrub land cover type. The minimum mapping unit for riparian woodland/scrub was 1 acre.

Some intermittent and ephemeral streams in the inventory area are dominated by a narrow corridor of oaks, California bay, or California buckeye, with only scattered riparian tree species (e.g., willows [*Salix* spp.] and cottonwoods [*Populus* spp.]) present. Stands in streams dominated by oaks were therefore mapped as oak woodland. In some places (e.g., Contra Loma Reservoir), riparian trees such as cottonwoods have been planted as ornamentals with an understory of irrigated turf. These areas were mapped as turf, not as riparian woodland/scrub.

Riparian woodland/scrub is dominated by a mixture of trees and shrubs adapted to saturated and/or flooded soil conditions. When present, trees include Fremont cottonwood (*Populus fremontii*), western sycamore (*Platanus racemosa*), and red willow (*Salix laevigata*). The understory may also include woody shrubs such as arroyo willow (*Salix lasiolepis*) and mule fat (*Baccharis salicifolia*). These understory shrubs are also found along streams where riparian woodland is extremely limited or nonexistent, and they are the dominant species in riparian scrub.

Riparian land cover provides habitat for a wide diversity of wildlife. The presence of flowing water associated with this land cover type attracts numerous mammals, amphibians, and reptiles. Riparian corridors are also important for deer migration. Common mammals found in this cover type include mule deer, raccoon, gray fox (*Urocyon cinereoargenteus*), striped skunk (*Mephitis mephitis*), deer mouse, harvest mouse, broad-handed mole (*Scapanus latimanus*), and dusky-footed woodrat (*Neotoma fuscipes*). Because of their proximity to rangelands, many riparian areas in the inventory area are grazed by livestock. Numerous birds are also typical of this cover type; these include yellow warbler (*Dendroica petechia*), northern flicker, Bewick's wren, white-tailed kite, Cooper's hawk (*Accipiter cooperii*), red-shouldered hawk (*Buteo lineatus*), song sparrow (*Melospiza melodia*), and black-headed grosbeak (*Pheucticus*

melanocephalus). Riparian habitat is especially important for neotropical migrants such as Pacific-slope flycatcher (*Empidonax difficilis*) and Wilson's warbler (*Wilsonia pusilla*).

Riparian woodland/scrub is rare in the inventory area, occurring on only 448 acres (<1%). The largest and longest stands of riparian vegetation are found in and near Pittsburg along Kirker Creek, and along Marsh Creek above and below Marsh Creek Reservoir.

Wetland

Wetlands are dominated by herbaceous species that grow in perennially or seasonally flooded, ponded, or saturated soil conditions. Wetlands were identified on the basis of their aerial photograph signatures and landscape positions that would support wetland hydrology (e.g., wetlands generally have a dark red signature on the infrared photographs because these areas are greener and are actively growing). The minimum mapping unit for all wetland land cover types was 1 acre.

Wetlands were further separated, when possible, into seasonal wetland and alkali wetland subtypes by their apparent duration of inundation and abundance of alkali soils (i.e., wetlands mapped within alkali grasslands were classified as alkali wetlands). Wetland subtypes were distinguished based on the darkness of the signature and the density of vegetation. If the type of wetland could not be determined (i.e., the duration of inundation could not be determined from aerial photography), the wetland was classified as the general wetland type. There are 483 acres of wetlands and wetland complexes in the inventory area. Wetlands include both permanent and seasonal wetland types. Vernal pools could not be distinguished on the aerial photographs; they are included as seasonal wetlands or wetlands.

Permanent Wetland

Permanent wetlands (also referred to as perennial wetlands) are characterized by a year-round water source. They are typically dominated by erect, rooted, herbaceous hydrophytic plant species adapted to growing in conditions of prolonged inundation. Common plant species present in this land cover type include perennial wetland species such as cattails (*Typha* spp.) and tules (*Scirpus* spp.). This land cover type is present in the inventory area but could not be differentiated from other types of wetland through available aerial photography. This land cover type was included in the general wetland type, which also includes some seasonal wetlands.

The permanent wetland land cover type is important for a wide variety of wildlife species. Representative waterbirds that forage and rest in permanent wetlands and associated open-water areas include great blue heron (*Ardea herodias*) and great egret (*Ardea alba*), as well as various ducks, including wood duck (*Aix*

sponsa), green-winged teal (*Anas crecca*), mallard (*Anas platyrhynchos*), American coot (*Fulica americana*), killdeer (*Charadrius vociferus*), and greater yellowlegs (*Tringa melanoleuca*). Typical amphibians and reptiles in this cover type include red-legged frog, western pond turtle (*Clemmys marmorata*), and garter snakes. Many of the larger mammals, such as mule deer, may frequent permanent wetlands and use them as a source of drinking water.

Seasonal Wetland

Seasonal wetlands are freshwater wetlands that support ponded or saturated soil conditions during winter and spring and are dry through the summer and fall until the first substantial rainfall. The vegetation is composed of wetland generalists, such as hyssop loosestrife (*Lythrum hyssopifolia*), cocklebur (*Xanthium* spp.), and Italian ryegrass (*Lolium multiflorum*), that typically occur in frequently disturbed sites, such as along streams.

During the wet season, these wetlands are commonly used by a variety of wildlife, including various amphibians such as western spadefoot (*Scaphiopus hammondii*), Pacific chorus frog (*Pseudacris regilla*), western toad (*Bufo boreas*), and California tiger salamander (*Ambystoma californiense*); shorebirds such as killdeer, black-necked stilt (*Himantopus mexicanus*), and American avocet (*Recurvirostra americana*); and passerines such as Brewer's blackbird (*Euphagus cyanocephalus*), red-winged blackbird (*Agelaius phoeniceus*), brown-headed cowbird (*Molothrus ater*), and American pipit (*Anthus rubescens*). During the dry season, a variety of small mammals use the areas, including deer mouse, California vole, and long-tailed weasel (*Mustela frenata*). Raptors such white-tailed kites, northern harrier, and red-tailed hawk may forage in this land cover type.

Vernal pool is a subtype of seasonal wetland that could not be separately mapped with available photography but is included in this land cover type. Vernal pools are areas that pond water on the surface for extended durations during winter and spring and dry completely during late spring and summer. Because of their unique hydrology, vernal pools support specialized plants adapted to growing in these stressful conditions, such as coyote thistle (*Eryngium* spp.), goldfields (*Lasthenia* spp.), downingia (*Downingia* spp.), and navarretia (*Navarretia* spp.). These species are generally restricted or nearly restricted to vernal pools. A number of special-status invertebrates, including vernal pool fairy shrimp (*Brachinecta lynchi*), vernal pool tadpole shrimp (*Lepidurus packardi*), and longhorn fairy shrimp (*Brachinecta longiantenna*), may occur in vernal pools.

A total of 121 acres of seasonal wetland complexes were mapped. Wetland complexes are groups of wetted pools spaced close together that form a distinct hydrologic unit. Individual pools or wetland patches within complexes could not be distinguished on air photos due to their small size, typically <0.1 acre. Seasonal wetland complexes therefore include grassland upland habitat that occurs between the wetted surface of pools and wet depressions.

Seasonal wetlands may be underrepresented because of the small size, isolated locations, and difficulty in interpreting the photographic signature of individual features. Many seasonal wetlands were not mapped because they were smaller than the minimum mapping unit of 1 acre or were not visible on the aerial photographs. In addition, some of the mapped seasonal wetlands were included in the general wetland land cover category because they could not be differentiated from permanent wetlands. However, this may have been offset by the inclusion of seasonal wetland complexes, which include non-wetland acreage.

Vernal pools are expected to be rare in the inventory area based on field surveys in large portions of the inventory area in which vernal pools could be found. In a comprehensive survey of land cover types in the Los Vaqueros watershed (19,600 acres), 15 acres of northern claypan vernal pools were mapped and field-verified (Jones & Stokes 1989). Most of these pools (10.5 acres) were low quality and found behind an artificial dam and were used at the time as a stock pond[3]. In extensive planning surveys for the Cowell Ranch State Park (4,277 acres), 0.4 acres of northern claypan vernal pools were found in 6 natural and 12 artificial pools (see references in Wagstaff and Associates 1996). Most pools varied in size between 300 and 1,500 square feet; the largest pool was 5,000 square feet. Surveys of a large area around Sand Creek (2,708 acres) found no vernal pools (see references in Mundie and Associates and City of Antioch 2002). Small amounts of vernal pools (< 1 acre of wetted surface) are also found adjacent to the Byron Airport (Stromberg and Ford 2003). The Byron Airport pools include 0.06 acres of vernal pools that were created as mitigation for expansion of the airport in 1992.

Alkali Wetland

Alkali wetlands support ponded or saturated soil conditions and occur as perennial or seasonally wet features on alkali soils. Wetlands greater than 1 acre on alkali soils were mapped as alkali wetlands. Alkali wetlands were mapped where wetlands occurred within the alkali grassland land cover type.

The vegetation of alkali wetlands is composed of halophytic plant species adapted to both wetland conditions and high salinity levels. Typical species include those common to both seasonal and alkali wetlands, such as salt grass (*Distichlis spicata*), alkali heath (*Frankenia salina*), and common spikeweed (*Centromadia pungens*).

Alkali wetlands provide function and value for wildlife similar to those provided by seasonal wetlands. The array of wildlife species found in seasonal wetlands is also found in alkali wetlands. Alkali wetlands are rare in the inventory area, occurring in wetland complexes (as defined above for seasonal wetlands) on 380 acres (<1%) primarily in the southeastern portion of the inventory area south and east of Byron.

[3] These pools were mapped as alkali wetland in this Plan because they occur on alkali soils.

Aquatic

Aquatic land cover types are open water or aquatic habitats such as lakes, reservoirs, water treatment ponds, sloughs, channels, streams, and ponds (including stock ponds) that do not support emergent vegetation. Open water land cover types that were not mapped as reservoirs and that encompassed more than 5 acres were mapped as the general aquatic land cover type. The most common features mapped as aquatic were water treatment ponds. Due to the ecological importance of stock ponds and natural ponds as habitat for covered species, ponds that were discernible on aerial photographs were mapped regardless of size. A total of 1,823 acres (1%) of the aquatic land cover type occurs in the inventory area.

Stream

A stream is defined as a long, narrow body of flowing water that occupies a channel with defined bed and bank and moves to lower elevations under the force of gravity. (Canals and aqueducts are not streams.) Many streams in the inventory area do not flow year-round, and may be categorized as ephemeral, intermittent, or perennial streams..

A perennial stream has flowing water year-round during a typical year. The water table is located above the streambed for most of the year. Groundwater is the primary source of water for stream flow. Runoff from rainfall is a supplemental source of water for stream flow[4].

An intermittent stream has flowing water during certain times of the year, when groundwater provides water for stream flow. During dry periods, intermittent streams may not have flowing water. Runoff from rainfall is a supplemental source of water for stream flow.

An ephemeral stream has flowing water only during and for a short duration after, precipitation events in a typical year. Ephemeral streambeds are located above the water table year-round. Groundwater is not a source of water for the stream. Runoff from rainfall is the primary source of water for stream flow.

Perennial streams are relatively rare, while intermittent and ephemeral streams are very common throughout the inventory area. Marsh Creek, Kirker Creek, Donner Creek, and lower Sand and Deer Creeks are the only perennial streams within the inventory area.

Streams in the inventory area were mapped by staff of the Contra Costa County Community Development and Public Works Departments. Mapping was done County-wide to support the concurrent development of a County watershed atlas (Contra Costa County 2003). The stream layer was mapped by interpreting digital orthographic photographs (scale 1:200 where available, 1:400 elsewhere),

[4] Source for all stream type definitions is the January 15, 2002 Federal Register; CFR 02-539.

10-foot contours, and County storm drain data. USGS creek data (2003) were used to help determine the drainages that should be mapped, but substantial drainages absent from USGS maps were included. Draft data were ground-truthed by County staff and proofread extensively by staff and by members of the Contra Costa Watershed Forum knowledgeable of each watershed.

Creeks' centerlines were digitized when visible on air photos. Otherwise, riparian vegetation, slope breaks, and contour lines were used to locate creek centerlines approximately. Small tributaries were mapped only when a distinct bed and bank were visible on the air photos or sharp contour lines clearly defined a channel. Air photo signatures for small tributaries were ground-truthed in the field to calibrate the mapping. Small tributaries were mapped to a minimum length of 300 feet. Streams were mapped as line features separate from the land cover polygons.

Approximately 409 miles of streams are known from the inventory area based on existing data. Assuming that streams are, on average, 5 feet wide[5], this is equivalent to 248 acres of streams. Streams that are channelized and contained by levees were mapped as slough/channel.

Like the riparian and wetland land cover types, the stream land cover type is important because it provides essential habitat for terrestrial and aquatic species. Many upland species rely on seasonal and perennial streams as water sources. In summer and early fall, perennial streams provide the only available water in an otherwise dry landscape. In addition, ephemeral, intermittent, and perennial streams provide habitat for aquatic macroinvertebrates, which are an important food source for local and downstream populations of fish, birds, and other animals.

Aquatic (Reservoir)

Los Vaqueros, Contra Loma, Antioch, and Marsh Creek Reservoirs, designated on USGS topographic maps as named reservoirs, were mapped as the aquatic land cover type (Los Vaqueros Reservoir is approximately 1,500 acres). Reservoirs were easily discernible on aerial photographs based on the smooth, uniform, dark signatures of open water. Where discernible, reservoirs were mapped to the high water line. The high water line was observed on the aerial photographs as either obvious rings of sparse vegetation or an open water signature (most of the reservoirs appeared to be full or nearly full when the aerial photographs were taken).

Reservoirs can be important to various ducks, including mallard, green-winged teal, cinnamon teal (*Anas cyanoptera*), gadwall (*A. strepera*), American wigeon (*A. americana*), and American coot. Shore and wading birds including killdeer, black-necked, greater yellowlegs, and several gull species can also be found in reservoirs. The vegetated fringes of reservoirs can provide habitat for

[5] This estimate was spot-checked during the 2004 field work and found to be reasonable.

amphibians such as California red-legged frog and reptiles such as western pond turtle. Large mammals can use reservoir habitat for drinking water.

Pond

Ponds are small perennial or seasonal water bodies dominated by little or no vegetation. If vegetation is present, it is typically submerged or floating. Ponds discernible on aerial photographs were mapped. Pond mapping generally included all open water occupying between 0.25 and 5 acres (including all stock ponds used by livestock). Ponds were easily discernible on the basis of two distinctive aerial photograph signatures. One signature— smooth, uniform, and dark black—indicates deeper and less turbid ponds. The other signature—light gray-brown—generally indicates a more shallow or more turbid pond. The latter signature was more difficult to discern on the aerial photographs and in many cases required field verification. Where discernible, this land cover type was mapped to the high water line. Some wetland land cover types were likely included as ponds. Ponds may occur naturally or may be created or expanded for livestock use (stock ponds).

Like the reservoir land cover type, ponds may support a variety of ducks and shore and wading birds. Ponds that contain either submerged or emergent vegetation are of particular importance to native amphibians as breeding habitat.

This land cover type is very common in the landscape of the inventory area, but occupies a small overall area, comprising a total of 165 acres (<1%). Ponds are evenly distributed in the inventory area, probably because ranchers have established them to support cattle grazing operations.

Slough/Channel

Sloughs and channels are features with perennial water and artificial banks (e.g., levees) constructed of natural soil materials; they have little or no in-channel vegetation. Although the banks of sloughs are generally composed of soil, portions of sloughs may be lined with riprap, concrete, or rock gabions for bank stabilization. Sloughs are tidally influenced and may contain brackish waters. Channels include channelized urban streams such as the lower portion of Marsh Creek in Brentwood and Oakley. Because levees were clearly visible on the aerial photographs, sloughs and channels could be mapped to the visible waterline. Large channels constructed to transport drinking water or agricultural water were mapped as aqueduct, not as slough/channel.

Like other aquatic land cover types, sloughs and channels can be important to a variety of wildlife because they provide drinking water, foraging habitat, and resting habitat. Common wildlife found associated with this land cover type include garter snakes, a variety of ducks, both wading and shore birds, and large mammals that use these features for drinking water. In addition, the portion of Marsh Creek mapped as slough/channel provides habitat for western pond turtle,

juvenile and spawning adult Chinook salmon (*Oncorhynchus tshawytscha*), and a variety of other aquatic species.

This cover type is relatively uncommon, occupying only 213 acres on the east and southeast sides of the inventory area near Discovery Bay and the Clifton Court Forebay.

Rock Outcrop

Rock outcrops are exposures of bedrock that typically lack soil and have sparse vegetation. Within the inventory area, several types of rock outcrops are present and are derived from sedimentary, volcanic, and metamorphic sources. This land cover type includes areas of serpentine outcrops that could not be mapped with the available data but are known to occur in the Mount Diablo area (Kruckeberg 1984; California Department of Conservation 1990). Rock outcrops identifiable on aerial photographs were mapped based on their unique aerial photograph signatures. Rock outcrop signatures appear as textured areas with mottled coloring on black-and-white aerial photographs.

Rock outcrops host common wildlife species such as western fence lizard and western rattlesnake. These species may use outcrops for basking and foraging areas. Common birds include rock wren (*Salpinctes obsoletus*) and several species of raptors that use rock outcrops for nesting or roosting.

Rock outcrops are a rare cover type, totaling 119 acres (<1%) in 39 patches. Concentrations of rock outcrops are found around Mount Diablo and near Los Vaqueros Reservoir (e.g., Vasco Caves). This land cover type is likely underrepresented in the land cover map for the inventory area because these features are difficult to see on aerial photographs, were difficult to recognize in the field from a distance, or were smaller than the minimum mapping unit. Accordingly, many small areas of rock outcrops are likely included in the chapparal/scrub, grassland, and oak woodland land cover types.

Irrigated Agriculture

Irrigated agriculture encompasses all areas where the native vegetation has been cleared for agricultural use. This land cover type was classified into four subtypes: pasture, cropland, orchard, and vineyard. In some cases, it was not possible to distinguish between these categories. For example, newly planted orchards resemble row crops on aerial photographs. In such instances, the area was mapped as cropland.

Pasture

The pasture land cover type comprises fast-growing annual and perennial grasses mixed with irrigated forage crops in the legume family. Pastures typically function as onsite sources of forage for livestock. These areas are distinguished from other cultivated land types by the presence of livestock and livestock fencing (paddocks). Pastures tend to occur in lowland areas adjacent to cropland. This land cover type is only common in the flat eastern portion of the inventory area around Knightsen and Byron. Pasture was mapped on aerial photographs based on its location and smooth texture on the photographs, indicating land that is covered by vegetation and not currently tilled for cropland. Nearly all the pastureland in the eastern portion of the inventory area was field-verified during field surveys in spring 2003. The minimum mapping unit for this land cover type was 10 acres.

Common vegetation includes fast-growing forage grasses, such as slender oats (*Avena fatua*) and Italian ryegrass, and irrigated legumes such as alfalfa (*Medicago* spp.), sweet clover (*Melilotus* spp.), and true clover (*Trifolium* spp.). In some areas, nonnative weedy vegetation, such as thistles, mustards, and a variety of other weedy forbs, are also common.

Pasture supports a variety of wildlife, particularly ground-nesting birds such as western meadowlarks. Irrigated pasture, particularly alfalfa, can provide a variety of wildlife benefits due to its relatively high production of small rodents. Several birds that forage in open grasslands, such as white-tailed kites and great blue herons, may also use this land cover type. The timing and intensity of livestock grazing affects the quality and character of wildlife habitat in this land cover type.

This land cover type occupies 4,491 acres (3%), primarily in the eastern portion of the inventory area around Knightsen and Byron.

Cropland

Tilled land not appearing in the aerial photographs to support orchard, vineyard, or pasture was mapped as cropland. Croplands are those areas tilled and cultivated for agricultural crops such as corn, summer squash, pumpkin, and wheat. Cropland also includes hay production in both dryland settings and irrigated areas. The key difference between hay production and pasture is that crops are harvested on site and consumed off site, whereas as pasture can be consumed by livestock on site (hay is also cut, bailed, and trucked off site). Fallow fields that were adjacent to active cropland were mapped as cropland. Some cropland may have been mapped as ruderal if it had been left fallow for several growing seasons or if it appeared to be in the path of incipient development.

Agricultural crops are planted early in the season and rotated with other crops on a yearly or seasonal basis. Common wildlife species found in croplands are

similar to those found in pasture, but the species composition depends heavily on the planting cycle. For example, cropland has a higher value for terrestrial mammals (e.g., black-tailed jackrabbit) and herbivorous birds (e.g., red-winged blackbird) near harvest time, when the standing crop is mature and produces a quantity of food (e.g., fruit, seeds), than it does after the harvest when the cropland is fallow. Agricultural production methods can also have an impact on wildlife use. For example, production practices such as "clean farming," where farm edges are maintained as vegetation-free areas, reduce cover and movement opportunities for wildlife; on the other hand, "wildlife friendly farming," where native cover crops and hedge rows are used between crops and on farm edges, can increase opportunities for wildlife use in croplands.

Cropland is the most common of the agriculture land cover types in the low-lying areas of the inventory area, occupying 20,516 acres (12%). Croplands are abundant in the eastern portion of the inventory area, particularly between Brentwood and the Clifton Court Forebay.

Orchard

Orchard was distinguished on the basis of its tree cover, canopy characteristics, and production rows. Nearly all orchards discernible on the 2000 aerial photographs were visited during spring 2003 for field verification. Orchards are those areas planted in fruit-bearing trees (e.g., apples, apricots, kiwis, and cherries). Orchards may provide habitat for common wildlife species such as raccoon, opossum, California vole, Brewer's blackbird, American crow (*Corvus brachyrhynchos*), and yellow-billed magpie (*Pica nuttalli*).

Orchards are scattered but relatively common throughout the low-lying agricultural lands in the northeastern portion of the inventory area, occupying 3,995 acres (2%). Orchards are most common in Oakley and immediately south of Brentwood in the area designated in the Contra Costa County General Plan as Agricultural Core.

Vineyard

Vineyard was identified on the basis of its row production pattern and canopy characteristics. Vineyards appeared similar to orchards on the aerial photographs but were characterized by more closely spaced rows with a smaller, less dense vegetation canopy. Nearly all vineyards discernible on the 2000 aerial photographs were visited during spring 2003 for field verification. Vineyards are relatively uncommon in the inventory area, but have increased in overall extent between 2000 and 2003. Data collected in Sonoma County indicates that vineyards generally support a far higher abundance of nonnative predators such as red fox and feral cats than do adjacent natural habitats (Hilty and Merenlender 2004). Other common wildlife species found in most vineyards include California ground squirrel, European starling, and Brewer's blackbird. As in other forms of agriculture, site-specific production methods are directly

correlated with wildlife use. Some vineyard practices may encourage habitat use by birds of prey such as American kestrel and great-horned owl (Locke 2002). Wildlife use of vineyards may be related to the timing and intensity of pesticide application with great pesticide use decreasing wildlife use and reproductive success. Vineyards occupy 2,031 acres (1%) in scattered areas in and around Oakley and Brentwood, generally surrounded by cropland or orchard. Vineyards south of Byron are surrounded by cropland and rangland.

Developed

Developed areas comprise all types of development for residential, commercial, industrial, transportation, landfill, landscaping, and recreational uses (e.g., sites with structures, paved surfaces, horticultural plantings, golf courses, and irrigated lawns). Developed sites were mapped on the basis of their distinct signatures. Developed areas are often characterized by geometric or regular shapes, and are readily distinguished from naturally occurring signatures in any terrain. This category was separated into six subtypes: urban, aqueduct, nonnative woodland, turf, wind turbine, and landfill.

Urban

Urban sites are those areas where the native vegetation has been cleared for residential, commercial, industrial, transportation, or recreational structures. Developed areas include areas that have structures, paved surfaces, horticultural plantings, and lawns smaller than 10 acres (irrigated lawns larger than 10 acres were mapped as turf). Many small, rural residential areas were observed in the inventory area (e.g., along Marsh Creek Road, Morgan Territory Road, within irrigated agricultural areas). Such areas were mapped as urban if they exhibited at least 10 acres of buildings, turf, and pavement. Rural residential areas of less than 10 acres that were adjacent to or surrounded by agriculture and/or grassland land cover types were mapped as the adjacent land cover type. Parcels of non-urban land cover types that received development entitlements from local agencies during development of the Plan but did receive take authorization, or were not expected to request or receive take authorization, were mapped as future urban in the Plan. Records of the prior land cover have been maintained and land cover conversion has been documented. The urban land cover type is the second most abundant type in the inventory area, occupying 32,459 acres (19%), mostly in the Cities of Pittsburg, Oakley, Clayton, and Brentwood. Small developed areas occur in unincorporated portions of the county east of Mount Diablo, in the agricultural areas of east Contra Costa County, in Byron, and around the Byron Airport. In addition to the 32,459 acres mapped as urban, 4,087 acres (2%) were mapped as future urban.

Aqueduct

Aqueducts were identified by the presence of a concrete-lined channel and open, perennially flowing water. These features were easily visible on aerial photographs as having lined channel banks with no vegetation. Aqueducts were distinguished because of their function as major barriers to movement of terrestrial wildlife. Buried aqueducts were not mapped. Surface aqueducts occupy 383 acres within the inventory area. Major aqueducts in the inventory area include the Delta-Mendota Canal (U.S. Bureau of Reclamation) and the Contra Costa Canal (owned by the U.S. Bureau of Reclamation, operated and maintained by CCWD).

Nonnative Woodland

Nonnative woodlands are those areas where ornamental and other introduced species of trees have been planted or naturalized and dominate to form a dense canopy. Nonnative woodland was mapped primarily in areas surrounded by development, where the signatures and locations did not meet the requirements for oak or riparian woodlands. Nonnative woodland was included as a separate land cover type because some stands could provide suitable habitat for raptors. The majority of nonnative woodland in the inventory area consists of planted stands of eucalyptus.

Nonnative woodlands occur on 51 acres (<1%).

Turf

The turf land cover type comprises developed parks and golf courses that support irrigated lawns and horticultural plantings with little or no natural land cover. Turf may be planted with native or ornamental trees. In some cases, selected native trees such as oaks were retained in the landscape and turf grass was planted in the understory.

Turf occupies 1,477 acres (<1%) near large residential areas south of Antioch and Pittsburg. The majority of the turf land cover type is in and around Contra Loma Regional Park, the Brentwood Golf Club (three courses), Stoneman Park in Pittsburg, and the Roddy Ranch Golf Course south of Antioch.

Wind Turbine

The wind turbine land cover type was mapped in the southern portion of the inventory area where turbines have been installed in rows for power generation. Wind turbine was mapped to the extent of disturbed land (mainly roads and turnarounds) around the turbines and with a standard 50-foot width. In some cases this may overestimate the acreage of disturbance because grassland in

between turbine towers are included in these polygons. However, access roads away from turbine towers are generally included in the annual grassland land cover type; access roads were not mapped as disturbed because they fell below the minimum mapping unit.

Wind turbine occupies 217 acres (<1 %) in the southern portion of the inventory area between Los Vaqueros Reservoir and Byron Airport.

Landfill

Landfills are those areas where vegetation has been cleared and large amounts of soil have been moved for solid waste disposal. Typically, these areas are excavated pits into which refuse is placed and compacted. After a landfill is closed and capped, it may be returned to grassland habitat through planting and management. It is unclear how much the wildlife community after closure would resemble that of an natural annual grassland. For example, post-closure management may include control of burrowing rodents to prevent breakage of the landfill lining. Only active landfills were mapped in this category. The Keller Canyon Landfill, located south of Pittsburg, is the only active landfill in ECCC. It was mapped as occupying 334 acres (<1%).

3.3.3 Historic Conditions

Land cover types within the inventory area have changed substantially since European settlement of the area. Although the historic distribution and composition of vegetation communities in the inventory area are unknown, some communities were likely substantially different from current communities. The land cover types that have probably undergone the most dramatic changes are grassland, streams and wetlands, riparian forests, and oak woodlands.

Most native wildlife was likely more abundant in the inventory area historically. For example, black bears (*Euarctos americanus*) were known to occur in the San Francisco Bay Area, as were tule elk (*Cervus elophus nannodes*). Other wildlife, such as mountain lion (*Felis concolor*) and bobcat (*Lynx rufus*), still occur in the inventory area but were likely more common prior to European settlement.

Grasslands

Native grasslands dominated by perennial grasses, such as purple needlegrass and Sandberg bluegrass, likely occurred throughout most of the inventory area in areas currently occupied by annual grassland, urban development, ruderal, and agricultural land cover types (Heady 1977; Wester 1981). These native grasslands supported a high diversity of native annual and perennial herbs and grasses. Common wildlife included high densities of pronghorn (*Antilocapra americana*), mule deer, Botta's pocket gopher, and tule elk (Heady 1977).

Prior to European settlement, native perennial grasslands in the inventory area were likely subject to regular burning by Native American people. Although historical records do not provide definitive data on the distribution of these native perennial grasslands, research indicates human use of fire may have had a profound impact on the distribution and extent of historic grasslands. Keeley (2002a) surmised that because dense shrubland or chaparral had little value to Native Americans, they used periodic burning to clear shrubs and provide habitat for fire-tolerant native grasses. Keeley (2002b) also implied that the mosaic of annual grassland we see today is likely a result of historic vegetation management that favored open grasslands over chaparral.

Starting in 1769, another anthropogenic change to the landscape occurred with the introduction and spread of many nonnative plants throughout California. These plants include Mediterranean annual grasses and herbs such as wild oats, bromes, barleys, ryes, and thistles (*Centaurea* sp., *Cirsium* sp.) (Bartolome and Gemmill 1981). The number of European settlers grazing livestock in the inventory area likely increased after the gold rush of the 1850s. The combination of livestock grazing, drought, and spread of exotic grasses and herbs dramatically altered the native grasslands that occurred in the inventory area prior to the 1850s (Heady 1977). No comprehensive surveys of native grassland have been conducted in the inventory area, but it is expected that native grasses remain in scattered populations throughout the inventory area. Although it is probably less intensive than in the past, grazing by livestock and wildlife continues today in most grasslands of the inventory area.

Streams and Wetlands

Aquatic habitats, such as vernal pools, seasonal wetlands, and alkali wetlands, were almost certainly more abundant in the inventory area than they are today. For example, vernal pools have been reduced to less than 10% of their former extent in the California's Central Valley (Holland 1978), of which the eastern portion of the inventory area is a part. Historically, vernal pools and other seasonal wetlands and ponds were likely scattered throughout the lowland portions of the inventory area. Streams in the northern and eastern portions of the inventory area historically flowed unimpeded by the channels, water diversions, and barriers that occur today.

Since European settlement, nonnative aquatic species, such as bullfrog (*Rana catesbeiana*), have been introduced into aquatic habitats, especially those whose hydrology has been altered by damming (e.g., stock ponds) or channelization.

Riparian Forests

Riparian forest, woodland, and scrub communities dominated by willows and cottonwood were likely more common in the inventory area historically than they are today. These communities likely dominated major streams, such as Marsh

Creek, Kellogg Creek, and Kirker Creek, from the foothills to near the San Joaquin River. Dense riparian vegetation was likely present within the 100-year floodplain of the lowland stream courses (Katibah 1984), usually between natural levees. Remnant stands of riparian forests, like that found along Marsh Creek in Brentwood's Creekside Park, suggest that these forests historically contained a highly diverse assemblage of trees. In addition to Fremont cottonwood and two species of willow, the stand in Creekside Park contains blue elderberry (*Sambucus mexicana*), box elder (*Acer negundo*), Oregon ash (*Fraxinus latifolia*), California walnut (*Juglans californica*), valley oak, and western sycamore. These forests and woodlands would have supported diverse passerine and raptor communities similar to those found today in these remnant habitats. Urban development, water diversion and flood control projects, woodcutting, agricultural expansion, and extensive livestock grazing have greatly reduced the extent of these riparian forests in the Central Valley (Katibah 1984).

There are many opportunities for restoration of riparian woodland and riparian scrub in the inventory area. Some of the best opportunities for restoration of riparian woodland exist along Marsh Creek as it flows through Brentwood and Oakley (Natural Heritage Institute 2002; Natural Heritage Institute and Delta Science Center 2002). Additional opportunities for riparian restoration exist along the intermittent reaches of Sand Creek as it flows through Antioch and Brentwood and along intermittent reaches of Marsh Creek directly upstream from the Marsh Creek Reservoir.

Oak Woodland

Historically, oak woodlands and savannahs may have been more extensive in the inventory area than today. The remnant valley oaks at the margins of agricultural fields in the inventory area suggest that these species were once more widespread. Valley oaks may have occurred on the deep alluvial soils common throughout the lowland areas of the inventory area. Myriad factors have contributed to the decline in density and extent in the inventory area of these and other oaks, including urban and agricultural development, woodcutting, livestock grazing, deer and rodent overpopulation (resulting from the elimination of native predators), and an altered fire regime (Pavlik et al. 1991). Some researchers hypothesize that many of these factors, continuing today in the inventory area, impair the ability of oaks to regenerate.

3.3.4 Natural Communities (Vegetation Communities)

The NCCPA requires that natural communities within the Plan area be identified in an NCCP. These are the communities that could be affected by plan implementation. This Plan also uses the term *vegetation communities* to describe the natural communities included in the Plan. This term is used because the communities are described on the basis of vegetation characteristics, such as

dominant species and vegetation structure, rather than other characteristics, such as wildlife composition. Vegetation communities were also selected as the means to define natural communities because of the accepted classification schemes commonly used for vegetation communities (Table 3-2).

This Plan includes the following six vegetation communities, corresponding to the major land cover types (excluding development).

- Grassland community.
- Chaparral/scrub community.
- Oak woodland community (including oak savannah).
- Riparian woodland/scrub community (including streams).
- Wetlands.
- Cultivated agriculture.

Irrigated agriculture is included as a vegetation community despite its disturbed or artificial nature because it provides habitat for some covered species.

Functions of Vegetation Communities

The ecological function for wildlife (i.e., value for forage, hunting, breeding, aestivating, movement, etc.) of each vegetation community is described briefly below to provide context for the impact analysis and the conservation strategies. The function and related value for wildlife of a specific patch of any vegetation community is linked to its size, species diversity, location relative to other vegetation communities, and structural complexity. For example, a small isolated stand of oak woodland generally provides a significantly reduced array of functions for wildlife than does a larger contiguous stand. Also, grasslands that intergrade with chaparral and oak savannah provide greater wildlife function than do grasslands adjacent to urban areas. In general, increased exposure to human disturbance and exotic weed invasion reduces the potential function of the vegetation community for wildlife habitat.

Grassland Community

The grassland vegetation community is the most abundant vegetation community in the inventory area, occupying 67,781 acres. Grasslands within the inventory area function as a core vegetation community, linking small and large patches of all other natural vegetation communities in the landscape. Grasslands also provide critical upland habitat for a variety of amphibians dependent on adjacent aquatic habitats such as ponds and seasonal wetlands. These amphibians move through grassland during the rainy season to disperse to other aquatic sites, and may aestivate within grassland during the dry season. Grasslands are important for fossorial rodents such as ground squirrels and gophers. Rodent burrows, in

turn, provide habitat for a variety of other species, including burrowing owls. The diverse and abundant rodent community supports an assemblage of raptors that feed on them, including golden eagle (*Aquila chrysaetos*), northern harrier, and white-tailed kite.

Periodic fire is an important part of the grassland vegetation community. Historically, fires from both lightning strikes and human ignition, and soil conditions kept woody vegetation from converting grassland into chaparral or oak woodland in higher elevation sites. At lower elevations, grassland was likely always the dominant vegetation community, kept open by native grazers such as tule elk and pronghorn, fire, and drought. Prescribed burning has become an important management tool in grasslands and other natural communities. However, this technique is becoming increasingly difficult to implement due to cost, safety concerns from expanding urban and rural development, and difficulty obtaining permits because of air quality concerns.

Another historic change in the grassland community is related to species composition. Today, large stands of native perennial herbs and grasses have been replaced by a landscape dominated by fast-growing nonnative annual grasses and herbs. Unlike perennial grasses, annual grasses generally do not develop extensive, long-lived root networks. These long-lived root networks are important to the function of the grassland ecosystem for a number of reasons, including protection of the topsoil from erosion and provision of habitat for a wide variety of soil microorganisms that create the backbone of the grassland food web. The production of plant biomass within grasslands has also shifted seasonally. In the past, native perennial grasses continued to grow actively into early summer and regreen early in fall. In contrast, nonnative annual grasses tend to dry out in late spring or early summer and germinate anew in fall. This shift has dramatic effects on the seasonal availability of forage for native grazers such as insects and rabbits (and to a lesser extent, mule deer), as well as the type of seeds and cover available for smaller mammals.

Chaparral/Scrub Community

The chaparral/shrub vegetation community occupies 3,016 acres in the southwestern portion of the inventory area. This community contains small, intermittent streams but no other special land cover types. Because it occurs on dry, south- and west-facing slopes, no wetlands or natural ponds occur within this vegetation community. This community has relatively high value for wildlife because, although it occurs in fragmented patches, almost all patches are surrounded by other natural communities. Moreover, this community has a relatively low proportion of nonnative species due to dense shrub canopies, dry conditions, relative isolation from urban land use, and other conditions.

Chaparral/scrub communities are dominated by heavily branched shrubs that burn easily. Consequently, many of the plants in this community have evolved to be dependent on periodic fire for regeneration. Many of the dominant shrubs, such as manzanita and ceanothus, resprout from basal burls following a fire event

while other species regenerate from seed. Regrowth is triggered by removal of the overstory, typically by fire. Chemicals in smoke and charred wood also stimulate germination in a wide variety of native forbs that lie dormant as seeds in the soil for decades before a fire. These fire-following forbs are abundant for one or more years after a fire and provide high-quality habitats for a diversity of insects and other wildlife. The unique flora of post-fire chaparral contributes to its trait of supporting the highest concentration of special-status plants of any community in California (California Native Plant Society 2001). Many species that inhabit chaparral also inhabit adjacent grassland and oak woodlands. However, some birds and mammals are found largely in the dense cover and shade of mature chaparral stands.

Oak Woodland Community

The oak woodland vegetation community is a combination of oak savannah; oak woodland; mixed evergreen woodland; and the ponds, streams, and rock outcrops that occur within them. There are 30,095 acres of this community within the inventory area. Oak woodlands share many of the same functions as the adjacent grassland and chaparral communities. However, the structure and food provided by the dominance of oak trees and other evergreen trees in this community distinguish it from the adjacent communities. Oak woodland is one of the most biologically diverse communities in California, providing essential habitat for approximately 2,000 plant, 5,000 insect, 80 amphibian and reptile, 160 bird, and 80 mammal species (Merelender and Crawford 1998). Oaks in the inventory area provide shelter, through shading and within trunk cavities, for a variety of wildlife in an otherwise open, dry landscape. Unlike the largely deciduous vegetation of riparian forest and scrub, evergreen oaks, California bay, madrone, and foothill pine provide shaded shelter year-round. Large acorn crops and a diverse insect fauna provide high-quality food for a wide variety of amphibians, reptiles, birds, and mammals.

Although oak woodlands and oak savannahs are functionally similar in many ways, they play somewhat different ecological roles in the landscape. For example, oak woodlands are more likely to provide cool, shady refugia for wildlife during the hot dry summer. Oak savannahs are more likely to function as a transition zone between dense oak woodlands and open grasslands and may offer more hunting opportunities for some species such as raptors.

Like grasslands, the oak woodland community provides important upland habitat for aquatic species such as frogs and salamanders that are dependent on ephemeral ponds and wetlands within oak woodland. The leaf litter under oaks provides a cover of organic matter and protection from desiccation for soil invertebrates and amphibians.

Riparian Woodland/Scrub Community and Streams

The riparian woodland/scrub vegetation community occupies 448 acres within the inventory area. This vegetation community is disproportionately important in the landscape because of its function as an interface between aquatic and terrestrial communities. Riparian woodlands support both terrestrial and aquatic species by providing movement corridors across the landscape and both nesting and foraging habitat; supporting high levels of invertebrate production; creating moist, cool refugia during the hot dry summer; moderating stream temperatures; armoring stream banks; and supporting the aquatic food chain by means of input of vegetative and other detritus.

Although riparian scrub is not as effective as riparian woodland in moderating stream temperatures, it may provide better nesting and foraging habitat for migratory passerine birds that prefer dense thickets. Riparian woodland extends into urban areas in Pittsburg and Brentwood, providing a partial link along streams between grasslands in the foothills and the habitats of the San Joaquin River. Where it occurs, riparian woodland/scrub serves to greatly reduce and moderate (i.e., reduce the variability of) stream temperatures, increasing the value of these aquatic habitats for native invertebrates, fish, and amphibians.

Many of the riparian areas and streams in the lowland section of the inventory have been severely affected by development. Streams such as Marsh Creek, Sand Creek, and Kirker Creek are either devoid of riparian vegetation or contain only narrow bands of remnant vegetation. In the upland portions of the inventory area, especially in the open grasslands, inappropriate livestock grazing practices have resulted in heavily degraded or denuded riparian areas. Consequently, there are many opportunities for restoration and enhancement of riparian areas in the inventory area.

Approximately 409 miles of stream have been mapped in the inventory area. These mapped streams represent a combination of perennial, intermittent, and ephemeral streams but likely exclude many smaller ephemeral streams. With or without riparian vegetation, streams provide ecosystem functions and values much greater than the proportion of the landscape they cover. Streams provide habitat for a wide array of aquatic insects that, in turn, function as food for amphibians, birds, and other insectivorous species. Perennial streams function as permanent water sources in an otherwise dry landscape. Streams also provide movement corridors between different terrestrial communities. In this way, networks of ephemeral, seasonal, and perennial streams link chaparral/scrub, oak woodland, oak savannah, riparian woodland, and grassland habitats. These links are not only important for the movement of wildlife, but also represent the fastest means of transporting energy and nutrients through a watershed. Thus, it is through stream networks that organic matter and minerals are transported from the highlands and deposited in the lowlands.

A detailed evaluation of the functions of streams in the inventory area is presented in Appendix J.

Wetlands

Wetland functional values are provided through several physical and biological processes (National Research Council 2001). Permanent and seasonal wetlands function as essential habitat for amphibians that depend on aquatic environments for reproduction and juvenile development. These wetlands also provide high levels of insect production, which in turn creates a major food sources for amphibians, birds, and other insectivorous species. The cyclical nature of inundation and drought in seasonal wetlands allows these systems to support a unique suite of highly adapted biota. Perennial wetlands are permanent water sources during the dry season in an otherwise arid landscape and thus function as essential habitat for a wide variety of water-dependant wildlife.

Wetlands also perform important functions with regard to physical processes. For example, wetlands play an important role in regulating biogeochemical cycles such as the nitrogen cycle. Wetlands also mediate flows in local streams and springs by providing temporary surface water storage and gradual recharge to local aquifers. On a small scale, wetlands in the inventory area also reduce erosion and sedimentation by reducing surface runoff.

A detailed evaluation of the functions of wetlands in the inventory area by watershed and subwatershed is presented in Appendix J.

Cultivated Agriculture

Cultivated agriculture occupies 33,232 acres[6] in the inventory area, almost exclusively within the northeastern, lowland portion. This land cover type has relatively low value for native plants and wildlife compared to natural communities. However, some native wildlife, such as small mammals, certain raptors, and migratory waterfowl, utilize this community seasonally or year-round. Year-round activity tends to be concentrated along the margins of active farmland where vegetation is less disturbed or where trees and shrubs tend to occur (some are planted deliberately as windbreaks). Open fields that are irrigated for forage crops are also used by wildlife. Cultivated agriculture is bisected by streams, sloughs, and channels. Some amphibians and reptiles (e.g., giant garter snake [*Thamnophis gigas*]) utilize these linear aquatic features and the adjacent upland habitat. For example, western pond turtles occur along lower Marsh Creek where it bisects irrigated agriculture in Oakley (John Cain pers. comm.).

Ecosystem Function

The NCCPA requires CDFG to make findings that this NCCP conserves, restores, and manages representative natural and seminatural landscapes to

[6] This value includes the acreage for slough/channel, which occurs exclusively within the eastern portion of the inventory area dominated by irrigated agriculture.

maintain the ecological integrity of large habitat blocks, including *ecosystem function* (California Fish and Game Code Section 2820 (a)(4)).

Ecosystems can be defined as "a community of organisms and their physical environmental interacting as an ecological unit" (Lincoln et al. 1998). The boundaries between ecosystems are somewhat arbitrary at the scale of the inventory area but can roughly be delineated by the six natural community types described above. Ecosystem function is defined as the "sum total of processes operating at the ecosystem level, such as the cycling of matter, energy, and nutrients" (Mooney et al. 1995). Ecosystem processes also include processes at lower ecological levels such as species interactions and the transfer of genetic material.

It is beyond the scope of this NCCP to analyze the full range of ecosystem functions in the inventory area. For example, nitrogen cycling cannot be evaluated without empirical data and complex computer modeling. As a surrogate for many ecosystem functions, the major watersheds and subwatersheds of the inventory area are described in Appendix J in Volume 2 of the HCP/NCCP, *Draft Aquatic Resources Inventory, Classification, and Function for East Contra Costa County HCP/NCCP Inventory Area*. Watersheds are a useful unit and a reasonable surrogate for many ecosystem functions in this Plan for several reasons:

- the inventory area was defined, in large part, by watershed boundaries,
- many of the proposed covered species depend wholly or in part on freshwater habitats that are supplied and maintained by the watershed, and
- maintaining an intact watershed should, all else being equal, maintain important ecosystem functions such as minimizing soil erosion, maintaining water quality, maintaining the local hydrologic cycle, ensuring adequate cycling of key nutrients, and ensuring species interactions between aquatic and terrestrial ecosystems.

This approach has been recommended to conserve freshwater species and habitats on a regional scale (Saunders, Meeuwig, and Vincent 2002). Appendix J in Volume 2 of the HCP/NCCP describes the watersheds and subwatersheds of the inventory area in terms of their hydrogeomorphic setting (i.e., geologic, soil, climatic, hydrologic, and land use origins), and the amount of pervious and impervious cover.

3.3.5 Regulatory Context of Wetlands, Streams, and Other Jurisdictional Waters

Wetlands, streams, reservoirs, sloughs, and ponds typically meet the criteria for federal jurisdiction under Section 404 of the CWA and state jurisdiction under the Porter-Cologne Water Quality Control Act. Streams and ponds typically meet the criteria for state jurisdiction under Section 1602 of the California Fish

and Game Code. Regional data on these resources collected for the HCP/NCCP do not represent a jurisdictional delineation for either federal or state regulations. The resources mapped, however, provide an excellent planning tool for identifying regional conservation measures for aquatic and wetland resources. Conservation of aquatic and wetland resources is a focus of the HCP/NCCP, and conservation measures developed for the Plan are intended to provide the framework for compliance with CWA Sections 404 and 401 and Section 1602 of the California Fish and Game Code.

Section 404 Regulated Waters

Under CWA Section 404, the U.S. Army Corps of Engineers (USACE) regulates activities that result in the discharge of dredged or fill material into waters of the United States. Waters of the United States is a broad category of water bodies that includes wetlands as well as nonwetland habitats, such as streams, rivers, lakes, reservoirs, ponds, bays, and oceans. USACE jurisdiction in nontidal waters is measured to the ordinary high water mark, defined in the federal regulations as

> that line on the shore established by the fluctuations of water and indicated by physical characteristics such as clear, natural line impressed on the bank, shelving, changes in the character of soil, destruction of terrestrial vegetation, the presence of litter and debris, or other appropriate means that consider the characteristics of the surrounding areas (33 CFR 328.3[e]).

Wetlands are defined under USACE regulations as

> those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas (33 CFR 328.3[b]).

Section 1602 Regulated Waters

Under Section 1602 of the California Fish and Game Code, CDFG regulates public agency activities that would alter the flow, bed, channel or bank of streams and lakes. The limits of CDFG jurisdiction are defined as the "…bed, channel or bank of any river, stream or lake designated by the department in which there is at any time an existing fish or wildlife resource or from which these resources derive benefit…" (California Fish and Game Code Section 1602). Streams are defined in the California Code of Regulations (CCR) as "a body of water that flows at least periodically or intermittently through a bed or channel having banks and supports fish or other aquatic life. This includes watercourses having a surface or subsurface flow that supports or has supported riparian vegetation" (14 CCR 1.72). In addition to streams, CDFG regulates watercourses such as sloughs, canals, aqueducts, and irrigation ditches. CDFG also regulates

the stream or channel bed and levees, including riparian vegetation. Reservoir, slough/channel, aqueduct, stream, and riparian woodland/scrub land cover types mapped in this HCP/NCCP are assumed to fall under CDFG jurisdiction (Table 3-4).

Federal and State Jurisdictional Waters in the Inventory Area

A detailed inventory, classification, and regional function analysis of aquatic resources in the inventory area is presented in Appendix J to support development of a Regional General Permit Program. This section presents an overview of the land cover types within the inventory area that may qualify as waters regulated by USACE and CDFG (Table 3-4). This section describes the biological setting that supports the analysis of impacts on these potentially regulated waters (Chapter 4); conservation measures for these waters (Chapter 5); and subsequent applications to these agencies for regional or programmatic permits.

USACE Jurisdiction

All aquatic and wetland land cover types within the inventory area are assumed to be waters of the United States under CWA Section 404 (Table 3-4). Most of these waters are nontidal. The only tidally influenced waters in the inventory area are sloughs and some channels connected to the Delta and the San Joaquin River.

There are an estimated 3,434 acres of potential wetlands and other waters in the inventory area (Table 3-5). The majority of these areas are reservoirs, including Los Vaqueros Reservoir (1,500 acres). Up to approximately 985 acres of these waters of the United States may qualify as jurisdictional wetlands[7].

Approximately 409 miles of streams are mapped in the inventory area; all are likely subject to USACE jurisdiction. The estimated extent of streams is likely an underestimate because many of the smaller jurisdictional streams (e.g., small ephemeral streams) were not mapped.

In some cases, isolated wetlands and ponds may not qualify as jurisdictional wetlands in accordance with a recent Supreme Court decision (SWANCC[8]), and applicable EPA and USACE regulations. In such circumstances, the resource mapping may have overestimated jurisdictional extent.

[7] Vegetated fringes of ponds or reservoirs may also qualify as jurisdictional wetlands, but these were not distinguished in the pond or aquatic categories. These fringing wetlands are not included in the total.
[8] The court case is commonly referred to by the plaintiff's name: Solid Waste Agency of Northern Cook County (SWANCC), Illinois.

CDFG Jurisdiction

There are approximately 3,116 acres of waters potentially subject to CDFG regulation within the inventory area (Table 3-6). These areas mostly comprise the reservoirs. There are approximately 409 miles of streams mapped in the inventory area, all of which are likely subject to CDFG jurisdiction. Up to 448 acres of riparian woodland/scrub are also likely subject to CDFG jurisdiction, although it is likely that much of this acreage overlaps with streams.

The estimated extent of CDFG jurisdiction is likely an underestimate because many of the smaller jurisdictional streams and channels were not mapped in the data collection. In addition, small stands (i.e., less than the minimum mapping unit) of CDFG-jurisdictional riparian woodland/scrub were not mapped but are likely present in the inventory area.

3.3.6 Biological Diversity

California is considered a global "hot spot" for biological diversity, where species diversity, endemism, and threats to this diversity are particularly high (Myers et al. 2000, Stein et al. 2000). California is particularly rich in unique plant species and contains globally-important sites of plant diversity (Davis et al. 1997).

By most measures of biological diversity, California stands out as unique in North America. For example, California contains more native biological diversity than any other state, including more endemic species than any other state (1,295 species) (Stein 2002). California is ranked 1st in the United States in the number of endemic species of vascular plants, amphibians, reptiles, mammals, and freshwater fish (Stein et al. 2000). Overall, California is ranked 1st among the states in the number of taxa (species richness) and endemism (Stein et al. 2000). California supports approximately one-third of all species of vascular plants and reptiles in the United States, 47% of mammal species, and 56% of bird species (California Department of Fish and Game 2003). This remarkable biological diversity is due, in part, to California's large size. But more importantly, it is due to California's very high diversity of climates, geology, and topography. This physical diversity creates an unusually high diversity of habitats in which new species can evolve and persist.

The HCP/NCCP inventory area represents less than 0.2% of the land area of California, but it contains a disproportionately high amount of the state's biological diversity. In a comprehensive national study of species rarity, the San Francisco Bay Area came up as only one of six hotspots of rarity in the United States (Stein et al. 2000). Within California, eastern Contra Costa County ranks high or very high (California Department of Fish and Game 2003c) in the following resources.

- Plant rarity (category 3 of 4).

- Amphibian richness (category 4 of 5).
- Reptile richness (categories 3 and 4 of 5).
- Bird richness—summer (categories 4 and 5 of 6).
- Bird richness—winter (categories 5 and 6 of 6).
- Bird rarity (category 3 of 3).
- Mammal richness (category 3 of 6).
- Invertebrate rarity (category 5 of 5)[9].

Eastern Contra Costa County also has important statewide examples of oak woodlands (California Department of Fish and Game 2003c) and vernal pool complexes (California Department of Fish and Game 1996, 1998). Although species counts and analyses specific to the HCP/NCCP inventory area have not been performed, these national and statewide studies strongly suggest that the biological diversity within the inventory area is high in most plant and animal groups relative to other parts of California and the United States.

3.3.7 Covered Species

Species Evaluation

To determine which species would be covered by the ECCC HCP/NCCP, a comprehensive list of 154 special-status species that occur or may occur in the inventory area was compiled (Table 3-7) on the basis of information from the following sources.

- California Natural Diversity Database (CNDDB).
- CNPS's (2001) *Inventory of Rare and Endangered Vascular Plants of California*.
- CDFG's Special Animals and Special Plants lists.
- Jones & Stokes research and environmental reports files.
- Jones & Stokes biological resource specialists.
- Informal consultation with USFWS (letter request).
- Jones & Stokes in-house file information.
- Personal communication with local experts including members of the HCPA Science Advisory Panel.

[9] The unusually high diversity of invertebrates is due, in part, to the rare invertebrates found in Antioch Dunes, which is outside the inventory area.

Definition of Special-Status Species

Special-status species are defined as plants and animals that are legally protected under ESA, CESA, or other regulations, and species that are considered sufficiently rare by the scientific community to qualify for such listing.

Special-status plants are species that are:

- listed or proposed for listing as threatened or endangered under ESA (50 Code of Federal Regulations [CFR] 17.12 [listed plants] and various notices in the Federal Register [FR] [proposed species]);
- candidates for possible future listing as threatened or endangered under the federal ESA (66 FR 54808, October 30, 2001);
- listed or candidates for listing by the State of California as threatened or endangered under CESA (14 CCR 670.5);
- listed as rare under the California Native Plant Protection Act (California Fish and Game Code Section 1900 *et seq*.);
- determined to meet the definitions of rare or endangered under CEQA (State CEQA Guidelines, Section 15380);
- considered by CNPS to be "rare, threatened or endangered in California" (Lists 1B and 2 in California Native Plant Society 2001); or
- listed by CNPS as plants about which more information is needed to determine their status and plants of limited distribution (Lists 3 and 4), which may be included as special-status species on the basis of local significance or recent biological information.

Special-status animals are species that are:

- listed or proposed for listing as threatened or endangered under ESA (50 CFR 17.11 [listed animals] and various notices in the FR [proposed species]);
- candidates for possible future listing as threatened or endangered under ESA (66 FR 54808, October 30, 2001);
- determined to meet the definitions of rare or endangered under CEQA (State CEQA Guidelines, Section 15380);
- listed or candidates for listing by the State of California as threatened or endangered under CESA (14 CCR 670.5);
- species of special concern (SSC) to CDFG (2003c) and the Point Reyes Bird Observatory (PRBO) 2001 (birds) (mammals); or
- fully protected under California Fish and Game Code Section 3511(birds), Section 4700 (mammals), Section 5515 (fish), and Section 5050 (reptiles and amphibians).

Covered Species Criteria

For each special-status species with potential to occur in the inventory area, information was gathered on its status, population trends, distribution, threats, and conservation and management efforts. The following criteria were then applied to each species to determine whether it would be covered (i.e., included in the final permits). To be covered, a species had to meet all four of the following criteria.

- **Range:** The species is known to occur or likely occurs within the inventory area, based on credible evidence.
- **Status:** The species is currently listed under ESA or CESA or is likely to become listed within the permit term (assumed to be up to 30 years). Species that are considered likely to become listed within the permit term include species that are:
  - proposed for listing under ESA,
  - candidates under CESA,
  - candidates under ESA, or
  - California fully protected species or specified birds;

  and some species, based on species specific information, that are:

  - California SSC;
  - CNPS Lists 1A, 1B, 2, or 3;
  - non-listed and are known by experts to be very rare (e.g., newly discovered species) or declining rapidly; or
  - non-listed and not rare, but the covered activities may affect a substantial portion of the species' range or important habitat.

  Whether a species is considered likely to be listed was based on existing information as well as professional judgment, knowledge of future listing packages, and input from species specialists and regulatory agencies.
- **Impact:** The species will be or will likely be adversely affected by covered activities.
- **Data:** Sufficient data exists on the species' life history, habitat requirements, and occurrence in the inventory area to adequately evaluate impacts on the species and to develop conservation measures to mitigate these impacts in accordance with regulatory standards. Data adequacy was a subjective decision based on professional judgment.

Table 3-7 lists all special-status species that were evaluated and the criteria that were met by each species. Table 3-8 presents the list of 28 species proposed for coverage in the Plan. Anadromous fish presented a special case in the evaluation of whether species should be covered. Details of the evaluation for this group of

species and the rationale for why fish are not covered are presented in Appendix C.

Many other native species (with and without special-status) are expected to benefit from the Plan because the Plan addresses requirements under the NCCP Act to conserve, restore, and manage representative natural and seminatural landscapes to maintain the ecological integrity of large habitat blocks, ecosystem function, and biological diversity. Species proposed for coverage in the Plan were limited to those species for which impacts from covered activities were likely in order to provide take authorization for the highest priority species. However, many other special-status species are expected to benefit from the Plan, as described in Chapter 5.

Covered Species Descriptions

Detailed species profiles of each of the 28 covered species (Table 3-8) are provided in Appendix D. These profiles summarize ecological information, distribution, status, threats, population trends, and conservation and management activities in and near the inventory area. The profiles represent the best available scientific data for each species on which to base this Plan. Each profile is designed for easy reference, so all literature cited within the profile is provided at the end of the profile. The biological data in these profiles form the basis for the impact analysis (Chapter 4) and conservation strategy (Chapter 5) in this HCP/NCCP.

Land cover types are the basic unit of evaluation for habitat modeling, analyzing potential impacts, and developing conservation strategies for covered species. Each covered species is associated with one or more land cover types (Table 3-9). These land cover type associations, plus other habitat features, were used to develop species distribution models for 20 of the 28 covered species that provide additional information on species impacts and conservation needs.

Species Distribution Models

The purpose of the species distribution models is to help identify areas within the inventory area where covered species occur or could occur based on known habitat requirements. These models have been used to assist in quantifying impacts of covered activities on covered species and to assist in developing conservation measures.[10] Alternative reserve and restoration designs were evaluated against each covered species model, when available, to help ensure that regulatory standards and biological goals for these species are met and that conservation for each species is maximized. Species distribution models for 20

[10] These models have been developed on a regional scale using regional data. The models do not necessarily provide accurate site-specific species information. For this reason, if the HCP/NCCP is suspended, these models should not be used for site-specific analysis and do not create a presumption of take under state or federal law.

of the covered species are described in detail in the relevant species profile. Methods used for all models are described below.

Because of the model limitations (see discussion below), models could not be developed for 8 of the 28 covered species. For some species, particularly vernal pool invertebrates and some plants with highly restricted distribution and habitat requirements, available location data and the resolution of the modeling were insufficient to precisely identify potential habitat. The wetland habitat areas used by vernal pool invertebrates were of such small size or specific physical condition (e.g., pond duration, depth) that they could not be mapped from aerial photography. Similar limitations pertained to several plant species. For species without models, the conservation strategy takes a more conservative approach than for species with models. For example, field surveys are required more often in suitable habitat for species without models than for species with models. Information in the species profiles was adequate to develop the impact analysis and conservation measures for the 8 species without species distribution models.

Model Structure and Development Methodology

The 20 species models described in the species profiles were designed to estimate the location of key habitat characteristics of each species and to be repeatable and scientifically defensible, while remaining as simple as possible. The models are based on identification of land cover types that provide important habitat for these species (Table 3-9). Land cover types were identified as suitable habitat based on the known or presumed habitat requirements and use patterns of each species. When supported by appropriate data, the models were refined using physical parameters such as elevation limits. In some cases, perimeter zones were used to designate habitat use a certain distance from a land cover type. For example, California red-legged frog uses upland habitat for aestivation (summer hibernation) and dispersal, but the probability of use decreases with increasing distance from suitable breeding sites (e.g., ponds, streams). For wildlife, land cover types considered to be suitable habitat were classified by habitat use. Land types used for breeding were designated as core use areas. Other important habitats that may or may not include the core areas include foraging areas; aestivation areas; and migration, movement, or dispersal corridors.

Determinations of suitable land cover types and additional physical parameters were based on available data from survey reports, environmental documents, and peer-reviewed scientific literature. When data were inconclusive or contradictory, conservative values were assumed in estimating suitable habitat.

Covered Species Locations

Documented occurrences of covered species within the inventory area were used to validate and refine the models. Sources of occurrence data are listed below.

- CNDDB.

- Data from a previous study of species distribution in the area (Jones & Stokes Associates 1996).
- Occurrence records from the EBRPD's biological database.
- *Rare, Unusual, and Significant Plants of Alameda and Contra Costa Counties, Seventh Edition* (Lake 2004).
- The University of California/Jepson Herbaria's SMASCH database (University of California/Jepson Herbaria 2005).
- *Contra Costa Breeding Bird Atlas*.
- Survey records from recent large-scale field surveys in the inventory area (e.g., Mundie & Associates and City of Antioch 2002).
- Survey records submitted by local experts in spring 2003 after solicitations by the HCPA Science Advisory Panel.

Individual occurrences that fell outside a model's predicted habitat distribution were evaluated separately to determine if they indicate flaws in the model or are anomalous points. The original aerial photographs were examined to assess the significance of serious outlier points.

The majority of the records come from the CNDDB. These records represent the best available statewide data but are limited in their use for conservation planning. CNDDB records rely on field biologists to voluntarily submit information on the results of surveys and monitoring. As a result, the database is biased geographically towards areas where surveys have been conducted or survey efforts are greater (many areas have not been surveyed at all). The database may also be biased toward species that receive more survey effort. For example, there have been more surveys for California red-legged frog than other special-status wildlife because it is a listed species. Conspicuous diurnal species such as raptors likely receive greater survey effort than nocturnal species such as bats. Plants typically receive less survey effort than wildlife.

Model Limitations

The precision of the species distribution models is limited by the 10-acre/1-acre minimum mapping units used to map certain land cover types. Areas of suitable habitat smaller than the mapping thresholds were not mapped and could therefore not be incorporated into the models. This constraint limited the degree of resolution of some habitat features potentially important to some species.

The species distribution models were limited to distinguishing habitat uses based on key life history requirements such as breeding, foraging, or dispersal that are tied to land cover types. The data do not allow for further distinctions of habitat quality on a regional scale. For example, California red-legged frogs disperse from breeding sites as their ponds or streams dry out during the summer. The movement corridors used by individuals may follow moisture gradients and associated wetland and/or swale vegetation. Including these features in the

models was not possible. Accordingly, conservative estimates of movement/dispersal habitat requirements were used. This approach tends to overestimate the actual extent of suitable or required habitat for this species, but is consistent with current conservation planning practices when data are limited (Noss et al. 1997).

Table 3-1. Hierarchical Classification of Land-Cover Types

1.0	Grassland
	1.1 Annual grassland
	1.2 Alkali grassland
	1.3 Native grassland*
	1.4 Ruderal
2.0	Shrubland
	2.1 Chaparral and scrub
3.0	Woodland
	3.1 Oak savannah
	3.2 Oak woodland
	3.3 Mixed evergreen forest*
4.0	Riparian
	4.1 Riparian woodland/scrub
5.0	Wetland
	5.1 Permanent wetland*
	5.2 Seasonal wetland
	5.3 Alkali wetland
6.0	Aquatic
	6.1 Stream
	6.2 Reservoir
	6.3 Pond
	6.4 Slough/channel
7.0	Rock outcrops
8.0	Irrigated Agriculture
	8.1 Pasture
	8.2 Cropland
	8.3 Orchard
	8.4 Vineyard
9.0	Developed
	9.1 Urban
	9.2 Aqueduct
	9.3 Nonnative woodland
	9.4 Turf
	9.5 Wind turbines
	9.6 Landfill

*not mapped due to limitations of aerial photos; see text for further discussion.

Table 3-2. Land-Cover Types Cross Referenced to Other Classification Systems

East Contra Costa County HCP/NCCP	Holland System (Element Code) [a]	CNPS Classification [b]	California Wildlife Habitat Relationship [c]
Native Grassland	Valley and Foothill Grassland (42000) Valley Needlegrass Grassland (42110) Valley Wildrye Grassland (42140) Pine Bluegrass Grassland (42150)	Creeping Ryegrass Series Foothill Needlegrass Series Nodding Needlegrass Series Purple Needlegrass Series One-sided Bluegrass Series	Perennial Grassland
Annual Grassland	Non-Native Grassland (42200)	California Annual Grassland Series	Annual Grassland
Alkali Grassland	Alkali Meadow (45310) Alkali Playa (46000) Valley Sink Scrub (36210)	Saltgrass Series Iodine Bush Series	N/A
Ruderal	N/A	N/A	Barren
Chaparral and Scrub	Scrub and Chaparral (30000) Chamise Chaparral (37200) Northern (Franciscan) Coastal Scrub (32100) Diablan Sage Scrub (32600) Mixed Montane Chaparral (37510) Buck Brush Chaparral (37810) Mesic North Slope Chaparral (37E00)	California Sagebrush Series California Sagebrush-Black Sage Series Coyote Bush Series California Buckwheat Series Chamise Series Chamise-Wedgeleaf Ceanothus Series	Mixed Chaparral Chamise-Redshank Chaparral Coastal Scrub
Oak Savannah/Woodland	Woodland (70000) Valley Oak Woodland (71130) Blue Oak Woodland (71140) Interior Live Oak Woodland (71150) Coast Live Oak Woodland (71160) Digger Pine Oak Woodland (71410) Mixed Evergreen Forest (81100)	Valley Oak Series Blue Oak Series Interior Live Oak Series Coast Live Oak Series Mixed Oak Series California Bay Series California Buckeye Series	Blue Oak, Valley Oak, Coastal Oak Woodland
Riparian Woodland/Scrub	Riparian and Bottomland Habitat (60000) Riparian Scrub (63000) Great Valley Willow Scrub (63410) Riparian Forest (61000) and Riparian Woodland (62000) Great Valley Cottonwood Riparian Forest (61410) Great Valley Mixed Riparian Forest (61420) Great Valley Valley Oak Riparian Forest (61430) Sycamore Alluvial Woodland (62100)	Black Willow Series Arroyo Willow Series Mixed Willow Series Narrowleaf Willow Series Red Willow Series Fremont Cottonwood Series Valley Oak Series California Sycamore Series	Valley Foothill Riparian

Table 3-2. Continued

East Contra Costa County HCP/NCCP	Holland System (Element Code) [a]	CNPS Classification [b]	California Wildlife Habitat Relationship [c]
Permanent Wetland	Marsh and Swamp (52000) Coastal and Valley Freshwater Marsh (52410)	Common Reed Series Bulrush Series Bulrush-Cattail Series Bur-reed Series Cattail Series Spikerush Series	Freshwater Emergent Wetland
Seasonal Wetland	Freshwater Seep (45400) Northern Hardpan Vernal Pool (44110) Northern Claypan Vernal Pool (44110)	Spikerush Series Northern Hardpan Vernal Pool Northern Claypan Vernal Pool	Freshwater Emergent Wetland
Alkali Wetland	Northern Claypan Vernal Pool (44110)	Northern Claypan Vernal Pool	Freshwater Emergent Wetland
Aquatic	N/A	Duckweed Series Pondweed with Floating Leaves Series Pondweed with Submerged Leaves Series	N/A
Pasture	N/A	N/A	Pasture Irrigated Hayfield
Cropland	N/A	N/A	Irrigated Row and Field Crops Irrigated Grain Crops Dryland Grain Crops
Orchard	N/A	N/A	Evergreen Orchard Deciduous Orchard
Vineyard	N/A	N/A	Vineyard
Urban	N/A	N/A	Urban
Non-Native Woodland	N/A	N/A	Eucalyptus

[a] Source: Holland 1986
[b] Source: Sawyer and Keeler-Wolf 1995
[c] Source: Mayer and Laudenslayer 1988, with additional agricultural and developed habitats from http://www.dfg.ca.gov/whdab/html/wildlife_habitats.html

Table 3-3. Land-Cover Types in the Inventory Area

Land-Cover Type	Number of Sites or Patches	Amount (Acres)	Proportion of Inventory Area (%)
Grassland			
Annual grassland	150	58,840	34%
Alkali grassland	47	1,997	1%
Ruderal	203	6,188	4%
Chaparral and scrub	101	3,016	2%
Oak savanna	220	5,894	3%
Oak woodland	121	24,198	14%
Riparian woodland/scrub	84	448	< 1%
Wetland (undetermined)	253	483	< 1%
Seasonal wetland	44	121	< 1%
Alkali wetland	55	380	< 1%
Aquatic	31	1,823	1%
Stream (miles)	n/a	409[1]	< 1%
Pond	405	165	< 1%
Slough/channel	14	213	< 1%
Rock outcrops	39	119	< 1%
Irrigated agriculture			
Cropland	61	20,516	12%
Pasture	28	4,491	3%
Orchard	81	3,995	2%
Vineyard	39	2,031	1%
Developed			
Future urban		4,087	2%
Urban	128	32,549	19%
Aqueduct	35	383	< 1%
Non-native woodland	9	51	< 1%
Turf	66	1,478	1%
Wind turbines	129	217	< 1%
Landfill	1	334	< 1%
Total		174,018	

[1] Streams were mapped as lines within the inventory area, not as polygons. Stream acreage is not reflected in land-cover map.

Table 3-4. Land-Cover Types that May Be Federal or State Jurisdictional Waters

Land-Cover Type	U.S. Army Corps of Engineers Jurisdictional Water	Regional Water Quality Control Board State Jurisdictional Water	Department of Fish and Game Jurisdictional Stream or Lake
Permanent wetland	X	X	
Seasonal wetland	X	X	
Alkali wetland	X	X	
Reservoir	X	X	X
Pond	X	X	X
Slough/channel	X	X	X
Stream	X	X	X
Aqueduct			X
Riparian woodland/scrub	X	X	X

Table 3-5. Potential Jurisdictional Wetlands and Waters in the Inventory Area

Land-Cover Type	Number of Sites	Amount (acres)	May Qualify as a Wetland or Water under Federal or State Jurisdiction[1]
Wetland (undetermined)	255	483	Yes
Seasonal wetland	44	121	Yes
Alkali wetland	55	380	Yes
Aquatic	31	1,823	Probably not[2]
Pond	405	165	Yes
Slough/channel	14	213	Yes
Stream	n/a	248[3]	Yes
Total potential wetlands and other waters		3,434	

[1] See Chapter 1 for a discussion of how the term "Jurisdictional Wetlands and Waters" is used in this HCP/NCCP

[2] This category mostly includes reservoirs such as Los Vaqueros, Marsh Creek, Antioch, and Contra Loma. Reservoirs are generally not jurisdictional waters except for reservoir margins that are vegetated.

[3] Estimated based on an average stream width of 5 feet (not measured) x 409 miles of streams in the inventory area.

Table 3-6. Land-Cover Types That Are Potential California Department of Fish and Game Jurisdictional Waters

Land-Cover Type	Number of Sites	Amount (acres)
Aquatic	31	1,823
Aqueduct	35	383
Slough/channel	14	213
Riparian woodland/scrub	84	448
Stream	n/a	248[1]
Total		3,116

[1] Estimated based on an average stream width of 5 feet (not measured) x 409 miles of streams (from land cover mapping) in the inventory area.

Table 3-7. Evaluation of Special-Status Species in East Contra Costa County for Coverage in the ECCC HCP/NCCP

Species	Status[1]		Criteria[2]				Recommended for Coverage	Notes
	State	Federal	Range	Status	Impact	Data		
Mammals								
Townsend's western big-eared bat *Corynorhinus townsendii townsendii*	CSC	–	Y	Y	Y	Y	Y	Western Bat Working Group High Priority species; high potential for listing
Berkeley kangaroo rat *Dipodomys heermanni berkeleyensis*	–	–	Y	N	Y	Y	N	CNDDB occurrences recorded as extant; IUCN VU/B1+2c
Greater western mastiff bat *Eumops perotis*	CSC	–	Y	N	N	Y	N	Western Bat Working Group High Priority species
Small-footed myotis *Myotis ciliolabrum*	–	–	Y	N	Y	Y	N	Widely distributed; unlikely to be listed; buildings, bridges
Long-eared myotis *Myotis evotis*	–	–	Y	N	N	Y	N	Primarily coniferous forest species
Fringed myotis *Myotis thysanodes*	–	–	Y	N	N	Y	N	Western Bat Working Group High Priority species
Long-legged myotis *Myotis volans*	–	–	Y	N	N	Y	N	Western Bat Working Group High Priority species
Yuma myotis *Myotis yumanensis*	–	–	Y	N	N	Y	N	Widely distributed; unlikely to be listed; not CSC
San Francisco dusky-footed woodrat *Neotoma fuscipes annectens*	CSC	–	Y	Y	Y	Y	N	
Riparian woodrat *Neotoma fuscipes riparia*	–	FE	N	Y	N	U	N	No records for ECCC HCP/NCCP inventory area
San Joaquin pocket mouse *Perognathus inornatus inornatus*	–	–	Y	N	Y	Y	N	
Saltmarsh harvest mouse *Reithrodontomys raviventris*	SE/FP	FE	N	Y	N	Y	N	Delta marsh
Suisun ornate shrew *Sorex ornatus sinuosus*	CSC	–	N	Y	N	Y	N	Tidal marsh
Riparian brush rabbit *Sylvilagus bachmani riparius*	SE	FE	N	Y	N	Y	N	No records for ECCC HCP/NCCP inventory area
San Joaquin kit fox *Vulpes macrotus mutica*	ST	FE	Y	Y	Y	Y	Y	
Birds								
Tricolored blackbird (nesting colony) *Agelaius tricolor*	CSC-1	–	Y	Y	Y	Y	Y	
Grasshopper sparrow (nesting) *Ammodramus savannarum*	CSC-2	–	Y	N	Y	Y	N	

Species	Status[1]		Criteria[2]				Recommended for Coverage	Notes
	State	Federal	Range	Status	Impact	Data		
Bell's sage sparrow (nesting) *Amphispiza belli belli*	CSC	–	Y	N	N	Y	N	Confirmed breeding within ECCC HCP/NCCP inventory area
Greater white-fronted goose (tule) *Anser albifrons elgasi*	CSC-2	–	Y	N	N	Y	N	
Golden eagle (nesting and wintering) *Aquila chrysaetos*	FP	BGPA	Y	Y	Y	Y	Y	
Great blue heron (rookery) *Ardea herodias*	–	–	Y	N	Y	Y	N	Observed breeding within ECCC HCP/NCCP inventory area
Short-eared owl (nesting) *Asio flammeus*	CSC-2	–	Y	N	Y	Y	N	
Western burrowing owl *Athene cunicularia*	CSC-1	–	Y	Y	Y	Y	Y	
Redhead *Aythya americana*	CSC-2	–	Y	Y	N	Y	N	Covered activities not likely to impact
American bittern *Botaurus lentiginosus*	CSC-3	–	Y	N	Y	Y	N	Possible breeding rookeries in northeast section of ECCC HCP/NCCP inventory area
Bufflehead *Bucephala albeola*	CSC-3	–	Y	Y	N	Y	N	Covered activities not likely to impact
Ferruginous hawk (wintering) *Buteo regalis*	CSC	–	Y	N	Y	Y	N	
Swainson's hawk (nesting) *Buteo swainsoni*	ST	–	Y	Y	Y	Y	Y	
Costa's hummingbird *Calypte costae*	CSC	–	Y	N	Y	Y	N	
Lawrence's goldfinch (nesting) *Carduelis lawrencei*	–	–	Y	N	Y	Y	N	Confirmed breeding within ECCC HCP/NCCP inventory area
Swainson's thrush *Catharus ustulatus*	CSC-2	–	Y	Y	N	Y	N	Confirmed breeding within ECCC HCP/NCCP inventory area
Belted kingfisher *Ceryle alcyon*	CSC-3	–	Y	N	Y	Y	N	
Vaux's swift *Chaetura vauxi*	CSC-2	–	Y	N	Y	Y	N	
Mountain plover (wintering) *Charadrius montanus*	CSC	FPT	Y	Y	N	Y	N	
Northern harrier (nesting) *Circus cyaneus*	CSC-2	–	Y	N	Y	Y	N	
Black swift *Cypseloides niger*	–	–	N	N	N	Y	N	Covered activities not likely to impact

Species	Status[1]		Criteria[2]				Recommended for Coverage	Notes
	State	Federal	Range	Status	Impact	Data		
White-tailed kite (nesting) *Elanus leucurus*	FP	–	Y	N	Y	Y	N	Likely to be de-listed from fully protected status when category revised; low potential for listing under state or federal ESA
Little willow flycatcher (nesting) *Empidonax trailii brewsteri*	SE	–	N	Y	N	Y	N	No records for ECCC HCP/NCCP inventory area
California horned lark *Eremophila alpestris*	CSC-3	–	Y	N	Y	Y	N	Confirmed breeding within ECCC HCP/NCCP inventory area
American peregrine falcon (nesting) *Falco peregrinus*	SE/FP	D	Y	Y	N	Y	N	Few records; covered activities not likely to directly impact
Saltmarsh common yellowthroat *Geothlypis trichas sinuosa*	CSC-2	–	N	Y	N	Y	N	Tidal marsh
Greater sandhill crane (nesting and wintering) *Grus canadensis tabida*	ST/FP	–	N	Y	Y	Y	N	No records for ECCC HCP/NCCP inventory area
Bald eagle (nesting and wintering) *Haliaeetus leucocephalus*	SE	FPD	Y	Y	N	Y	N	Few records; covered activities not likely to directly impact
Loggerhead shrike *Laniue ludovicianus*	–	–	Y	N	Y	Y	N	
California black rail *Laterallus jamaicensis coturniculus*	ST/FP	–	N	Y	N	Y	N	Delta tidelands
Lewis' woodpecker *Melanerpes lewis*	–	–	Y	N	Y	Y	N	
Suisun song sparrow *Melospiza melodia*	CSC-3	–	N	N	N	Y	N	Tidal marsh
Alameda song sparrow *Melospiza melodia pusillula*	CSC-1	–	N	N	N	Y	N	Tidal marsh
San Pablo song sparrow *Melospoza melodia samuelis*	CSC-2	–	N	Y	N	Y	N	Tidal marsh
Long-billed curlew (nesting) *Numenius americanus*	CSC	–	Y	N	Y	Y	N	
California brown pelican (nesting colony) *Pelecanus occidentalis californicus*	SE	–	N	Y	N	Y	N	No records for ECCC HCP/NCCP inventory area
Double-crested cormorant (rookery) *Phalacrocorax auritus*	CSC	–	N	N	N	Y	N	Observed breeding within ECCC HCP/NCCP inventory area
White-faced ibis (rookery site) *Plegadis chihi*	CSC	–	Y	N	N	Y	N	
Sora *Porzana carolina*	CSC-3	–	Y	N	N	Y	N	Tidal marsh
California clapper rail *Rallus longirostris obsoletus*	SE/FP	FE	N	Y	N	Y	N	Delta tidelands

Species	Status[1]		Criteria[2]				Recommended for Coverage	Notes
	State	Federal	Range	Status	Impact	Data		
Bank swallow (nesting) *Riparia riparia*	ST	–	Y	Y	N	Y	N	Only rare migrants or post-breeding wanderers; no real suitable habitat
Rufous hummingbird *Selaphorus rufus*	–	–	Y	N	Y	Y	N	
Allen's hummingbird *Selasphorus sasin*	–	–	Y	N	Y	Y	N	
California least tern (nesting colony) *Sterna antillarum browni*	SE/FP	FE	N	Y	N	Y	N	Delta tidelands
Reptiles								
Silvery legless lizard *Anniella pulchra pulchra*	CSC	–	Y	Y	Y	Y	Y	One record near north border; suitable habitat within inventory area
Western pond turtle *Clemmys marmorata*	CSC	–	Y	Y	Y	Y	Y	
Alameda whipsnake *Masticophis lateralis euryxanthus*	ST	FT	Y	Y	Y	Y	Y	
California horned lizard *Phrynosoma coronatum frontale*	CSC	–	Y	N	Y	Y	N	
Giant garter snake *Thamnophis gigas*	ST	FT	Y	Y	Y	Y	Y	Records in delta, suitable habitat within ECCC HCP/NCCP inventory area
San Joaquin whipsnake *Masticophis flagellum ruddocki*	CSC	–	Y	N	Y	Y	N	
Amphibians								
California tiger salamander *Ambystoma californiense*	–	FT	Y	Y	Y	Y	Y	
California red-legged frog *Rana aurora draytonii*	–	FT	Y	Y	Y	Y	Y	
Foothill yellow-legged frog *Rana boylii*	CSC	–	Y	Y	Y	Y	Y	
Western spadefoot toad *Scaphiophus hammondii*	CSC	–	Y	N	Y	Y	N	
Fish								
Green sturgeon *Acipenser medirostris*	–	–	N	N	N	Y	N	Delta riverine
Sacramento perch (within native range) *Archoplites interruptus*	–	–	N	N	N	Y	N	Delta riverine
Delta smelt *Hypomesus transpacificus*	ST	FT	N	Y	N	Y	N	Delta riverine and tidal areas

Species	Status[1]		Criteria[2]				Recommended for Coverage	Notes
	State	Federal	Range	Status	Impact	Data		
River lamprey *Lampetra ayresi*	–	–	N	N	N	Y	N	Delta riverine
Pacific lamprey *Lampetra tridentata*	–	–	N	N	N	Y	N	Delta riverine
Central valley steelhead *Oncorhynchus mykiss*	–	FT	N	Y	N	Y	N	No records or accessible habitat for ECCC HCP/NCCP inventory area. Anecdotal evidence of rainbow trout in upper Marsh Creek watershed; known from occurrences in sloughs and channels adjacent to inventory area.
Central valley spring-run chinook salmon *Oncorhynchus tshawytscha*	ST	FT	N	Y	N	Y	N	No records or accessible habitat for ECCC HCP/NCCP inventory area
Sacramento River winter-run chinook salmon *Onchorhynchus tshawytscha*	SE	FE	N	Y	N	Y	N	No records or accessible habitat for ECCC HCP/NCCP inventory area
Central valley fall/late fall-run chinook salmon *Onchorhynchus tshawytscha*	–	–	Y	N	N	Y	N	Recent observations of Chinook salmon during upstream migration in lower 3 miles of Marsh Creek between mouth at Big Break and the WWTP in Brentwood.
Sacramento splittail *Pogonichthys macrolepidotus*	–	FT	N	Y	N	Y	N	Delta riverine and tidal areas
Longfin smelt *Spirinichus thaleichthys*	–	–	N	N	N	Y	N	Delta riverine and tidal
Invertebrates								
Ciervo aegialian scarab beetle *Aegialia concinna*	–	–	N	N	N	Y	N	No records for ECCC HCP/NCCP inventory area
Antioch dunes anthicid beetle *Anthicus antiochensis*	–	–	N	N	N	Y	N	Antioch dunes
Sacramento anthicid beetle *Anthicus sacramento*	–	–	N	N	N	Y	N	No records for ECCC HCP/NCCP inventory area
Lange's metalmark butterfly *Apodemia mormo langei*	–	FE	N	Y	N	Y	N	No records for ECCC HCP/NCCP inventory area
Longhorn fairy shrimp *Branchinecta longiantenna*	–	FE	Y	Y	Y	Y	Y	
Vernal pool fairy shrimp *Branchinecta lynchi*	–	FT	Y	Y	Y	Y	Y	
Midvalley fairy shrimp *Branchinecta mesovalliensis*	–	–	Y	Y	Y	Y	Y	Likely to be listed when officially described
San Joaquin dune beetle *Coelus gracilis*	–	–	N	N	N	Y	N	No records for ECCC HCP/NCCP inventory area
Valley elderberry longhorn beetle *Desmocerus californicus dimorphus*	–	FT	Y	Y	N?	Y	N	Species may occur at eastern fringe of inventory area; impacts would be limited. Existing mitigation programs are adequate to address species' and permitting needs without HCP coverage.

Species	Status[1]		Criteria[2]				Recommended for Coverage	Notes
	State	Federal	Range	Status	Impact	Data		
Antioch cophuran robberfly *Efferia antioch*	–	–	N	N	N	Y	N	Antioch dunes
Antioch efferian robberfly *Efferia antiochi*	–	–	N	N	N	Y	N	Antioch dunes
Delta green ground beetle *Elaphrus viridis*	–	FT	N	Y	N	Y	N	No records for ECCC HCP/NCCP inventory area
Bridges' Coast Range shoulderband snail *Helminthoglypta nickliniana bridgesi*	–	–	N	N	N	Y	N	No records for ECCC HCP/NCCP inventory area
Ricksecker's water scavenger beetle *Hydrochara ricksecker*i	–	–	N	N	N	Y	N	No records for ECCC HCP/NCCP inventory area
Curved-foot hygrotus diving beetle *Hygrotus curvipes*	–	–	N	Y	Y	Y	N	No records for ECCC HCP/NCCP inventory area
Middlekauf's shieldback katydid *Idiostatus middlekaufi*	–	–	N	N	N	Y	N	Antioch dunes
Vernal pool tadpole shrimp *Lepidurus packardi*	–	FE	Y	Y	Y	Y	Y	
California linderiella fairy shrimp *Linderiella occidentalis*	–	–	N	N	Y	Y	N	No records for ECCC HCP/NCCP inventory area
Molestan blister beetle *Lytta molesta*	–	–	Y	N	Y	Y	N	2 CNDDB records
Hurd's metapogon robberfly *Metapogon hurdi*	–	–	N	N	N	Y	N	No records for ECCC HCP/NCCP inventory area
Antioch multillid wasp *Myrmosula pacifica*	–	–	N	N	N	Y	N	Antioch dunes
Yellow-banded andrenid bee *Perdita scituta antiochensis*	–	–	N	N	N	Y	N	No records for ECCC HCP/NCCP inventory area
Antioch andrenid bee *Perdita scituta antiochensis*	–	–	N	N	N	Y	N	Antioch dunes
Antioch sphecid wasp *Proceratium californicum*	–	–	N	N	N	Y	N	Antioch dunes
Callippe silverspot butterfly *Speyeria callippe callippe*	–	FE	N	Y	N	Y	N	No records for ECCC HCP/NCCP inventory area
California freshwater shrimp *Syncaris pacifica*	SE	FE	N	Y	N	Y	N	No records for ECCC HCP/NCCP inventory area
Plants								
Large-flowered fiddleneck *Amsinckia grandiflora*	SE	FE	Y	Y	N	Y	N	All natural populations in CC Co. have been extirpated
Mount Diablo manzanita *Arctostaphylos auriculata*	1B	–	Y	Y	Y	Y	Y	

Species	Status[1]		Criteria[2]				Recommended for Coverage	Notes
	State	Federal	Range	Status	Impact	Data		
Contra Costa County manzanita *Arctostaphylos manzanita* ssp. *laevigata*	1B	–	Y	Y	N	Y	N	All CC Co. occurrences in Mt. Diablo SP or EBRPD
Suisun Marsh aster *Aster lentus*	1B	–	N	Y	N	Y	N	Tidal marsh
Ferris' milkvetch *Astragalus tener* ssp. *ferrisiae*	1B	–	N	Y	N	Y	N	No records from CC Co.
Alkali milkvetch *Astragalus tener* ssp. *tener*	1B	–	Y	Y	N	N	N	Historic occurrence; insufficient data to determine whether plant still exists in HCP/NCCP inventory area
Heartscale *Atriplex cordulata*	1B	–	N	Y	N	Y	N	Reported occurrences are misidentified; are actually crownscale
Brittlescale *Atriplex depressa*	1B	–	Y	Y	Y	Y	Y	
San Joaquin spearscale *Atriplex joaquiniana*	1B	–	Y	Y	Y	Y	Y	
Big tarplant *Blepharizonia plumosa*	1B	–	Y	Y	Y	Y	Y	
Mount Diablo fairy lantern *Calochortus pulchellus*	1B	–	Y	Y	Y	Y	Y	
Butte County morning-glory *Calystegia atriplicifolia* ssp. *buttensis*	1B	–	N	Y	N	N	N	Reported occurrence in CC Co. is probably misidentification
Bristly sedge *Carex comosa*	1B	–	N	Y	N	Y	N	Tidal marsh
Congdon's spikeweed *Centromadia parryi* ssp. *congdonii*	1B	–	N	Y	N	Y	N	No records from HCP/NCCP inventory area
Soft bird's-beak *Cordylanthus mollis mollis*	SR	FE	N	Y	N	Y	N	Tidal marsh
Mount Diablo bird's-beak *Cordylanthus nidularius*	SR	–	Y	Y	N	Y	N	Only known occurrence in Mt. Diablo SP
Hospital Canyon larkspur *Delphinium californicum* ssp. *interius*	1B	–	Y	Y	N	Y	N	All CC Co. occurrences in Mt. Diablo SP
Recurved larkspur *Delphinium recurvatum*	1B	–	Y	Y	Y	Y	Y	
Dwarf downingia *Downingia pusilla*	1B	–	N	Y	N	Y	N	No records from CC Co.
Round-leaved filaree *Erodium macrophyllum*	2	–	Y	Y	Y	Y	Y	
Mount Diablo buckwheat *Eriogonum truncatum*	1B	–	Y	Y	N	N	N	Presumed to be extinct. No information on historic occurrences in HCP/NCCP inventory area.

Species	Status[1]		Criteria[2]				Recommended for Coverage	Notes
	State	Federal	Range	Status	Impact	Data		
Delta button-celery *Eryngium racemosum*	SE	–	N	Y	Y	Y	N	Delta wetlands
Contra Costa wallflower *Erysimum capitatum angustatum*	SE	FE	Y	Y	N	N	N	Occurrences are in Antioch Dunes NWR
Diamond-petaled poppy *Eschscholzia rhombipetala*	1B	–	Y ?	Y	Y	Y	N	If species occurs in inventory, impacts would not be allowed under permit. Designated a no-take species instead; see Table 5-4.
Fragrant fritillary *Fritillaria liliacea*	1B	–	N	Y	N	Y	N	No records from HCP/NCCP inventory area
Diablo helianthella *Helianthella castanea*	1B	–	Y	Y	Y	Y	Y	
Brewer's dwarf flax *Hesperolinin breweri*	1B	–	Y	Y	Y	Y	Y	All known CC Co. occurrences in Mount Diablo SP, EBRPD, or CCWD lands, but may occur outside these areas
California hibiscus *Hibiscus lasiocarpus*	1B	–	N	Y	N	Y	N	Delta wetlands
Carquinez goldenbush *Isocoma arguta*	1B	–	N	Y	N	Y	N	No records from HCP/NCCP inventory area
Contra Costa goldfields *Lasthenia conjugens*	–	FE	Y	Y	N	N	N	All HCP/NCCP inventory area populations are extirpated
Delta tule pea *Lathyrus jepsonii* ssp. *jepsonii*	1B	–	N	Y	N	Y	N	Delta wetlands
Mason's lilaeopsis *Lilaeopsis masonii*	1B	–	N	Y	N	Y	N	Delta wetlands
Delta mudwort *Limosella subulata*	1B	–	N	Y	N	Y	N	Delta wetlands
Showy madia *Madia radiata*	1B	–	Y	Y	N	N	Y	Historic occurrence; insufficient data to determine whether plant still exists in HCP/NCCP inventory area
Hall's bush mallow *Malacothamnus hallii*	1B	–	Y	Y	N	Y	N	All CC Co. occurrences in Mount Diablo SP
Robust monardella *Monardella villosa* ssp. *globosa*	1B	–	N	Y	N	Y	N	No records from HCP/NCCP inventory area
Little mousetail *Myosurus minimus* ssp. *apus*	3	–	Y	Y	N	N	N	Reported to occur in HCP/NCCP inventory area, but insufficient info.
Adobe navarretia *Navarretia nigelliformis* ssp. *nigelliformis*	–	–	Y	Y	Y	Y	Y	
Colusa grass *Neostapfia colusana*	SE	FT	N	Y	N	Y	N	No records from CC Co.
Antioch dunes evening primrose *Oenothera deltoides howellii*	SE	FE	Y	Y	Y	Y	N	Populations planted or in Antioch Dunes NWR

Species	Status[1]		Criteria[2]				Recommended for Coverage	Notes
	State	Federal	Range	Status	Impact	Data		
Mount Diablo phacelia *Phacelia phacelioides*	1B	–	Y	Y	N	Y	N	All CC Co. occurrences in Mount Diablo SP
Bearded popcorn-flower *Plagiobothrys hystriculus*	1A	–	N	Y	N	Y	N	No record of sp. in CC Co.
Rock sanicle *Sanicula saxitilis*	SR	–	Y	Y	N	Y	N	All CC Co. occurrences in Mount Diablo SP
Marsh skullcap *Scutellaria galariculata*	2	–	N	Y	N	Y	N	Occurrences are in Delta
Blue skullcap *Scutellaria lateriflora*	2	–	N	Y	N	Y	N	Occurrences are in Delta
Rayless ragwort *Senecio aphanactis*	2	–	Y	N	Y	N	N	Historic occurrences; insufficient data to determine whether plant still exists in HCP/NCCP inventory area
Livermore tarplant *Deinandra bacigalupii*	1B	–	N	Y	N	Y	N	No records from CC Co.
Most-beautiful jewelflower *Streptanthus albidus* ssp. *peramoenus*	1B	–	Y	Y	N	Y	N	All CC Co. occurrences in Mount Diablo SP
Mount Diablo jewelflower *Streptanthus hispidus*	1B	–	Y	Y	N	Y	N	All CC Co. occurrences in Mount Diablo SP
Caper-fruited tropidocarpum *Tropidocarpum capparideum*	1A	–	Y	Y	N	N	N	Historic occurrences; insufficient data to determine whether plant still exists in HCP/NCCP inventory area

[1] State

- FP Fully Protected
- SE State listed as endangered
- ST State listed as threatened
- CSC California special concern species
- CSC-1 Bird species of special concern (BSSC); First priority
- CSC-2 Bird species of special concern; Second priority
- CSC-3 Bird species of special concern; Third priority
- CSC (no number) Former CDFG California special concern species; replaced by BSSC list
- SR State rare (plants)

Federal

- FE Federally endangered
- FT Federally threatened
- FPT Federally proposed for threatened listing
- FPD Federally proposed for delisting
- FD Federally delisted

California Native Plant Society Ranking

- 1A Presumed extinct in California
- 1B Rare or endangered in California and elsewhere
- 2 Rare or endangered in California, more common elsewhere

[2]See text for a description of each criteria category.

Table 3-8. Special-Status Species Proposed for Coverage

Common Name	Scientific name	Status[1] State	Status[1] Federal
Mammals			
Townsend's western big-eared bat	*Corynorhinus townsendii townsendii*	CSC	–
San Joaquin kit fox	*Vulpes macrotus mutica*	ST	FE
Birds			
Tricolored Blackbird	*Agelaius tricolor*	CSC-1	–
Golden Eagle	*Aquila chrysaetos*	FP	BGPA
Western Burrowing Owl	*Athene cunicularia hypugea*	CSC-1	–
Swainson's Hawk	*Buteo swainsoni*	ST	–
Reptiles			
Silvery legless lizard	*Anniella pulchra pulchra*	CSC	–
Alameda whipsnake	*Masticophis lateralis euryxanthus*	ST	FT
Giant garter snake	*Thamnophis gigas*	ST	FT
Western pond turtle	*Clemmys marmorata*	CSC	–
Amphibians			
California tiger salamander	*Ambystoma californiense*	CSC	FT
California red-legged frog	*Rana aurora draytonii*	–	FT
Foothill yellow-legged frog	*Rana boylii*	CSC	–
Invertebrates			
Longhorn fairy shrimp	*Brachinecta longiantenna*	–	FE
Vernal pool fairy shrimp	*Brachinecta lynchi*	–	FT
Midvalley fairy shrimp	*Brachinecta mesovallensis*	–	–
Vernal pool tadpole shrimp	*Lepidurus packardi*	–	FE
Plants		**CNPS**	
Mount Diablo manzanita	*Arctostaphylos auriculata*	1B	–
Brittlescale	*Atriplex depressa*	1B	–
San Joaquin spearscale	*Atriplex joanquiniana*	1B	–
Big tarplant	*Blepharizonia plumosa*	1B	–
Mount Diablo fairy lantern	*Calochortus pulchellus*	1B	–
Recurved larkspur	*Delphinium recurvatum*	1B	–
Round-leaved filaree	*Erodium macrophyllum*	1B	–
Diablo helianthella	*Helianthella castanea*	1B	–
Brewer's dwarf flax	*Hesperolinon breweri*	1B	–
Showy madia	*Madia radiata*	1B	–
Adobe navarretia	*Navarretia nigelliformis* ssp. *nigelliformis*	–	–

[1]Status:

Federal

FE Federally Endangered
FT Federally Threatened
BGPA Bald and Golden Eagle Protection Act

State

ST State Listed as Threatened
CSC California Special Concern Species
CSC-1 Bird Species of Special Concern; First Priority
FP Fully Protected

California Native Plant Society

1B Rare or Endangered in California and Elsewhere

Table 3-9. Association of Land-Cover Types with Covered Species

Covered Species	Land-Cover Types															
	Annual Grassland	Alkali Grassland	Ruderal	Chaparral/ Scrub	Oak Savannah	Oak woodland	Riparian Woodland	Perennial wetland	Seasonal wetland	Alkali wetland	Aquatic/ Pond	Aquatic/ Slough	Aquatic/ Stream	Cultivated Agriculture	Urban/ Developed	Rock Outcrop
Townsend's western big-eared bat	A/M/F/B	A/M/F/B	A/M/F/B	A/M/F/B	A/M/F/B	A/M/F/B	A/M/F/B	M/F	M/F	M/F	M/F	M/F	M/F	M/F	A/B	A/B
San Joaquin kit fox	B/F/M	B/F/M	B/F/M		B/F/M				F/M					F/M		
Tricolored blackbird			B/F*				B/F	B/F						F		
Golden eagle	F	F	F	F	B/F	B	B	F	F	F	F	F	F	F	F*	B/F
Western burrowing owl	B/F	B/F	B/F						B/F					B/F		
Swainson's hawk	F	F	F*				B		F*					F		
Silvery legless lizard				B/F/M	B/F/M	B/F/M	B/F/M									
Alameda whipsnake	M/F			B/M/F	M/F	M/F	M/F									B/M/F
Giant garter snake			M/F									B/M/F		M/F		
Western pond	B/M	B/M			M	M	B/F/M	B/F			B/F		B/F/M			

Covered Species	Land-Cover Types															
	Annual Grassland	Alkali Grassland	Ruderal	Chaparral/ Scrub	Oak Savannah	Oak woodland	Riparian Woodland	Perennial wetland	Seasonal wetland	Alkali wetland	Aquatic/ Pond	Aquatic/ Slough	Aquatic/ Stream	Cultivated Agriculture	Urban/ Developed	Rock Outcrop
turtle																
California tiger salamander	A/M/F	A/M/F	M	M/F	A/M/F	A/M/F	A/M/F	B/F	B/F	B/F	B/F		M	M/A*		
California red-legged frog	A/M/F	A/M/F	A/M/F	M/F	A/M/F	A/M/F	A/M/F	B/F	B/F	F	B/F		B/F/M	M*		
Foothill yellow-legged frog							M						B/M/F			
Longhorn fairy shrimp									Y							
Vernal pool fairy shrimp									Y							
Midvalley fairy shrimp									Y							
Vernal pool tadpole shrimp									Y							

*Occasional use

Key:

F = Foraging Habitat A = Aestivation Habitat
M = Movement Habitat B = Breeding Habitat
Y = Year-round Habitat