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3.1 REGIONAL AND HISTORICAL CONTEXT

Adapted from the report prepared by the Habitat Conservation Plan (HCP) Science Advisors (Noss et al. 2002), this chapter provides an overview of the biodiversity within Solano County and an analysis of the key geographic, geologic, and hydrologic factors influencing the habitats, physical processes, and biota of the region. Understanding these ecological mechanisms is critical to effective conservation planning.

This chapter also provides historical context for understanding how habitats in Solano County have changed over time, present ecological conditions, and current conservation issues in Solano County, including important ecological system interactions that shape the biodiversity of the area. An understanding of the evolution of Solano County's natural systems can inform future protection and restoration actions and provide insight on the potential outcomes of future landscape alterations.

3.1.1 Regional Biodiversity

The Greater San Francisco Bay Area region, which includes Solano County, has been recognized as a biodiversity hotspot both globally and nationally. Chaplin et al. (2000) employed a rarity-weighted richness index to produce a contour map of the United States that highlights areas with large numbers of limited-range species—the peaks of rarity and richness. The version of this rarity-weighted richness map prepared for The Nature Conservancy (Morse and Watson 2000) is shown on Figure 3-1. The Greater San Francisco Bay Area region, including both coastal and inland habitats, is one of the five highest peaks for species rarity and richness in the United States. In a global analysis of biodiversity hotspots, Myers et al. (2000) identified 25 regions that together comprise only 1.4 percent of the earth's land surface but support an estimated 44 percent of all species of vascular plants and 35 percent of all species of vertebrates. Only three regions in North America—the California Floristic Province, Mesoamerica (including tropical regions of Mexico), and the Caribbean (including southern Florida)—are included in this list of global hotspots.

Despite its significance as a global and national hotspot of biodiversity, Solano County, as it currently exists, is a human-altered landscape. Natural habitats are degraded and highly fragmented as a result of the disruption of typical dispersal processes. Urban development, agriculture, roads, hydrological alterations and invasive species have profoundly affected the structure, composition, and functionality of the Solano County ecosystems.

3.1.2 Geography and Geology

Solano County is located within the southern portion of the Sacramento Valley and is one of the nine counties that constitute the Greater San Francisco Bay Area. Solano County, despite its modest size, lies at the intersection of numerous geographical and geological provinces that, in conjunction with variations in hydrology and climate, has resulted in the formation of unique and rare biological and ecological conditions (Figure 3-2).





3.1.2.1 **Coast Range Uplands and Foothill Terraces**

The most prominent topographic features in Solano County are the mountains and hills that form its western boundary, including the Vaca Mountains, West Hills, and the Sulphur Spring Mountain range in the Tri-City/County Planning Area (Figure 3-2). The mountains and hills of western Solano County, which are part of the Coast Range, form a strip of steeply sloping land that varies widely in elevation, bedrock composition, and climate. Mt. Vaca is the highest point in Solano County at an elevation of 2,819 feet (ft) above sea level. Due to the increased elevation in this area, annual precipitation is slightly higher than elsewhere in Solano County, from 20 to 40 inches per year. Bedrock in this geographical province is dominated by Cretaceous marine sedimentary units, with smaller inclusions of Tertiary sedimentary and basic igneous rocks (geological information here and elsewhere from Wagner et al. [1981] and Wagner and Bortugno [1982]). These units form ridges with intervening narrow valleys that trend northwest. Vegetation varies with precipitation and includes grassland, oak savanna, oak woodland, and dense chaparral shrubland.

3.1.2.2 **Montezuma Hills and Potrero Hills**

The Montezuma Hills and Potrero Hills Province dominates the southeastern portion of Solano County (Figure 3-2) and is distinguished from other upland communities by the unique composition of bedrock found in this region. Elevation in this area ranges from approximately 25 to 350 ft above sea level, and annual precipitation is between 15 and 23 inches. The bedrock is composed of poorly sorted sandy clay sediments of the Quaternary Montezuma formation that weathers into Vertisols clay soils with exceedingly high clay content. The clay is dominated by the mineral smectite. The high clay content combined with smectite results in a high shrink/swell characteristic and deep cracking, to 19 inches or more. Shrinking and swelling of the soils cause fences and utility poles to be extruded from the soil and lean at an angle. Roads become rough and rolling due to soil movement. This region, because of the soils, is primarily used for dryland farming and grazing and was likely perennial grassland, with oaks in higher elevations, under preagricultural conditions (Burcham [1957] as cited in Bates et al. [1977]).

3.1.2.3 **Alluvial Fans, Terraces, and Basins**

The Alluvial Fans, Terraces, and Basins Province comprises a significant portion of Solano County, including most of the valley floor, and as a result has been most affected by agriculture and urban development (Figure 3-2). The local geology and soils and associated drainage patterns vary considerably throughout this province. Several distinct subprovinces and associated habitats are described below.

Well Drained to Poorly Drained Recent Alluvial Fans and Basin Deposits. The northeastern quarter of Solano County contains a subprovince that consists of well drained to poorly drained recent alluvial fans and basin deposits. This subprovince is often referred to as Dixon Ridge

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(Figure 3-2) and is the heart of agricultural development in the County. Sediment in this region consists of loams/silt loams to clays derived from streams that drain the Coast Range. Soils are young, lack restrictive horizons, and are amenable to irrigated agricultural development, though drainage or levee systems have been required in the lower basin margin and basin landscapes that trend downward from east to west and in the lands east of Highway 113 that were (prior to channelization) frequently flooded by tributaries to the Sacramento River.

Dense oak forests historically covered the plains along major streams (such as Putah Creek) and stream fans, with high fans and terraces having more open stands of grass and oaks. Lower lying basin deposits supported tules, reeds, and other water-tolerant plants (Burcham [1957] as cited in Bates et al. [1977]).

Well to Somewhat Poorly Drained Terraces. The other subprovince within the Alluvial Fans, Terraces, and Basins Province consists of well to somewhat poorly drained terraces. This subprovince consists primarily of older alluvial fan deposits that have been incised by streams and elevated above the major drainage systems; younger deposits, described above, are also located in this subprovince. This landscape can be divided into two distinct landscapes based on their geologic age and hydrology.

- 1. Well Drained, Somewhat Acidic, Clay Pan Landscapes. These landscapes occur north of Vacaville and consist of a dense subsurface "clay pan" (formed by long expanses of soil formation and clay development) that restrict water penetration and create seasonally-perched water tables. These landscapes are dominated primarily by grassland habitats and include mixes of Northern Hardpan and Northern Clay Pan Vernal Pool habitat types (classifications based on Holland 1986; see Section 3.3.2 for additional information).
- 2. Well to Somewhat Poorly Drained, Alkaline Landscapes. These landscapes occur primarily north and northwest of the Montezuma Hills and encompass much of the region from northern Vacaville through the Jepson Prairie to the Potrero Hills and over into Fairfield and Suisun City (Figure 3-2). These landscapes, due to their proximity to shallow ground water from the Delta (to the east) or Suisun Bay (to the south), have an accumulation of dissolved salts. Salt types found in these soils are separated by solubility and upward water flow patterns (modified by the downward flow of fresh rainwater). As a result, these soils contain significant amounts of sodium bicarbonate (NaHCO₃) and other salts leading to highly alkaline (pH > 8.3) and sometimes highly saline (total salt content) soil horizons. Most of these soils have a clay-enriched subsoil (or clay pan) that restricts water movement.

Due to the high alkalinity and salinity of these soils and the presence of underlying clay pan, this land is considered poor for agriculture and has not been intensively developed for agriculture. However, this region holds important economic value in its use for extensive agricultural operations, primarily sheep and cattle grazing; as a result, many of the vernal pool habitats remaining in this region have been preserved.

3.1.2.4 Delta Marshlands

The Delta Marshlands lie roughly north/ northeast of Rio Vista and contain part of the Sacramento-San Joaquin River Delta (locally known simply as the "Delta", Figure 3-2). Prior to human disturbance, this area was a freshwater marshland dominated by river channels and dense "tule" vegetation (Figure 3-3). Dense vegetation, combined with slow base level (sea level) rise, led to the



accumulation of thick peat deposits and relatively high organic matter concentrations in the predominantly mineral-rich lands that dominate the fringe of the Delta in Solano County.

Levee building to stabilize the river system and the installation of large pumping plants, tidal gates, etc. lowered the groundwater table sufficiently to allow agriculture to be established in the region. As a result of the drainage, much of the land has subsided (due to peat oxidation and compaction) and now lies 10 ft or more below sea level.

Most of this area has been converted to agriculture, with some small undisturbed areas remaining near Cache Slough and a few riparian areas remaining within river channels.

3.1.2.5 Suisun Bay Marshlands

Located adjacent to Suisun Bay, the Suisan Bay Marshlands (Figure 3-2), like the Delta Marshlands, is a deltaic environment. The Suisun Bay Marshlands were formed in part from local stream sediment rather than sediment from the main Central Valley drainage and have greater contact with brackish water than the Delta Marshlands. Tidal marsh formation within the San Francisco Bay Estuary was initiated about 10,000 years ago during the Holocene submergence when sea water flowed into San Francisco Bay, and the rate of sea-level rise slowed sufficiently for tidal marsh sediments to accrete near sea level (Atwater et al. 1979). Prior to that time, the San Francisco Bay Estuary consisted of broad stream valleys. Following European settlement, huge influxes of sediment associated with hydraulic gold mining in the Sierra Nevada contributed to rapid marsh growth (Hedgpeth 1979).

The Suisun Bay Marshlands of Solano County have the most complex origin within the San Francisco Bay-Delta System, composed of tidal wetlands with estuarine and riverine origins (Wells 1995). Higher salinity waters fringing the land in this area have created environmental and ecological conditions that distinguish this area from other marshlands. First, it contains mapped areas of peatland: Wheeler Island, Van Sickle Island, and Chipps Island, as well as a region south of Suisun City. Second, many of the non-peat soils are both highly acidic and saline. The acidity arises from the oxidation of pyrite (or other iron sulphides) caused by lowering of the water table and the change from reducing to oxidizing conditions creating sulfuric acids and the distinctive reddish and yellow-red colors associated with oxidized iron (Fe). Vegetation in this area consists of tules, reeds, and salt-tolerant grasses and forbs.

3.2 CLIMATE AND HYDROLOGY

3.2.1 Climate

The climate of Solano County depends largely on variations in rainfall distribution at different elevations. The eastern parts of the County (Sacramento Valley/Sacramento and Suisun Bay watersheds) are classified as having a Mediterranean climate with hot summers, while the western portions (Napa River/San Pablo Bay watersheds) have a Mediterranean climate with cool summers (CDFG 2003a). Average annual precipitation in the low-lying valley areas in central Solano County is typically between 15 and 25 inches, with higher rainfall amounts (25 to 40 inches) falling in the western hills (CDFG 2003a; Figure 3-2).

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3.2.2 Hydrology

Solano County is divided into two drainage regions or drainage provinces (Figure 3-4): San Francisco Bay Province and Sacramento River Province. The San Francisco Bay Province encompasses the southwestern portion of the County and includes the local watersheds that drain into San Francisco Bay through Suisun Bay and San Pablo Bay. These drainages include the Napa River, American Canyon Creek, Green Valley Creek, Suisun Creek, Ledgewood Creek, Laurel Creek, McCoy Creek, Union Creek, and their tributaries. The Sacramento River Province encompasses the local watersheds in the northeast portion of Solano County that drain into the Sacramento Delta. Major drainages in this province include Alamo Creek, Ulatis Creek, Putah Creek and their tributaries. These watersheds are shown on Figure 3-4.

The majority of stream flow and runoff occurs during the winter rainy season when rainfall levels are high. Low-lying areas of the County typically receive 0.35 inch of annual runoff while the western mountains receive 3 to 20 inches of annual runoff (Rantz 1971, 1972).

3.3 BIOLOGICAL RESOURCES

The geography of Solano County, with the Central Valley to the east, a large bay and estuary system to the south and west, and coastal mountain ranges to the west and north, has resulted in a great diversity of native species and habitats. The juxtaposition of numerous geographical and geological provinces within the County lends to its division into four broad Natural Communities: (1) Valley Floor Grassland and Vernal Pool; (2) Inner Coast Range; (3) Riparian, Stream and Freshwater Marsh; and (4) Coastal Marsh (Figure 3-5). While not technically natural community, agriculture is a dominant cover type, particularly in the northeastern quarter of the county (Figure 3-5), and provides important habitat for several Covered Species (e.g., Swainson's hawk and burrowing owl) and Special Management Species (e.g., loggerhead shrike and northern harrier). Therefore; agriculture is treated as a fifth Natural Community in the descriptions below. A sixth broader cover type, Developed, is also included within the community mapping. A brief description of each Natural Community is provided, including the vegetation and cover types mapped for the HCP and vegetation alliances that may be found within those vegetation types. Detailed conceptual models for each Natural Community are provided in Appendix B, the methodology for mapping the vegetation and cover types within the Plan Area is detailed below, and the vegetation alliances are based on Sawyer et al. (2009).

3.3.1 Vegetation and Cover Types

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Within the broader natural communities, 14 vegetation and cover types were mapped within the Planning Area: (1) agriculture, (2) inner coast range grasslands, (3) valley floor grasslands, (4) vernal pool system grasslands, (5) scrub/chaparral, (6) oak savanna, (7) oak woodland, (8) riparian, (9) marsh, (10) tidal flat, (11) open water, (12) levee, (13) developed, and (14) pre-approved developed (Figure 3-6). These 14 vegetation and cover types were defined and mapped based on the presence of specific vegetation or other features that could be used to delineate specified land areas (see vegetation mapping and classification section below for methods). The vegetation and cover types mapped within the Planning Area were assigned to a Natural Community. Descriptions of each vegetation and cover type, along with additional subcategories, are described in sections below.

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3.3.1.1 Vegetation Mapping and Classification

Baseline mapping relied on existing sources of information to categorize and map the various vegetation types and land uses within the County. Mapping was completed using a geographic information system (GIS) based format (ArcInfo/ArcView) compatible with United States Fish and Wildlife Service (USFWS) and United States Department of the Interior, Bureau of Reclamation (USBR) systems. After evaluating previous mapping efforts, a useful base map was generated by merging the existing Solano County Water Agency (SCWA) base map with the appropriate United States Geological Survey (USGS) 7.5-minute topographic quadrangles.

Existing data for Solano County vegetation types and land uses were compiled from various sources such as the DWR and National Wetlands Inventory. The DWR land use data are designed to overlay USGS topographic 7.5-minute maps. They provide a comprehensive overview of Solano County land use patterns, especially the agricultural areas in eastern Solano County; however, the DWR data provided limited information on natural vegetation types. To ascertain more detailed information on natural habitats, two sets of aerial imagery (1999 aerial photographs at a scale of 1" = 2,000') were originally used to document the countywide baseline conditions and update and refine the existing DWR information. Existing and potential vernal pool communities/habitats were further identified by supplementing existing mapping data with the Natural Resources Conservation Service (NRCS) soil type mapping. This supplemental information was used to distinguish grassland occurring on soil series/associations linked to vernal pool habitats from intermixed grasslands that typically contain upland vegetation. Where possible or necessary, visual observations were made to confirm or enhance data interpretations.

Habitat mapping has been regularly updated throughout the Solano HCP planning process. Development projects that have been approved and implemented in the interim period between contract renewal and HCP approval have also been incorporated. Cover types and other relevant land use data have been revised based on the results of field observations, comments, and input from various sources, and the availability of higher resolution aerial photography (i.e., using 2004 aerial photographs with a pixel resolution of 6 inches in urban areas and 1 ft outside of urban areas).

3.3.1.2 California Vegetation Alliances

California's vegetation systems have been categorized into a series of alliances referred to as California Vegetation Alliances (Sawyer et al. 2009). This was done to provide an organizational framework that allows ecologists the ability to record and document vegetation types with consistency across sites. Several different California Vegetation Alliances may be found within a vegetation/cover type. In the description of each vegetation/cover type, a list of vegetation alliances expected to occur within the respective type in the Plan Area is included.

3.3.2 Natural Community and Vegetation Descriptions

Brief descriptions of the Natural Communities found within the Plan Area (Figure 3-5), their associated vegetation and cover types (Figure 3-6), and California Vegetation Alliances are provided below. Table 3.1 gives the extent of each community within the Plan Area. Tables 3.2 to 3.12 (which are provided later in this chapter) provide a cross-reference of the expected or typical California Vegetation Alliances (Sawyer et al. 2009) associated with each Natural Community.



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Vegetation/Community Type	Acreage
Developed	52,700
Approved Development	10
Pre-approved Development	3,120
Developed Rural Residential	9,400
Developed/Vacant	3,600
Development Agreement	550
Agriculture	187,800
Grassland – Inner Coast Range	36,700
Grassland – Valley Floor	71,700
Grassland – Vernal Pool System	40,300
Levee	1,800
Marsh	72,400
Oak Savanna	9,200
Oak Woodland	27,800
Open Water	48,400
Riparian	3,600
Scrub/chaparral	11,300
Tidal Flats	4,100
Other	100
Grand Total	584,580

 Table 3.1: Vegetation/Cover Types within the Solano HCP Plan Area

3.3.2.1 Valley Floor Grassland and Vernal Pool Natural Community

The Valley Floor Grassland and Vernal Pool Natural Community is predominantly located within the southeastern portion of the Plan Area, but includes portions of Lagoon Valley, Green Valley and Suisun Valley (Figure 3-5). The community is distinguished by its shared geographic location, elevation, and soil types. This region represents the western edge of California's Central Valley, where lands are relatively level or marked with low hills. The soil types and weather patterns combine to discourage the extensive growth of trees and shrubs associated with many of the plant communities that exist within the Inner Coast Range. Vegetation communities within the Valley Floor Grassland and Vernal Pool Natural Community consist mainly of types such as grasslands that are dominated by herbaceous species.

Large portions of North America's grasslands were historically composed of native perennial grasses interspersed with native, annual, and perennial forbs (broad-leaved plants) and grasses. The introduction of nonnative species and livestock grazing following European settlement in the mid-19th century have substantially reduced or eliminated most of the native grasses and forbs in California, including Solano County. Nonnative grass and forb species are well adapted to colonize and persist in disturbed landscapes and often out-compete native species in these locations. As a result, nonnative annual grassland, characterized by a dominance of nonnative grass and forb species, has largely replaced the perennial native grassland. Nonnative grassland is currently the dominant grassland community in Solano County.

Grassland is the dominant vegetation type within the Valley Floor Grassland and Vernal Pool Natural Community. While this broad category contains a number of recognized grassland vegetation alliances, for the purposes of the HCP, grasslands in the Valley Floor Grassland and Vernal Pool Natural Community were divided into two primary associations (based on soil types): Valley Floor Grasslands and Vernal Pool System Grasslands. The Valley Floor Grasslands are associated with the low hills (Montezuma Hills and Potrero Hills) and upper terraces along the



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valley floor. Vernal Pool System grasslands are located on soil types such as Antioch, San Ysidro, Pescadero, and Clear Lake, which retain shallow pools during and after the winter and spring rains.

Valley Floor Grasslands. Valley Floor Grasslands constitute 12 percent of Solano County (71,700 acres [ac]) (Figure 3-6). This vegetation type is representative of the typical grassland systems in California. Valley Floor Grasslands are dominated by nonnatives and are typically found growing on Altamont and Diablo soil associations, which are mainly located in the Montezuma Hills and Potrero Hills of Solano County. The characteristic species include wild oats (*Avena* spp.), various bromes and barleys (*Bromus* spp. and *Hordeum* ssp.), Italian wildrye (*Lolium multiflorum*), filarees (*Erodium* spp.), mustards (*Brassica rapa*, *B. niger*, *Hirschfeldia incana*), wild radish (*Raphanus sativus*), mallows (*Malva* spp.), vetches (*Vicia* spp.), starthistles (*Centaurea* spp.), and others. Native species that commonly occur with nonnative plants include small-flowered lupine (*Lupinus bicolor*), fiddleneck (*Amsinckia* spp.), California goldfields (*Lasthenia californica*), California poppy (*Eschscholzia californica*), and owl's-clovers (*Castilleja* spp., *Triphysaria* spp.). This community corresponds with the "Non-native Grassland" community identified by Holland (Element Code 42200; Holland 1986). Table 3-2 lists the California Vegetation Alliances expected to occur within the Valley Floor Grassland vegetation type.

In portions of Solano County, particularly in the Montezuma Hills, the valley floor grasslands are also periodically cultivated for dryland production of oats, wheat, and barley. While these areas are often regularly cultivated, many of the grassland ecosystem functions remain. Therefore, areas of dryland farming are included within the grassland community association versus being incorporated into the agricultural community, which consists primarily of irrigated agriculture. (Note that the HCP habitat mapping distinguished cultivated grasslands from non-cultivated lands as a component of the baseline mapping.)

Vernal Pool System Grasslands. Grasslands have been placed in this category because they consist of a mosaic of upland grassland types (identical to Valley Floor Grasslands) and vernal pools and other seasonal wetlands. Vernal Pool System Grasslands make up 7 percent of the County (40,300 ac) and are associated with the Antioch, San Ysidro, Pescadero, Solano, Millsap, Sycamore, and Clear Lake soil series (Figure 3-6). These are soils that are characterized by large expanses of seasonal wetlands that form where dense clays beneath the soil surface impede water infiltration.

Vernal pools are found on level or gently undulating land in the low-lying areas of California, especially in the grasslands of the Central Valley. They are generally small, ephemeral (seasonal) wetlands that form in shallow depressions underlain by hardpan (i.e., a layer near the ground surface that restricts water percolation). During the winter, these depressions fill with rainwater and runoff from adjacent areas and may remain inundated throughout the spring to early summer. Rising spring temperatures cause water to evaporate, promoting the growth of concentric bands of plant species, especially wildflowers, along the shrinking edge of the pool. Vernal pool vegetation in California is characterized by a high percentage of native species, several of which are endemic (restricted) to vernal pools. Many of these plant species and a number of associated animal species are listed as or are otherwise considered to be rare, threatened, or endangered. As a result, species found in these grassland habitats are very different than those found in upland areas. Vernal pool and swale plant communities comprise a small portion (5 to 50 percent) of the broader grassland matrix.

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Table 3.2: California Vegetation Alliances Associated with the **Valley Floor Grassland Vegetation Type**

Applicable Floristic Alliances	Alliance Common Name
Amsinckia (menziesii, tessellata) Alliance	Fiddleneck fields
Aegilops triuncialis Provisional Semi-Natural Stands	Barbed goatgrass patches
Agrostis (gigantea, stolonifera)-Festuca arundinacea Semi-	Bent grass-tall fescue meadows
Natural Stands	
Avena (barbata, fatua) Semi-Natural Stands	Wild oats grasslands
Brassica nigra and Other Mustards Semi-Natural Stands	Upland mustards
Bromus (diandrus, hordeaceus)–Brachypodium distachyon	Annual brome grasslands
Semi-Natural Stands	
Bromus rubens-Schismus (arabicus, barbatus) Semi-Natural	Red brome or Mediterranean grass grasslands
Stands	
Bromus tectorum Semi-Natural Stands	Cheatgrass grassland
Centaurea (solstitialis, melitensis) Semi- Natural Stands	Yellow star-thistle fields
Centaurea (virgata) Provisional Semi-Natural Stands	Knapweed and purple-flowered starthistle fields
Conium maculatum-Foeniculum vulgare Semi-Natural Stands	Poison hemlock or fennel patches
Cortaderia (jubata, selloana) Semi-Natural Stands	Pampas grass patches
Cynosurus echinatus Semi-Natural Stands	Annual dogtail grasslands
Danthonia californica Alliance	California oat grass prairie
Deschampsia caespitosa Alliance	Tufted hair grass meadows
Elymus multisetus Provisional Alliance	Big squirreltail patches
Holcus lanatus-Anthoxanthum odoratum Semi-Natural Stands	Common velvet grass-sweet vernal grass meadows
Hordeum brachyantherum Alliance	Meadow barley patches
Lasthenia californica–Plantago erecta–Vulpia microstachys	California goldfields–Dwarf plantain–Six-weeks
Alliance	fescue flower fields
Leymus triticoides Alliance	Creeping rye grass turfs
Lolium perenne Semi-Natural Stands	Perennial rye grass fields
Lotus purshianus Provisional Alliance	Spanish clover fields
Nassella cernua Provisional Alliance	Nodding needle grass grassland
Nassella pulchra Alliance	Purple needle grass grassland
Phalaris aquatica Semi-Natural Stands	Harding grass swards
Plagiobothrys nothofulvus Alliance	Popcorn flower fields
Poa pratensis Semi-Natural Stands	Kentucky blue grass turf
Poa secunda Alliance	Curly blue grass grassland
Solidago canadensis Provisional Alliance	Canada goldenrod patches
Trifolium variegatum Alliance	White-tip clover swales

Seasonal wetlands are typically distinguished from vernal pools by: a longer or altered hydrology; the presence of more persistent emergent vegetation such as rush (Juncus spp.), spike rush (Eleocharis spp.), and sedge (Carex spp.); nonnative grass species such as ryegrass and Mediterranean barley; and/or a reduced number of native forbs that typically grow in vernal pools. In many cases, seasonal wetlands occur in historic vernal pool habitats that have lost many or all of their natural characteristics due to land disturbance. While often lacking significant native components, seasonal wetlands can support species of concern and can provide opportunities for vernal pool restoration.

Vernal Pool System Grasslands are typical of areas that are well-suited for agricultural use and, as a result, have become very rare throughout California. In the last 150 years, 75 percent of vernal pools in the Central Valley have been lost. Between 1994 and 1997, the rate of loss has continued at 1.5 percent per year (Solano County Farmlands and Open Space Foundation 2001). Historically, Solano County supported approximately 118,000 ac of potential Vernal Pool System Grasslands



(Figure 3-7). Currently, approximately 40,300 ac of potential vernal pool system grassland habitat remain, which is 34 percent of the historical potential (Figure 3-7), although much of the remaining vernal pool habitat has been highly disturbed as a result of past land use practices.

Northern Claypan Vernal Pools. Northern Claypan Vernal Pools (Element Code 44120; Holland 1986) are the most common pool type in Solano County and are most prevalent in the central portion of the County, particularly east of Fairfield and Suisun City and beyond the Jepson Prairie Preserve. This community type is typically associated with basin-rim and low-terrace alluvial soils, including the Antioch, San Ysidro, Pescadero, Solano, Millsap, Sycamore, and Clear Lake soil series and occurs on neutral to alkaline, silica-cemented, hardpan soils that are often more or less saline.

Pools may be small, covering only a few square meters, or large, covering several hectares. Larger pools are referred to as vernal lakes or playa pools. Vegetation in the Northern Claypan Vernal Pools is similar to that in the Northern Hardpan Vernal Pools (see below), but vegetative cover is not usually as tall. Characteristic native species include goldfields (*Lasthenia fremontii*, *L. glaberrima*), coyote thistles (*Eryngium spp.*), dwarf blennosperma (*Blennosperma nanum*), spreading alkali-weed (*Cressa truxillensis*), and Douglas' mesamint (*Pogogyne douglasii*).

Northern Hardpan Vernal Pools. Northern Hardpan Vernal Pools (Element Code 44110; Holland 1986) occur in a relatively small area north of Vacaville on old, acidic, iron-silica cemented soils typically associated with the Corning, Redding, and San Joaquin soil series. Although, the Solano Soil Survey (Bates et al. 1977) indicates that the upper horizons of the Corning soils display more claypan characteristics than typical Corning soils, this technical difference has limited significance (Noss et al. 2002) because most species found in Northern Claypan Vernal Pools (see above) are also found in Northern Hardpan Vernal Pools, with the exception of alkaline-adapted species. Other species present in the Northern Hardpan Vernal Pool community include popcorn-flowers (*Plagiobothrys* spp.), willow-herbs (*Epilobium* spp.), downingias (*Downingia bicornuta*; *D. pulchella*; *D. cuspidata*), and paintbrush (*Castilleja campestris*).

Alkali Playa. The Alkali Playa (Element Code 46000; Holland 1986) community occurs in poorly drained soils with high salinity or alkalinity caused by the evaporation of water from closed depressions or drainages. In these areas, the water table is often high, and salt crusts are visible on the ground surface. Vegetation in this community consists of low-growing, small-leaved, often succulent shrubs that grow to less than 1.5 feet in Solano County. Total vegetative cover is sparse due to the low distributional density of the shrubs and the poorly developed herbaceous understory. Characteristic species of this plant community in Solano County include seep-weed (*Suaeda moquinii*), alkali heath (*Frankenia salina*), pickleweed (*Salicornia virginica*), and several species of saltbush (*Atriplex* spp.).

Alkali Meadow. Alkali Meadow (Element Code 45310; Holland 1986) occurs on fine-textured, semi-moist to permanently moist alkaline soils and consists of dense to relatively open growth, dominated by low-growing perennial grasses and sedges. It intergrades with nonnative grassland and Northern Claypan Vernal Pools on drier, less alkaline soils. Characteristic species of this

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community include sedges (*Carex* spp.), saltgrass (*Distichlis spicata*), scratchgrass (*Muhlenbergia asperifolia*), and alkali sacaton (*Sporobolus airoides*).

For the purposes of the Solano HCP, seasonal wetlands that occur within areas historically supporting vernal pools (i.e., that contain soil types associated with vernal pools) are considered within the Valley Floor Grassland and Vernal Pool Natural Community. The HCP also considers upland areas (contributing watersheds) and wetland swales and pools to be an integral component of the vernal pool ecosystem. Seasonal wetlands, including vernal pools, can also occur in most other community types including Upland Grassland, Agricultural, Woodland, Scrub/Chaparral, Developed - Vacant/Disturbed, and Developed - Rural Residential. However, wetlands typically comprise a small percentage of the total area (on average less than 5 percent) of these communities.

This broader vegetation type is expected to include the California Vegetation Alliances listed under Valley Floor Grasslands (Table 3-2) as well as the additional alliances listed under Vernal Pool System Grasslands (Table 3-3).

Applicable Floristic Alliances	Alliance Common Name		
Long-inundated Pools			
Lasthenia glaberrima Alliance	Smooth goldfields vernal pool bottoms		
Eleocharis macrostachya Alliance	Pale spike rush marshes		
Isoetes (bolanderi, echinospora, howellii,nuttallii,	Quillwort beds		
occidentalis) Provisional Alliance			
Shallower Pools			
Eryngium aristulatum Alliance	California button-celery patches		
Atriplex prostrata–Cotula coronopifolia Semi-	Fields of fat hen and brass buttons		
Natural Stands			
Alkaline/Saline Pools			
Lasthenia fremontii–Distichlis spicata Alliance	Fremont's goldfields-Saltgrass alkaline vernal pools		
Frankenia salina Alliance	Alkali heath marsh		
Cressa truxillensis–Distichlis spicata Alliance	Alkali weed–Salt grass playas and sinks		
Associated Mesic Communities			
Alopecurus geniculatus Provisional Alliance	Water foxtail meadows		
Hordeum brachyantherum Alliance	Meadow barley patches		
Ambrosia psilostachya Provisional Alliance	Western ragweed meadows		
Grindelia (stricta) Provisional Alliance	Gum plant patches		
Lotus purshianus Provisional Alliance	Spanish clover fields		
Persicaria lapathifolia–Xanthium strumarium	Smartweed cocklebur patches		
Provisional Alliance			
Trifolium variegatum Alliance	White-tip clover swales		

Table 3.3: California Vegetation Alliances associated with the Vernal Pool System Grassland Vegetation Type

3.3.2.2 Inner Coast Range

The Inner Coast Range is located along the western margin of the County and includes the Sky Valley and Sulphur Springs Mountain area (Tri-City/County Planning Area), the area west of Green Valley (e.g., West Hills), the volcanic hills of the Rockville area, and the Vaca Mountains/Blue Ridge (Figure 3-5). This community association is distinguished by geographic location, elevation, and soils. Consisting of ridges and valleys that trend in a northwestern direction, this natural community is better characterized as a geographical region based on its



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shared topography and because it combines a number of plant communities, including grassland, oak woodland, oak savanna, and mixed chaparral/scrub that form a mosaic over the entire Inner Coast Range.

Inner Coast Range Grasslands. Both the Inner Coast Range and Valley Floor Grassland vegetation types share many of the same plant species (particularly introduced annual grasses and forbs) and also correspond with the "Non-native Grassland" community identified by Holland (Element Code 42200; Holland 1986). However, the historical function, association of natural communities, and the importance for Covered Species is the basis to differentiate these similar vegetation types from each other. Inner Coast Range grasslands are associated with the dry conditions that typically occur on hillsides, slopes, ridges, and flat areas with well-drained soil within the Inner Coast Range and foothill terraces (Figure 3-6). This grassland community represents 6 percent of Solano County (36,700 ac) and is common in the southwestern corner of the Plan Area, but within the Inner Coast Range community it is interspersed with other vegetation types, including oak woodland, oak savanna, and chaparral. The Inner Coast Range Grassland vegetation type is expected to include the California Vegetation Alliances listed in Table 3.4.

Despite the large-scale introduction and spread of nonnative grasses and forbs, some native perennial grasses persist as small patches or intermixed stands with nonnative grasses, depending on various environmental factors and the severity of disturbance. Typical native grass species include purple needlegrass (*Nassella pulchra*), one-sided blue-grass (*Poa secunda*), California fescue (*Festuca californica*), and creeping wildrye (*Leymus triticoides*). The most prevalent native grassland community in Solano County is Valley Needlegrass Grassland. This vegetation type corresponds to the Valley Needlegrass Grassland community identified by Holland (Element Code 42110; Holland 1986).

Mixed Chaparral/Scrub. Scrub/chaparral communities are characterized by dense growth of lowgrowing scrub and brush species. These two vegetation types typically consist as a mosaic that includes Inner Coast Range Grasslands. Mixed Chaparral/Scrub comprises 2 percent of the Plan Area (Figure 3-6).

Chaparral is a structurally homogenous plant community dominated by dense, fire-adapted shrubs. Shrub height and canopy cover vary with age since last burn, precipitation regime, species, aspect, and soil type. Mixed chaparral typically grows as a dense, nearly impenetrable thicket with greater than 80 percent canopy cover up to 13 ft in height. On poor soils, including serpentine soils, the canopy cover may be reduced and shrubs may be shorter. This community corresponds to the Northern Mixed Chaparral community identified by Holland (Element Code 37110; Holland 1986).

In Solano County, chaparral is the predominant community in the higher elevations of the Vaca Mountains, along the Napa County border. Species include scrub oak (*Quercus berberidifolia*), manzanita (*Arctostaphylos* spp.), chaparral pea (*Pickeringia montana*), and chamise (*Adenostoma fasciculatum*). Herbaceous species may include needlegrass (*Nassella lepida*), California cudweed (*Gnaphalium californicum*), vinegar weed (*Trichostema lanceolatum*), woolly sunflower (*Eriophyllum lanatum*), and goldwire (*Hypericum concinnum*).

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Table 3.4: California Vegetation Alliances Associated with the Inner Coast Range Grassland Vegetation Type

Applicable Floristic Alliances	Alliance Common Name
Amsinckia (menziesii, tessellata) Alliance	Fiddleneck fields
Aegilops triuncialis Provisional Semi-Natural Stands	Barbed goatgrass patches
Agrostis (gigantea, stolonifera)–Festuca arundinacea	Bent grass-tall fescue meadows Semi-Natural Stands
Avena (barbata, fatua) Semi-Natural Stands	Wild oats grasslands
Brassica nigra and Other Mustards Semi- Natural	Upland mustards
Stands	-
Bromus (diandrus, hordeaceus)–Brachypodium	Annual brome grasslands
distachyon Semi-Natural Stands	
Bromus rubens–Schismus (arabicus, barbatus)	Red brome or Mediterranean grass Semi-Natural Stands
	grasslands
Bromus tectorum Semi-Natural Stands	Cheatgrass grassland
Centaurea (solstitialis, melitensis) Semi- Natural Stands	Yellow star-thistle fields
Centaurea (virgata) Provisional Semi-Natural Stands	Knapweed and purple-flowered starthistle fields
Conium maculatum–Foeniculum vulgare Semi-Natural	Poison hemlock or fennel
Stands patches	
Cortaderia (jubata, selloana) Semi-Natural Stands	Pampas grass patches
Cynosurus echinatus Semi-Natural Stands	Annual dogtail grasslands
Danthonia californica Alliance	California oat grass prairie
Deschampsia caespitosa Alliance	Tufted hair grass meadows
Elymus multisetus Provisional Alliance	Big squirreltail patches
Holcus lanatus–Anthoxanthum odoratum	Common velvet grass-sweet Semi-Natural Stands vernal
	grass meadows
Hordeum brachyantherum Alliance	Meadow barley patches
Lasthenia californica–Plantago erecta–Vulpia	California goldfields–Dwarf plantain– Six-weeks fescue
microstachys Alliance	flower fields
Leymus triticoides Alliance	Creeping rye grass turfs
Lolium perenne Semi-Natural Stands	Perennial rye grass fields
Lotus purshianus Provisional Alliance	Spanish clover fields
Melica torreyana Provisional Alliance	Torrey's melic grass patches
Nassella cernua Provisional Alliance	Nodding needle grass grassland
Nassella lepida Provisional Alliance	Foothill needle grass grassland
Nassella pulchra Alliance	Purple needle grass grassland
Phalaris aquatica Semi-Natural Stands	Harding grass swards
Plagiobothrys nothofulvus Alliance	Popcorn flower fields
Poa pratensis Semi-Natural Stands	Kentucky blue grass turf
Poa secunda Alliance	Curly blue grass grassland
Solidago canadensis Provisional Alliance	Canada goldenrod patches
Trifolium variegatum Alliance	White-tip clover swales

Scrub, in contrast to chaparral, thrives under moister conditions. Species composition depends on geographic location, soil, and climate, but often one or a few shrub species will dominate and herbaceous plants and grasses may occur in the understory. Scrub habitat is common in ecotones between woodland and grassland communities, and the herbaceous species will be those that are found in the adjacent grassland.

Scrub communities in Solano County are often dominated by coyote bush (*Baccharis pilularis*) on relatively moist sites, and California sagebrush (*Artemesia californica*) and sticky monkey flower (*Mimulus aurantiacus*) on dry sites. This community corresponds to the Diablan Sage Scrub community identified by Holland (Element Code 32600; Holland 1986).





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The Scrub/Chaparral vegetation type is expected to include the California Vegetation Alliances listed in Table 3.5.

Applicable Floristic Alliances	Alliance Common Name
Adenostoma fasciculatum Alliance	Chamise chaparral (some associations rare)
Arctostaphylos glandulosa	Alliance Eastwood manzanita chaparral
Arctostaphylos viscida Alliance	White leaf manzanita chaparral
Artemisia californica–Eriogonum fasciculatum	California sagebrush–California buckwheat scrub
Alliance	
Atriplex lentiformis Alliance	Quailbush scrub
Baccharis pilularis Alliance	Coyote brush scrub
Broom (Cytisus scoparius and Others) Semi- Natural	Broom patches
Stands	
Ceanothus cuneatus Alliance	Wedge leaf ceanothus chaparral, Buck brush chap.
Ceanothus integerrimus Alliance	Deer brush chaparral
Ceanothus oliganthus Alliance	Hairy leaf ceanothus chaparral
Cercocarpus montanus Alliance	Birch leaf mountain mahogany chaparral
Dendromecon rigida Alliance	Bush poppy scrub
Eriodictyon californicum Alliance	California yerba santa scrub
Eriogonum fasciculatum-Salvia apiana Alliance	California buckwheat-white sage scrub
Eriogonum wrightii Alliance	Wright's buckwheat patches
Frangula californica Alliance	California coffee berry scrub (some associations rare)
Lotus scoparius Alliance	Deer weed scrub
Lupinus albifrons Alliance	Silver bush lupine scrub
Quercus berberidifolia Alliance	Scrub oak chaparral
Quercus garryana Shrub Alliance	Brewer oak scrub
Quercus wislizeni Shrub Alliance	Interior live oak chaparral
Rubus armeniacus Semi-Natural Stands	Himalayan black berry brambles

Table 3.5: California Vegetation Alliances Associated with the Mixed Chaparral/Scrub Vegetation Type

Oak Woodland and Oak Savanna. Both oak woodland and oak savanna are wooded communities that are dominated by oaks (*Quercus* spp.). However, the density and structure of these plant communities vary within their distributional range depending on the dominant species of oak and other environmental parameters, such as soils, availability of water, aspect, and elevation. Oak woodland and oak savanna commonly intergrade, going from dense woodlands to open savanna (Figure 3-6). These communities, while not as diverse floristically as grasslands, support an unusual diversity of animal species as a result of the many resources that oaks provide, including nesting sites and an abundance of food (i.e., large acorn crops). Many oak woodland and savanna habitats have been lost due to intensive agriculture and urban development, and most oak woodlands that do persist have been significantly altered as evidenced by the predominance of nonnative annual grasslands as ground cover. Regeneration of oak woodlands has been greatly reduced due to disturbance from grazing and increased seedling mortality from competition with nonnative grasses.

Oak Savanna. Oak savanna is an open canopy community similar to grasslands, but with an overstory consisting of mature native oak trees. The canopy cover in oak savanna typically ranges from 10 to 30 percent. In Solano County, oak savanna covers 1.5 percent of the area (9,200 ac) and the dominant oak species include valley oak (*Quercus lobata*), which grows on deep, alluvial soils on the Central Valley floor, and blue oak (*Q. douglasii*), which occurs on





shallow soils and in xeric areas at higher elevations. The shrubby understory that may occasionally be found in oak savanna typically consists of poison oak (*Toxicodendron diversalobum*), gooseberries (*Ribes* spp.), and/or toyon (*Heteromales arbutifolia*). However in areas grazed by livestock, this understory is poorly developed, if present at all. In such areas, the herbaceous understory consists of nonnative grasses and forbs; however, native wildflowers and grasses may also be abundant in less disturbed areas.

Oak savanna occurs on the lower slopes of the eastern Vaca Mountains and generally grades into oak woodland at higher elevations (Figure 3-6). This community corresponds to the Valley Oak and Blue Oak woodland communities identified by Holland (Element Codes 71130 and 71140; Holland 1986). The oak savanna vegetation type is expected to include the California Vegetation Alliances listed in Table 3.6.

Applicable Floristic Alliances	Alliance Common Name
Quercus agrifolia Alliance	Coast live oak woodland
Quercus douglasii Alliance	Blue oak woodland
Quercus lobata Alliance	Valley oak woodland
Quercus wislizeni Tree Alliance	Interior live oak woodland

Table 3.6: California Vegetation Alliances Associated with the
Oak Savanna Vegetation Type

Oak Woodland. Oak woodland is one of the dominant plant communities in the Vaca Mountains at the eastern edge of the Coast Range and makes up 5 percent of the County (27,800 ac) (Figure 3-6). Oak woodlands typically consist of a denser tree cover and understory than oak savanna. The canopy cover in oak woodland communities ranges from 30 to 100 percent, depending on the aspect of the woodland; on moist, north-to-east-facing slopes the cover is greater than on dry, south-to-west-facing slopes. Species composition will also vary according to aspect and water availability. Coast live oak (*Q. agrifolia*) and blue oak commonly dominate oak woodlands of Solano County. Other broad-leaved, evergreen or deciduous trees, including interior live oak (*Q. wislezenii*), black oak (*Q. kelloggii*), California bay (*Umbellularia californica*), California buckeye (*Aesculus californica*), and walnut (*Juglans spp.*), are common associates in or at the edges of oak woodlands. Where the canopy cover is less dense and sunlight reaches the forest floor, a diverse flora of mostly native shrubs and herbaceous species may exist. Understory shrubs may include currant/gooseberry, woodland rose (*Rosa gymnocarpa*), poison oak, and California hazelnut (*Cornus cornuta* var. *californica*).

These plant communities include broadleaved upland forest and cismontane woodland, as designated by the California Native Plant Society (CNPS 2001). Similar communities identified by Holland (1986) include: Oregon Oak Woodland (Element Code 71110), Valley Oak Woodland (Element Code 71130), Blue Oak Woodland (Element Code 71140), and Coast Live Oak Woodland (Element Code 71160). The Oak Woodland vegetation type is expected to include the California Vegetation Alliances listed in Table 3.7.

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Applicable Floristic Alliances	Alliance Common Name
Aesculus californica Alliance	California buckeye groves
Arbutus menziesii Alliance	Madrone forest
Callitropsis macnabiana Alliance	McNab cypress woodland
Callitropsis sargentii Alliance	Sargent cypress woodland
Calocedrus decurrens Alliance	Incense cedar forest
Chamaecyparis lawsoniana	Alliance Port Orford cedar forest
Eucalyptus (globulus, camaldulensis) Semi-Natural	Eucalyptus groves
Stands	
Juniperus californica Alliance	California juniper woodland
Lithocarpus densiflorus Alliance	Tanoak forest
Pinus attenuata Alliance	Knobcone pine forest
Pinus ponderosa Alliance	Ponderosa pine forest
Pinus ponderosa-Pseudotsuga menziesii Alliance	Ponderosa pine–Douglas fir forest
Pinus sabiniana Alliance	Ghost pine woodland
Pseudotsuga menziesii Alliance	Douglas fir forest
Pseudotsuga menziesii–Lithocarpus densiflorus Alliance	Douglas fir-tanoak forest
Quercus agrifolia Alliance	Coast live oak woodland
Quercus chrysolepis Tree Alliance	Canyon live oak forest
Quercus douglasii Alliance	Blue oak woodland
Quercus garryana Tree Alliance	Oregon white oak woodland
Quercus kelloggii Alliance	California black oak forest
Quercus lobata Alliance	Valley oak woodland
Quercus parvula var. shrevei Provisional Alliance	Shreve oak forests
Quercus (agrifolia, douglasii, garryana, kelloggii,	Mixed oak forest
lobata, wislizeni) Alliance	
Quercus wislizeni Tree Alliance	Interior live oak woodland
Sequoia sempervirens Alliance	Redwood forest
Umbellularia californica Alliance	California bay forest

Table 3.7: California Vegetation Alliances Associated with the Oak Woodland Vegetation Type

3.3.2.3 Riparian, Stream and Freshwater Marsh Natural Community

The Riparian, Stream and Freshwater Marsh Natural Community is interwoven through each of the other natural communities throughout the Plan Area (Figure 3-5). The Riparian, Stream and Freshwater Marsh Natural Community was recognized as unique from the surrounding regional communities based on its association with flowing or pooled freshwater conditions. While many of the plant communities within the other natural communities are highly adapted to the dry conditions typical of California, the Riparian, Stream and Freshwater Marsh Natural Community is adapted to the presence of fresh water in and along streams, rivers, creeks and marshes.

Riparian. Riparian vegetation occurs along water bodies such as intermittent and perennial streams, lakes, ponds, and floodplains that are the interface between terrestrial and aquatic ecosystems. Riparian vegetation also occurs in areas, such as seeps and springs, where the water table is sufficiently high to provide water to the roots of plants year round. Riparian vegetation types cover 0.5 percent of the County (3,600 ac). These areas, known for high species diversity and productivity, are distinct from surrounding communities due to soil and vegetation characteristics that are strongly influenced by the presence of water.

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Agricultural, residential, and industrial water use, as well as land development, has drastically reduced the extent of riparian habitats in California, especially in the Central Valley. Several declining animal species are highly dependent on riparian habitats. As such, the preservation and restoration of riparian habitats has been a focus of conservation efforts.

Riparian communities can be divided into three types that are identified by the lack of or dominance of either trees or shrubs: riparian woodland, riparian scrub, and herbaceous riparian.

Riparian Woodland. Riparian woodland is dominated by winter-deciduous, broadleaved trees, up to 60 ft in height, with a canopy cover ranging from relatively open to very dense. "True" riparian species (i.e., species that are dependent on available water year round) are found along major rivers and streams and other freshwater features. Cottonwoods (*Populus* spp.) and willows (*Salix* spp.) mixed with bigleaf maple (*Acer macrophyllum*), Oregon ash (*Fraxinus latifolia*), box elder (*Acer negundo*), and California sycamore (*Platanus racemosa*) are the most commonly occurring "true" riparian trees in central California. Valley oak and various species of walnut (*Juglans californica ssp. hindsii*; *J. nigra*; *J. regia*) are also common in riparian areas in the Central Valley. Other trees, including coast live oak and California bay can be found in riparian woodlands as well as drier environments. Riparian woodland commonly has a shrubby understory (see Riparian Scrub below). Equivalent communities as described by Holland (1986) might include: Great Valley Cottonwood Riparian Forest (Element Code 61410), Great Valley Mixed Riparian Forest (Element Code 61420), White Alder Riparian Forest (Element Code 61510), and Central Coast Live Oak Riparian Forest (Element Code 61220).

Riparian Scrub. This riparian vegetation type is dominated by dense to open scrub. Shrub species vary with geographical location. Broad-leaved, deciduous riparian thickets are usually dominated by any of several species of willow, especially arroyo willow, forming dense thickets within the riparian corridor. Other shrubby species that may occur are blue elderberry (*Sambucus mexicana*), California blackberry (*Rubus ursinus*), Himalayan blackberry (*R. discolor*), California rose (*Rosa californica*), poison oak, and California grape (*Vitis californica*). The herbaceous layer, if present, is a mix of grasses and forbs, commonly including Italian wildrye, and mugwort (*Artemisia douglasiana*). This community corresponds to the Central Coast Riparian Scrub community identified by Holland (Element Code 63200; Holland 1986).

Herbaceous Riparian. When riparian areas lack trees or shrubs, the vegetation becomes dominated by the herbaceous plant species. In riparian woodland and scrub situations, these understory plants are typically held in check by the tree and scrub cover in other areas. The herbaceous species are similar to the composition of freshwater marshes in other locations. Herbaceous riparian cover types are typically distinguished from freshwater marsh by width. Riparian areas extend along the edge of water ways and are usually only several feet wide.

The Riparian vegetation type is expected to include the California Vegetation Alliances listed in Table 3.8.



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Applicable Floristic Alliances	Alliance Common Name
Acer macrophyllum Alliance	Bigleaf maple forest
Acer negundo Alliance	Box-elder forest
Alnus rhombifolia Alliance	White alder groves
Baccharis salicifolia Alliance	Mulefat thickets
Calocedrus decurrens Alliance	Incense cedar forest
Cephalanthus occidentalis Alliance	Button willow thickets
Cornus sericea Alliance	Red osier thickets
Fraxinus latifolia Alliance	Oregon ash groves
Eucalyptus (globulus, camaldulensis) Semi-Natural	Eucalyptus groves
Stands	
Juglans hindsii and hybrids Special and Semi-Natural	Hinds's walnut and related stands (presumed extirpated
Stands	in Solano County)
Platanus racemosa Alliance	California sycamore woodlands
Populus fremontii Alliance	Fremont cottonwood forest
Persicaria lapathifolia–Xanthium strumarium	Smartweed-cocklebur patches
Provisional Alliance	
Quercus lobata Alliance	Valley oak woodland
Rhododendron occidentale Provisional Alliance	Western azalea patches
Rosa californica Alliance	California rose briar patches
Rubus armeniacus Semi-Natural Stands	Himalayan black berry brambles
Salix breweri Alliance	Brewer willow thickets
Salix exigua Alliance	Sandbar willow thickets
Salix gooddingii Alliance	Black willow thickets
Salix laevigata Alliance	Red willow thickets
Salix lasiolepis Alliance	Arroyo willow thickets
Salix lucida Alliance	Shining willow groves
Sambucus nigra Alliance	Blue elderberry stands
Tamarix spp. Semi-Natural Stands	Tamarisk thickets
Umbellularia californica Alliance	California bay forest

Table 3.8: California Vegetation Alliances Associated with the
Riparian Vegetation Type

Freshwater Marsh. Typical freshwater marsh is an herbaceous community that develops in shallow, standing, or slow-moving water at the edges of ponds and streams and at other sites that lack currents and are permanently flooded by fresh water. Freshwater marsh habitat is unique in that it falls under the definitions of aquatic and riparian habitat. In Solano County, the freshwater marsh plant community is present in the upper reaches of Suisun Marsh, in portions of the Delta where saltwater intrusion is absent or minimal, and in association with numerous, slow-moving freshwater streams and ponds. This plant community is typically dominated by up to 12 ft tall, perennial, emergent plants. Characteristic species include cattails (*Typha angustifolia*, *T. domingensis*, *T. latifolia*) and bulrushes (*Scirpus acutus*, *S. americanus*, *S. californicus*). Other smaller hydrophytic species are also present, including sedges (*Carex* spp.), flat-sedges (*Cyperus* spp.), bur-reed (*Sparganium eurycarpum*), and penny-wort (*Hydrocotyle verticillata*). This community corresponds to Holland's Coastal and Valley Freshwater Marsh (Element Code 52410; Holland 1986). The Freshwater Marsh vegetation type is expected to include the California Vegetation Alliances listed in Table 3.9.

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Table 3.9:	California Vegetation Alliances Associated with the
	Freshwater Marsh Vegetation Type

Applicable Floristic Alliances	Alliance Common Name
Agrostis (gigantea, stolonifera)–Festuca arundinacea	Bent grass-tall fescue meadows
Semi-Natural Stands	
Arundo donax Semi-Natural Stands	Giant reed breaks
Carex barbarae Alliance	White-root beds
Carex densa Provisional Alliance	Dense sedge marshes
Carex nudata Alliance	Torrent sedge patches
Juncus (oxymeris, xiphioides) Provisional Alliance	Iris-leaf rush seeps
Juncus arcticus (var. balticus, mexicanus) Alliance	Baltic and Mexican rush marshes
Juncus effusus Alliance	Soft rush marshes
Juncus patens Provisional Alliance	Western rush marshes
Lepidium latifolium Semi-Natural Stands	Perennial pepper weed patches
Leymus triticoides Alliance	Creeping rye grass turfs
Ludwigia (hexapetala, peploides) Provisional Semi-	Water primrose wetlands
Natural Stands	
Mimulus (guttatus) Alliance	Common monkey flower seeps
Oenanthe sarmentosa Alliance	Water-parsley marsh
Persicaria lapathifolia–Xanthium strumarium	Smartweed-cocklebur patches
Provisional Alliance	
Phragmites australis Alliance	Common reed marshes
Schoenoplectus acutus Alliance	Hardstem bulrush marsh
Schoenoplectus americanus Alliance	American bulrush marsh
Schoenoplectus californicus Alliance	California bulrush marsh
Typha (angustifolia, domingensis, latifolia) Alliance	Cattail marshes

Streams. The creeks and other drainages that hold or carry fresh water are typically open water features that support riparian vegetation along their banks. While the unvegetated portions of these features are similar to the Open Water cover type (below), we include them here because they are a necessary part of the riparian system. There are three basic types of streams in Solano County: perennial, intermittent, and ephemeral.

Perennial streams have visible water flowing above the streambed year-round. The remaining two (intermittent and ephemeral streams) are often confused with one another. Ephemeral streams or watercourses flow only in response to precipitation, with flows ceasing a few days or weeks after the rains. Intermittent streams are those that fall in between perennial and ephemeral; however, the nature of intermittency may be either spatial or temporal. Spatially intermittent streams have water that appears above the streambed in certain reaches whereas in other reaches, the water remains below the streambed. Temporally intermittent streams often flow for at least several months of the year. The source of much of this water is from the water table that rises above the surface of the streambed after being recharged by rainfall or snowmelt. The critical difference between intermittent and ephemeral streams is the connection that intermittent streams have with the groundwater table. Vegetation growing along intermittent streams often has access to the water table or at least a greater quantity of soil moisture due to the proximity of the water table. This creates distinct differences in the vegetation and hydrologic characteristics of intermittent versus ephemeral streams.



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Levees/Dikes. Over the last century or more, numerous levees or dikes have been created in Solano County for flood protection and water transport, primarily for agricultural use. Depending on the geographical location of the levee and the salt concentration of the waterbody, herbaceous species adapted to fresh or salt water can be present. While levees contain ample water to support riparian vegetation, vegetation is typically cleared for safety and maintenance purposes. As a result, few trees or shrubs exist, and vegetation consists primarily of the nonnative grasses and forbs typically associated with upland situations and a few water-tolerant species in more saturated zones. Vegetation growth is controlled through mowing and the spraying of herbicides to preserve the integrity of the levee.

Open Water. This cover category falls within several of the basic natural communities and is distinguished primarily by the presence of water deep enough to prevent the growth of terrestrial plants. Within the Riparian, Stream and Freshwater Marsh Natural Community, the mapped open water cover types include man-made impoundments such as Lagoon Valley Lake, ponds, and reservoirs as well as more natural features such as the Delta sloughs and waterways (Figure 3-6).

3.3.2.4 Coastal Marsh Natural Community

Portions of the southern part of the Planning Area consist of low-lying lands that stretch along the edge of San Pablo Bay and Suisun Bay (Figure 3-5). These low areas are strongly influenced by tidal action, and water depths can vary in some areas from dry to depths of several feet twice a day. This regular fluctuation in water levels distinguished this community type from the Freshwater Marsh Community described above. The shallow water depths promote the growth of numerous emergent plant species that form communities unique to these tidally influenced shores. The Coastal Marsh Natural Community is recognized because of its geographic location and unique hydrology. Vegetation within this community is entirely herbaceous and consists mainly of saltwater and brackish water marshes.

Marshes. The term marsh encompasses a broad range of vegetation types. The primary distinguishing characteristic of marsh communities is the presence of persistent to perennial marsh vegetation, ranging in height from less than 1 ft to over 12 ft. These marsh communities include marshes with relatively natural hydrological regimes (e.g., tidal influence) as well as marshes with highly altered, managed hydrologic systems. The marsh vegetation type occupies 12 percent of the Plan Area (72,400 ac). The distribution of marsh plants is strongly influenced by tidal elevation and salinity. Two categories of coastal marshes, based on the amount of fresh water versus salt water, are dominant within the Plan Area: coastal salt marsh and coastal brackish marsh.

Coastal Salt Marsh. Coastal salt marsh is restricted to the upper intertidal zone of protected shallow bays, lagoons, and estuaries and in higher-salinity diked, non-tidally influenced environments. Salt marsh is a highly "productive" plant community consisting of plants that are tolerant of saline soils and regular tidal inundations. The salt marsh community is composed of relatively low-growing plants, ranging in height from a few inches to about 3 ft. Small differences in elevation along the marsh edges affect the frequency and duration of tidal flooding and change the plant composition in these areas. Characteristic salt-tolerant plants of the upper pickleweed zone include pickleweed (*Salicornia virginica*), alkali heath (*Frankenia salina*), marsh rosemary (*Limonium californicum*), jaumea (*Jaumea carnosa*), sand-spurreys



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(Spergularia spp.), and saltgrass (Distichlis spicata). Marsh gumplant (Grindelia stricta var. angustifolia) is common on isolated mounds, on slightly elevated berms, along channels within the salt marsh, or along natural levees of tidal sloughs that are infrequently inundated. Lower elevations are generally bordered by pure stands of native cordgrass (Spartina foliosa) that are replaced by a dense cover of pickleweed at the mean high water level. In the last 20 years, several invasive nonnative cordgrasses (S. alterniflora, S. densiflora, S. patens, and S. anglica) have become established in San Francisco Bay, with the most significant infestation occurring in south/central San Francisco Bay. In Solano County, known infestations are limited to S. patens in Southampton Marsh and S. densiflora in one location in the Napa Marshes. Nonnative cordgrass readily hybridize with native cordgrass and threaten the natural ecology of San Francisco Bay. This community corresponds to the Northern Coastal Salt Marsh community identified by Holland (Element Code 52110; Holland 1986).

Coastal salt marsh vegetation exhibiting the typical characteristics described above is present along San Pablo Bay and Suisun Bay. The diking and filling of marshlands for agriculture and development in the 19th and 20th centuries have severely reduced the extent of the San Francisco Bay salt marshes. While only about 10 percent of the historic tidal marshes remain, substantial areas of valuable managed wetlands still exist within the historic margins of the San Francisco Bay. Figure 3-8 shows both the historic extent of marshland communities and the current marshland communities within Solano County. While sharing similar vegetation characteristics to natural tidal marsh communities, the altered hydrological conditions in the non-tidal (diked) communities do not support many of the uncommon plant and animal species found in the natural tidal marshes.

Coastal Brackish Marsh. Coastal brackish marsh vegetation develops in shallow, standing, or slow-moving waters in coastal bays, estuaries, and lagoons, where fresh water and salt water converge in a tidal area. Salinity may vary daily and seasonally depending on the tide and the level of freshwater input. Brackish marsh usually intergrades with salt marsh toward the saline waterbody and with freshwater marsh at the mouths of rivers, especially in the Sacramento-San Joaquin River Delta. Brackish marsh generally contains similar species to both coastal salt marsh and freshwater marsh and is typically dominated by perennial, emergent, herbaceous plants up to 6.5 ft in height. The most common species are cattails and species of bulrush, especially alkali rush (*Scirpus robustus*). Depending on the salinity, other species of sedge, rush (*Juncus* spp.), pickleweed, and others may be present. This community corresponds to the Coastal Brackish Marsh community identified by Holland (Element Code 52200; Holland 1986).

In Solano County, brackish marsh is extensively developed in Suisun Marsh and around Suisun Bay and at the mouth of the Sacramento-San Joaquin River Delta. Much of the brackish marsh within the County occurs in diked environments that are managed for waterfowl. As with the northern salt marsh communities, the altered hydrological conditions in the non-tidal brackish communities do not support many of the uncommon plant and animal species found in the more natural tidal marshes; however, these non-tidal marshes can be highly important to other special-status wildlife species.

The Marsh vegetation type is expected to include the California Vegetation Alliances listed in Table 3.10.

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Applicable Floristic Alliances	Alliance Common Name
Argentina egedii Alliance	Pacific silverweed marshes
Arthrocnemum subterminale Alliance	Parish's glasswort patches
Arundo donax Semi-Natural Stands	Giant reed breaks
Atriplex prostrata-Cotula coronopifolia Semi- Natural Stands	Fields of fat hen and brass buttons
Bolboschoenus maritimus Alliance	Salt marsh bulrush marshes
Cressa truxillensis–Distichlis spicata Alliance	Alkali weed-Salt grass playas and sinks
Distichlis spicata Alliance	Salt grass flats
Frankenia salina Alliance	Alkali heath marsh
Grindelia (stricta) Provisional Alliance	Gum plant patches
Lepidium latifolium Semi-Natural Stands	Perennial pepper weed patches
Persicaria lapathifolia-Xanthium strumarium Provisional Alliance	Smartweed-cocklebur patches
Phragmites australis Alliance	Common reed marshes
Sarcocornia pacifica (Salicornia depressa) Alliance	Pickleweed mats
Schoenoplectus acutus Alliance	Hardstem bulrush marsh
Schoenoplectus americanus Alliance	American bulrush marsh
Schoenoplectus californicus Alliance	California bulrush marsh
Spartina (alterniflora, densiflora) Semi-Natural Stands	Smooth or Chilean cordgrass marshes
Spartina foliosa Alliance	California cordgrass marsh
Typha (angustifolia, domingensis, latifolia) Alliance	Cattail marshes

Table 3.10: California Vegetation Alliances Associated with the Marsh Vegetation Type

Tidal Flats/Open Water. Tidal open waters within the Plan Area include Suisun Bay and sloughs, portions of San Pablo Bay, and lower stretches of the Sacramento River Delta and its associated sloughs (Figure 3-6). This community is distinguished from others by the presence of deep water and the lack of terrestrial plants. In tidally-influenced areas, mudflats are exposed at low tides. These tidal mudflats typically occur between approximately Mean Tide Line and Mean Lower Low Water. These inter-tidal mudflats are particularly important foraging habitat for a variety of shorebirds and other water birds. Tidal mud flats represent 1 percent of the County (4,100 ac). Overall, open water habitats cover approximately 8 percent of the County. The tidal flat vegetation type is expected to include the California Vegetation Alliances listed in Table 3.11.

Table 3.11: California Vegetation Alliances Associated with theTidal Flat Vegetation Type

Applicable Floristic Alliances	Alliance Common Name
Phragmites australis Alliance	Common reed marshes
Sarcocornia pacifica (Salicornia depressa) Alliance	Pickleweed mats
Schoenoplectus acutus Alliance	Hardstem bulrush marsh
Schoenoplectus americanus Alliance	American bulrush marsh
Schoenoplectus californicus Alliance	California bulrush marsh
Spartina (alterniflora, densiflora) Semi-Natural Stands	Smooth or Chilean cordgrass marshes
Spartina foliosa Alliance	California cordgrass marsh
Typha (angustifolia, domingensis, latifolia) Alliance	Cattail marshes

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3.3.2.5 Agricultural Lands

Much of the northeastern portion of Solano County has been converted into intensive agricultural uses (Figure 3-5). Conversion to agriculture has resulted in a high degree of habitat alteration. Agricultural lands typically support domesticated species of plants that have been raised for harvest purposes, such as alfalfa, corn, or tomatoes. When taken out of active production, agricultural lands tend to support ruderal, weedy grasses and forbs that marginalize potential habitat value. The use of these lands by wildlife depends on the vegetation characteristics, cultivation practices, and flooding regimes conducted in these agricultural areas. Within Solano County, agricultural lands can provide important habitat for numerous raptors, including Swainson's hawk and burrowing owl.

Agriculture is the second most prevalent use of land in the County (exceeded only by livestock grazing), with approximately 32 percent of Solano County lands (187,800 ac) in agricultural cultivation. Agricultural lands in Solano County are mainly used to grow grains, vegetables, or nut and fruit trees. Figure 3-9 shows trends in Solano County crop production over the last 20 years. For the cover type mapping, three distinctive types were identified: intensively farmed croplands (field crops, seed crops, vegetable crops), cultivated grasslands (typically dryland hay or grain crops), and orchards/vineyards:

• **Croplands (Irrigated Agriculture).** Croplands are typically established on low terrain with fertile soils and available irrigation. This land use requires extensive manipulation in terms of soils, irrigation, crop rotation, and fertilization. Croplands are usually seeded in a single plant species (monoculture) with crops planted in rows to facilitate harvest. Use includes regular soil tillage and/or the application of herbicides to eliminate unwanted vegetation. Due to the variety of sizes and growing patterns associated with these cultivated species, this vegetation type can exhibit various heights and canopy covers.

Irrigated agriculture covers the northeastern/eastern portion of Solano County, including the diked areas of the Delta. Croplands are mostly used to grow grains and vegetables. Alfalfa has become the most commonly planted field crops in Solano County, comprising approximately one-third of the field crop acreage in 2009. Production acreage for alfalfa has increased from 16,000 ac in 1990 to 31,000 ac in 2009 (Solano County Department of Agriculture Annual Crop and Livestock Reports 1999 to 2009).

• **Cultivated Grassland/Dry-Land Farming.** Cultivated grassland (or dryland farming) is a less intensive form of agriculture where land is planted in fast-growing annual grain crops, particularly oats (*Avena* sp.), barley (*Hordeum* sp.), and wheat (*Triticum* sp.). This method relies solely on rainwater to irrigate crops and is most common around the Montezuma Hills, where irrigation water is not readily available and/or the topography is not suitable for irrigation. Like croplands, cultivated grasslands consist of mono-crop species plantings and are annually tilled. However, dry-farmed areas are not typically leveled and support a low cover of annual grasses.

Cultivated grassland areas are similar to the nonnative annual grasslands described above and provide similar wildlife habitat. Therefore, the majority of the dryland agricultural areas have been incorporated into the Valley Floor Grassland Natural Community.

• Orchards and Vineyards. Orchards and vineyards are croplands that have been planted a single time in perennial trees or vines and may or may not have been leveled. Typically, the trees or vines are in rows that facilitate harvesting fruit. The soil underneath the plantings is generally disked or sprayed with herbicides to control the growth of weeds and other plant species. As the trees mature, they form a moderately dense canopy. Small areas in and around



the Suisun Valley and along the Vaca Mountains have been planted in grapes, walnuts, and fruit trees. The amount of orchards and vineyards in the County has increased from 13,387 ac in 1990 to a high of over 19,000 ac in 2001; however, this acreage has remained relatively constant (around 19,000 ac) between 2001 and 2009 (Figure 3-9). Albeit low, orchards and vineyards can provide habitat for wildlife such as songbirds, raptors, deer, coyotes, and others.

The California Vegetation Alliances listed in Table 3.12 would be expected in this Agricultural cover type.

Applicable Floristic Alliances	Alliance Common Name
Amsinckia (menziesii, tessellata) Alliance	Fiddleneck fields
Avena (barbata, fatua) Semi-Natural Stands	Wild oats grasslands
Brassica nigra and Other Mustards Semi- Natural	Upland mustards
Stands	
Bromus (diandrus, hordeaceus)–Brachypodium	Annual brome grasslands
distachyon Semi-Natural Stands	
Bromus rubens–Schismus (arabicus, barbatus)	Red brome or Mediterranean grass
Semi-Natural Stands	Grasslands
Bromus tectorum Semi-Natural Stands	Cheatgrass grassland
Centaurea (solstitialis, melitensis) Semi- Natural	Yellow star-thistle fields
Stands	
Centaurea (virgata) Provisional Semi-Natural	Knapweed and purple-flowered starthistle fields
Stands	
Conium maculatum–Foeniculum vulgare	Poison hemlock or fennel
Semi-Natural Stands patches	
Eucalyptus (globulus, camaldulensis) Semi-	Eucalyptus groves
Natural Stands	
Lolium perenne Semi-Natural Stands	Perennial rye grass fields
Rubus armeniacus Semi-Natural Stands	Himalayan black berry brambles

Table 3.12: California Vegetation Alliances Associated with the Agricultural Cover Type

3.3.2.6 Developed Areas

The rural character of portions of Solano County has slowly changed to a more urban setting as farm lands and natural settings are converted over to single-family homes, multifamily living structures, retail outlets, industrial complexes, and their associated infrastructure. The alterations consist of removing natural or naturalized vegetation and replacing it with structures, asphalt and concrete overlay, and landscaped plantings and lawns. Once developed, these areas are no longer considered part of a natural community because of their highly altered conditions. Urban areas occur throughout Solano County but are concentrated along I-80, the main transportation artery that runs northeast to southwest (Figure 3-6).

For the Solano HCP, two urban cover types were mapped: the typical urban environment described above and rural residential areas. Rural residential areas are characterized by large lots (typically 1 to 5 ac) and may contain remnants of native or naturalized plant communities. However, human activities, development, and ornamental vegetation typically dominate these areas. The vegetation

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and cover type map (Figure 3-6) shows only the broader Developed category and a Pre-approved Development category.

Developed Areas. Urban areas occur throughout Solano County but are concentrated along I-80. Urban vegetation generally consists of nonnative, horticultural plants with very few native trees and shrubs. Most of the vegetation in urban settings is maintained as a monoculture, such as in groves, street strips, and lawns. Urban vegetation consisting of large and/or dense stands of trees and shrubs can provide habitat for "urban adapted" wildlife and, in some cases, for migrating species. Vacant lots and disturbed lands supporting ruderal vegetation have also been included within this category as Urban–Vacant lands. These areas may also support wildlife species such as burrowing owls and contain isolated wetlands.

Pre-Approved Development. Several proposed development projects have completed their California Environmental Quality Act (CEQA) review and local approvals, but have not been developed yet. These projects will be located on lands that fall within several of the vegetation and cover types described in this document. Because the Plan Participants cannot impose additional or different restrictions or mitigation measures, such as those required under the HCP, on these developments (assuming they proceed within designated timeframes and the projects are built per current approvals), the conversion of these lands is not considered a Covered Activity under the HCP.

3.4 COVERED SPECIES

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One of the guiding principles of the Solano HCP (see Section 1.3.2) involves streamlining the local, State, and Federal regulatory processes to provide consistent and predictable treatment of actions requiring discretionary approval from participating agencies (e.g., obtaining incidental take permits and other required authorizations for modifications to natural communities). As such, the Solano HCP has sought to be as inclusive as practicable by including conservation actions that address the broadest array of species and natural communities. At the same time, the HCP strives to balance the need for maximum regulatory certainty with practical considerations such as manageability, availability of biological information, and cost.

The first step in deriving the list of species to be covered under the HCP was to establish an initial list of all special-status species occurring in the Plan Area. Special-status species are defined as plants and animals that are legally protected under the California Endangered Species Act (CESA), the Federal Endangered Species Act (FESA), or other State or Federal regulations (see Section 1.6), and also species that are considered rare by the scientific community, environmental organizations, or knowledgeable individuals. In many cases, this latter group of species may also qualify for consideration as threatened or endangered species under CEQA Guidelines Section 15380. This initial list of special-status species was derived based on the following criteria:

- Required species identified in the Solano Project Biological Opinion (USFWS 1999a).
- Species that are listed, or designated as candidates for listing, as threatened or endangered under the FESA.

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- Species that are listed, or designated as candidates for listing as rare (plants), threatened, or endangered under the CESA.
- Plant species considered to be rare, threatened or endangered in California by CNPS (List 1A, List 1B, and List 2 of the CNPS's Inventory of Rare and Endangered Plants of California; Tibor 2001).
- Plant species identified by CNPS about which more information is needed to determine their status, and plant species considered to be of limited distribution (Lists 3 and 4 of the CNPS's Inventory of Rare and Endangered Plants of California; Tibor 2001).
- Wildlife species listed by the California Department of Fish and Game (CDFG) as species of special concern or fully protected species.
- Species that meet the definition of rare or endangered under CEQA. (Under Section 15380 of CEQA, a species not included on any formal list shall nevertheless be considered rare or endangered if the species can be shown to meet the criteria for listing.)

Species whose range/distribution are known or are believed to occur in Solano County were identified for the initial list of 92 plant and animals species. This list was further refined using the following additional criteria:

- Required species identified in the 1999 Solano Project Biological Opinion (USFWS 1999a)
- Species whose range, habitat associations, and/or known location indicate the potential for take/adverse impact as a result of Covered Activities.
- Species who could occur in Solano County based on their range and habitat associations, but whose presence and distribution in the County are unknown, were also included if information on their life history and habitat associations was sufficient to allow for their conservation along with other Covered Species.
- Species for which sufficient information on their distribution and population is available for Federal agencies to determine that Covered Activities would not appreciably reduce the likelihood of their survival and recovery in the wild.

During this phase, the following species were excluded from the potential Covered Species list:

- Federally listed species for which a "no-effect" determination was made in the 1999 Solano Project Biological Opinion (USFWS 1999a).
- Species who are unlikely to be impacted by Covered Activities due to their distribution and/or habitat association (e.g., serpentine endemic species were not included because serpentine habitats do not occur within the Plan Area).
- Species whose life history and/or habitat associations are insufficiently known to determine if conservation efforts for these species can succeed.
- Species considered to be extirpated or with very limited occurrences within the Plan Area whose conservation, if such species were found to be present in the future, would be best addressed through individual, site-specific protection measures and consultation with the Resource Agencies.

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Based on these additional criteria, the initial list of 92 species was pared down to 35 species to be covered under the HCP. The list of covered species has been regularly evaluated and updated to reflect changes in species status and to incorporate new information. For example, one additional Federally listed endangered species, San Joaquin Valley Orcutt grass (*Orcuttia inaequalis*), that was not known to occur in Solano County was identified in a potential habitat preserve during the spring of 2002. Since this newly discovered population is located within a potential preserve management area, it has been included on the Covered Species list. In addition, the longfin smelt was accepted as a Federal candidate for endangered species status on February 7, 2008, and a candidate species under CESA in June 2008. Therefore, this species was also added to the Covered Species list, thereby bringing the total to 36 species (Table 3.13).

Of the 36 species proposed for coverage under the Solano HCP, 25 are Federally listed as either endangered, threatened, or a candidate for listing; 16 are State-listed as either rare, endangered, threatened, a candidate species, or fully protected (12 of which are joint Federal/State-listed/candidates); 4 plant species are classified as List 1B species by the CNPS; and 2 animal species are listed as California Species of Special Concern by CDFG (Table 3.13). The 2 California Species of Species of Special Concern are burrowing owl and tricolored blackbird.

Table 3.13 lists the 36 Covered Species and provides information on their natural community and habitat associations and status. Detailed species profiles are included in Appendix B. These profiles summarize information on the ecology of the species, including: status and distribution; range, population, and activity; habitat associations; populations and occurrences in Solano County; dispersal; and identified threats and conservation issues.

3.4.1 Species Covered Under the State Incidental Take Permit

Only a subset of the species covered under the Federal Section 10(a)1(B) "incidental take permit", will be covered by the CESA Permit issued under Section 2081(b) of the California Fish and Game Code. Eleven species are currently listed as either threatened or endangered under CESA and are not California Fully Protected Species (Table 3.14). These 11 species are the only species that can be covered under the State Incidental Take Permit. For the three California Fully Protected Species (California black rail, California clapper rail, and salt marsh harvest mouse), Plan Participants are requesting a formal agreement, such as a Memorandum of Understanding, with the CDFG only for Covered Activities associated with efforts to recover the species, such as habitat management, enhancement, and restoration (see Section 2.5.5), or other actions that would not directly or indirectly kill an individual of a Fully Protected Species (e.g., development or alteration of unoccupied habitat) (Cal. Admin. Code tit. 14, § 670.7). For the two plant species (soft bird's-beak and Mason's lilaeopsis) that are listed as rare under the California Native Plant Protection Act (NPPA) of 1977 (California Fish and Game Code Section 1900-1913), the Plan Participants are requesting a formal agreement, such as a Memorandum of Understanding, with the CDFG for impacts to these species resulting from Covered Activities.





	Va Fle Gras and V Pe	lley oor sland /ernal ool	Inner Coast Range				Riparian, Stream, and Freshwater Marsh					Coastal Marsh		Other			
Covered Species (Common Name/Scientific Name)	Valley Floor Grasslands	Vernal Pool System Grasslands ¹	Inner Coast Range Grasslands	Oak Woodland	Oak Savanna	Scrub/Chaparral	Riparian	Freshwater Marsh	Streams/Sloughs	Levee	Ponds/Lakes	Coastal Marsh	Tidal Flats	Agricultural	Urban	Status ² (Federal, State, and CNPS) /Comments	
				1					PL	ANT	S			1	1		
Ferris's Milk-vetch/ Astragalus tener var. ferrisiae	•	•														L1B/ Required species in Biological Opinion	
Alkali Milk-vetch/ Astragalus tener var. tener	•	•														L1B/ Required species in Biological Opinion	
Vernal Pool Smallscale/ Atriplex persistens		•														L1B/ Required species in Biological Opinion	
Suisun Thistle/ Cirsium hydrophilum var. hydrophilum												•				FE, CH, and L1B/ Required species in Biological Opinion	
Soft Bird's-beak/ Cordylanthus mollis ssp. mollis												•				FE, CH, SR and L1B/ Required species in Biological Opinion	
Boggs Lake Hedge-hyssop/ Gratiola heterosepala		•														SE and L1B/ Required species in Biological Opinion	
Contra Costa Goldfields/ Lasthenia conjugens		•														FE, CH, and L1B/ Required species in Biological Opinion	
Legenere/ Legenere limosa		•														L1B/ Occurs in vernal pool habitats and conservation measures could be addressed through other required species.	
Mason's Lilaeopsis/ Lilaeopsis masonii												•				SR and L1B/ Required species in Biological Opinion	

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	Va Fl Gras and V P	lley oor ssland Vernal ool	Inner Coast Range				Riparian, Stream, and Freshwater Marsh					Coastal Marsh		Other			
Covered Species (Common Name/Scientific Name)	Valley Floor Grasslands	Vernal Pool System Grasslands ¹	Inner Coast Range Grasslands	Oak Woodland	Oak Savanna	Scrub/Chaparral	Riparian	Freshwater Marsh	Streams/Sloughs	Levee	Ponds/Lakes	Coastal Marsh	Tidal Flats	Agricultural	Urban	Status ² (Federal, State, and CNPS) /Comments	
Colusa Grass/	, r			-	-	•1			•1			-		`		FT, CH, SE, and L1B/ Required Species in	
Neostapfia colusana																Biological Opinion.	
San Joaquin Valley Orcutt																FT, CH, SE, and L1B/ Species not previously	
Grass/		•														known in Solano County. One population found in	
Orcuttia inaequalis																2003 in a potential reserve area.	
Solano Grass/																FE, CH, SE, and L1B/ Required species in	
Tuctoria mucronata		•														Biological Opinion.	
									AN	IMAI	S						
Swainson's Hawk/					•		•			•					•	ST/ Concern for development and O&M activities	
Buteo swainsoni	•	•	•		•		•			•				•	•	in much of County.	
California Black Rail/																ST and CFP/ Would be covered under conservation	
Laterallus jamaicensis												•				actions for required Federal species such as clappe	
coturniculus																rail.	
California Clapper Rail/												-				FE, SE, and CFP/ Required species under	
Rallus longirostris obsoletus												•				Biological Opinion.	
																CSC/Potential for impacts and potential species for	
Burrowing Owl/	•	•	•		•			•		•		•		•	•	future Federal and State listing: nest sites protected	
Athene cunicularia																by existing State and Federal laws.	
	1	1	1													CSC/ Potential for future listing; Some overlap with	
Tricolored Blackbird/	•	•						•	•			•		•		conservation strategies for other required species	
Agelaius tricolor																may require additional measures.	
California Tiger Salamander/																FT, CH, and ST/ Required species in Biological	
Ambystoma californiense	•	•														Opinion.	

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Covered Species (Common Name/Scientific Name)	Valley Floor Grasslands	Vernal Pool System Grasslands ¹	Inner Coast Range Grasslands	Oak Woodland	Oak Savanna	Scrub/Chaparral	Riparian	Freshwater Marsh	Streams/Sloughs	Levee	Ponds/Lakes	Coastal Marsh	Tidal Flats	Agricultural	Urban	Status ² (Federal, State, and CNPS) /Comments	
California Red-legged Frog/ Rana draytonii	•		•	•	•	•										FT, CH, and CSC/ Required species in Biological	
Giant Garter Snake/ Thamnophis gigas							•	•	•	•				•		FT, ST/ Required species in Biological Opinion.	
Salt Marsh Harvest Mouse/ Reithrodontomys raviventris halicoetes												•				FE, SE, and CFP/ Required species in Biological Opinion.	
Conservancy Fairy Shrimp/ Branchinecta conservation		•														FE and CH/ Required species in Biological Opinion.	
Vernal Pool Fairy Shrimp/ Branchinecta lynchi		•														FT and CH/ Required species in Biological Opinion.	
Vernal Pool Tadpole Shrimp/ Lepiduras packardi		•														FE and CH/ Required species in Biological Opinion.	
Valley Elderberry Longhorn Beetle/ Desmocerus californicus dimorphus						•	•		•	•						FT and CH/ Required species in Biological Opinion.	
Delta Green Ground Beetle/ Elaphrus viridis		•														FE and CH/ Required species in Biological Opir	
Callippe Silverspot Butterfly/ Speyeria callippe callippe			•													FE/ Required species in Biological Opinion	
Green Sturgeon/ Acipenser medirostris							•		•	•						FT and CH/ Required species in Biological Opinion.	

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	Va Fle Gras and V Pe	lley oor sland Inner Coast Range /ernal ool					Riparian, Stream, and Freshwater Marsh					Coastal Marsh		Other		
Covered Species (Common Name/Scientific Name)	Valley Floor Grasslands	Vernal Pool System Grasslands ¹	Inner Coast Range Grasslands	Oak Woodland	Oak Savanna	Scrub/Chaparral	Riparian	Freshwater Marsh	Streams/Sloughs	Levee	Ponds/Lakes	Coastal Marsh	Tidal Flats	Agricultural	Urban	Status ² (Federal, State, and CNPS) /Comments
Chinook Salmon – Sacramento River Winter-run ESU/ Oncorhynchus tshawtyscha							•		•	•						FE, CH, and SE/ Primary concerns are for passage/movement and water quality.
Chinook Salmon-Central Valley fall/late fall-run ESU/ Oncorhynchus tshawtyscha							•		•	•						Candidate – not warranted, CSC/ Some potential breeding habitat. Concerns for water quality, passage, and riparian habitat protection.
Chinook Salmon – Central Valley Spring-run ESU/ Oncorhynchus tshawtyscha							•		•	•						FT, CH, and ST/ Primary concerns are for passage/movement and water quality
Steelhead - Central California Coast DPS/ Oncorhynchus mykiss	L						•		•	•						FT, CH, and CSC/ Breeding habitat present; many streams in County may qualify as critical habitat; concerns for water quality, passage, and riparian habitat protection.
Steelhead - Central Valley DPS/ Oncorhynchus mykiss							•		•	•						FT, CH, and CSC/ Breeding habitat present; many streams in County may qualify as critical habitat; concerns for water quality, passage, and riparian habitat protection.
Delta Smelt/ Hypomesus transpacificus Sacramento splittail/ Pogonichthys macrolepidotus	,							•	•			•				FT, CH, SE/ Required species in Biological Opinion. Delisted, CSC/ Required species in Biological Opinion.



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-LSA



	Va Flo Gras and V Po	lley oor sland ⁄ernal ool	Inne	er Co	ast Ra	ange	Riparian, Stream, and Freshwater Marsh					Coastal Marsh		Other		
Covered Species (Common Name/Scientific Name)	Valley Floor Grasslands	Vernal Pool System Grasslands ¹	Inner Coast Range Grasslands	Oak Woodland	Oak Savanna	Scrub/Chaparral	Riparian	Freshwater Marsh	Streams/Sloughs	Levee	Ponds/Lakes	Coastal Marsh	Tidal Flats	Agricultural	Urban	Status ² (Federal, State, and CNPS) /Comments
Longfin Smelt/ Spirinchus thaleichthys												•				FC, ST, and State candidate for endangered / Potential for future listing; overlap with conservation strategies for Delta Smelt.

Plants that are also found in alkali playa, chenopod scrub, and alkali meadow habitats.

Status: Federal:

SOC = Federal Species of Concern

FC = Federal Candidate for listing

FPT = Federally Proposed Threatened Species

CH = Designated Critical Habitat present in County

2

State:

FE = Federally Endangered Species SR = State Rare Species (applies only to FT = Federally Threatened Species

plants)

- SE = State Endangered Species
 - ST = State Threatened Species
 - CSC = California Species of Special Concern
 - CFP = California Fully Protected Species

CNPS (California Native Plant Society):

List 1B = Plant rare, threatened or endangered in

California and elsewhere

List 2 = Plant rare, threatened or endangered in

California but common elsewhere

List 3 = Plant for which more information is needed for assignment to a list

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List 4 = Plant of limited distribution (a watch list)

Common Name (Scientific Name)	Status
Boggs Lake Hedge-hyssop	State Endangered
(Gratiola heterosepala)	_
Colusa Grass	State Endangered
(Neostapfia colusana)	
San Joaquin Valley Orcutt Grass	State Endangered
(Orcuttia inaequalis)	
Solano Grass (Crampton's Tuctoria)	State Endangered
(Tuctoria mucronata)	
Swainson's Hawk	State Threatened
(Buteo swainsoni)	
California Tiger Salamander	State Threatened
(Ambystoma californiense)	
Giant Garter Snake	State Threatened
(Thamnophis gigas)	
Chinook Salmon -Sacramento River Winter-Run ESU	State Endangered
(Oncorhynchus tshawtyscha)	
Chinook Salmon - Central Valley Spring-Run ESU	State Threatened
(Oncorhynchus tshawtyscha)	
Delta Smelt	State Threatened
(Hypomesus transpacificus)	
Longfin Smelt	State Threatened, Candidate for Endangered
(Spirinchus thaleichthys)	

Table 3.14:	Species	Covered	Under	the	State	2081	Permit
1 abic 3.14.	operies	Covercu	Unuci	unc	State	2001	I CI IIIIt

3.4.2 Special Management Species

- ISA

Special Management Species represent those special-status plants and animals that are typically considered under CEQA to be threatened or endangered (CEQA Guidelines, 14 California Code of Regulations [CCR] §15380). Special Management Species include several plant species considered to be rare, threatened or endangered in California by CNPS (List 1A, List 1B, and List 2 species), along with several wildlife species listed by CDFG as Species of Special Concern. In addition, the Solano Project Biological Opinion (USFWS 1999a) also includes a plant conservation measure that requires development of a conservation program for the protection of special-status plant species in Solano County in coordination with the HCP. Thirteen of the special-status plant species included in this program are not considered Covered Species for the Solano HCP.

It would be desirable to address conservation of these species in conjunction with the Covered Species in order to comply with the requirements of the Solano Biological Opinion and to streamline future project reviews. However, there is insufficient information available on their life history and management to allow the USFWS to make the necessary findings under the No Surprises Rule (see Section 10.7 for additional information). The purpose of the No Surprises Rule is to provide assurances to non-Federal landowners participating in habitat conservation planning under FESA that no additional land restrictions or financial compensation will be required for species adequately covered by a properly implemented HCP, in light of unforeseen circumstances (see Section 10.7.9).

To address the conflicting desire for coverage of all special-status species and compliance with regulatory standards, the "Special Management Species" classification was created for the Solano

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HCP. Species in this category would benefit from the conservation actions undertaken by Plan Participants, but USFWS would not provide the "No Surprise" assurances for these species. The conservation program for the Special Management Species is embodied in the natural community conservation measures for the Covered Species. Additional management actions needed to conserve these species, beyond the natural community conservation measures, are discussed at the end of Chapters 5.0 and 6.0. Information on their distribution, habitat requirements, and life history is detailed in Appendix C.

Addressing the Special Management Species in this manner allows conservation benefits of the overall HCP to be considered and future project approvals under CEQA to be streamlined. In addition, information gained from implementing the HCP (i.e., through monitoring and adaptive management) can be used to determine future species listings and/or modifications to the HCP as a result of such listings.

The Special Management Species include 20 plant species considered rare or endangered or of regional concern by CNPS and 15 special-status wildlife species (Table 3.15). Species whose life history and/or habitat association allow for their conservation in conjunction with the Covered Species were considered for inclusion in this category. The conservation program for these Special Management Species relies primarily on the reserve system that will be established as part of the HCP, but also recognizes that additional management actions may be needed to provide suitable habitat for them. These additional management actions are detailed in the Conservation Program, and the status of these Special Management Species will be monitored and tracked throughout the reserve system. These species were also considered in the Conservation Analysis (see Chapter 4.0) in order to inform priority areas for conservation.

3.5 EXISTING PRESERVES/RESERVES

Solano County has a long history of land preservation and has a large system of public and private open space and conservation lands, many of which have been established for the protection of rare species and their habitats. Approximately 74,000 ac of open space lands are located within the Plan Area (Figure 3-10), roughly 13 percent of the Plan Area. These open space lands range in size from a few acres to larger reserves covering thousands of acres (e.g., CDFG's Grizzly Island Wildlife Management Area at over 8,500 ac). Figure 3-11 shows the location of existing reserves and preserves, potential reserves and preserves, and other protected lands within the Plan Area. Table 3.16 lists the names of the reserves and preserves identified on Figure 3-11.

Reserves and preserves have been designated into four categories for the HCP conservation analysis: conservation lands, open space lands, individual mitigation projects, conservation banks and mitigation banks.

• *Conservation lands* are owned in fee title by a government agency, non-governmental organization (NGO), or private landowner and are protected (e.g., through a conservation easement, deed restriction, or legislative mandate) for the primary purpose of preserving agricultural lands and natural resources.

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	Va Fl Gras and V P	lley oor ssland Vernal ool	Inne	er Co	ast Ra	ange	Ri	paria Freshv	arian, Stream, reshwater Mar			Coa Ma	istal Irsh	Otl	her		
Common Name/ Scientific Name	Valley Floor Grasslands	Vernal Pools System Grasslands ¹	inner Coast Range Grasslands	Dak Woodland	Dak Savanna	Scrub/Chaparral	Riparian	Freshwater Marsh	Streams/Sloughs	Levee	Ponds/Lakes	Coastal Marsh	Fidal Flats	Agricultural	Urban	Status/Comments ²	
	-	- 0		Ŭ	Ŭ	•1	-	-	PL	ANT	s	U		4		I	
Heartscale ¹ / Atriplex cordulata		•														L1B/ Occurs in vernal pool habitats and conservation measures could be addressed thr Covered Species.	
Brittlescale ¹ / Atriplex depressa		•														L1B/ Occurs in vernal pool habitats and conservation measures could be addressed thr Covered Species.	
San Joaquin Spearscale ¹ / Atriplex joaquiniana	•	•														L1B/ Occurs in vernal pool habitats and conservation measures could be addressed thre Covered Species.	
Pappose Tarplant/ Centromadia parryi ssp. parryi	•	•														L1B/ Occurs in vernal pool habitats and conservation measures could be addressed thre Covered Species.	
Hispid Bird's-beak/ Cordylanthus mollis ssp. hispidus		•										•				L1B/ Occurs in vernal pool habitats and conservation measures could be addressed thre Covered Species.	
Recurved Larkspur/ Delphinium recurvatum	•	•														L1B/ Occurs in vernal pool habitats and conservation measures could be addressed thr Covered Species.	
Dwarf Downingia/ Downingia pusilla		•														L2/ Occurs in vernal pool habitats and conserv measures could be addressed through Covered Species	

Table 3.15: Solano HCP Draft List of Special Management Species and Associated Habitats



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 Table 3.15:
 Solano HCP Draft List of Special Management Species and Associated Habitats

	Va Fl Gras and V Po	lley oor sland Vernal ool	Inne	er Co	ast Ra	nge	Rij I	paria Freshv	n, Stro vater	eam, a Mars	and h	Coa Ma	nstal Arsh	Ot	her		
Common Name/ Scientific Name	Valley Floor Grasslands	Vernal Pools System Grasslands ¹	Inner Coast Range Grasslands	Oak Woodland	Oak Savanna	Scrub/Chaparral	Riparian	Freshwater Marsh	Streams/Sloughs	Levee	Ponds/Lakes	Coastal Marsh	Tidal Flats	Agricultural	Urban	Status/Comments ²	
Fragrant Fritillary/ Fritillaria liliacea	•	•														L1B/ Occurs in vernal pool habitats and conservation measures could be addressed through Covered Species.	
Hogwallow Starfish/ Hesperevax caulescens		•														L4/ Occurs in vernal pool habitats and conservation measures could be addressed through Covered Species.	
Rose-mallow/ Hibiscus lasiocarpus												•				L2/ Occurs in vernal pool habitats and conservation measures could be addressed through Covered Species.	
Carquinez Goldenbush/ Isocoma arguta	•	•														L1B/ Occurs in vernal pool habitats and conservation measures could be addressed through Covered Species.	
Ferris's Goldfields/ Lasthenia ferrisiae		•														L4/ Occurs in vernal pool habitats and conservation measures could be addressed through Covered Species.	
Delta Tule Pea/ Lathyrus jepsonii var. jepsonii												•				L1B/ Required species in Biological Opinion	
Heckard's Pepper-grass/ Lepidium latipes var. heckardii	•	•														L1B/ Occurs in vernal pool habitats and conservation measures could be addressed through Covered Species.	

	Va Fle Gras and V Pe	lley oor ssland Vernal ool	Inne	er Co	ast Ra	st Range		paria Freshv	n, Stro water	eam, a Mars	and h	Coa Ma	Coastal Marsh		her		
Common Name/ Scientific Name	Valley Floor Grasslands	Vernal Pools System Grasslands ¹	Inner Coast Range Grasslands	Oak Woodland	Oak Savanna	Scrub/Chaparral	Riparian	Freshwater Marsh	Streams/Sloughs	Levee	Ponds/Lakes	Coastal Marsh	Tidal Flats	Agricultural	Urban	Status/Comments ²	
Delta Mudwort/ Limosella subulata				-								•				L2/ Similar habitats to Mason's lilaeopsis and Tule pea and could be covered under the conservation measures for these required speci	
Baker's Navarretia/ Navarretia leucocephala ssp. bakeri		•														L1B/ Required species in Biological Opinion.	
Bearded Popcorn-flower/ Plagiobothrys hystriculus		•												•		L1B/ Typically occurs in vernal pools and oth seasonally wet areas; Conservation needs coul likely be incorporated with Covered Species.	
Suisun Marsh Aster/ Symphyotrichum lentum												•				L1B/ Similar habitats to Mason's lilaeopsis and Delta Tule pea and could be covered under the conservation measures for these Covered Spec	
Saline Clover/ Trifolium depauperatum var. hydrophilum	•	•														L1B/ Occurs in wetlands with alkaline soils; Conservation measures could likely be incorpo with Covered Species.	
Valley Needlegrass Grassland	•	•	•		•											Conservation measures could likely be incorp with Covered Species but may also require sp management	
									AN	IMAI	LS						
Northern Harrier/ Circus cvaneaus	•	•										•				CSC/ Could generally be covered by conservations for Covered Species.	

Table 3.15: Solano HCP Draft List of Special Management Species and Associated Habitats



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 Table 3.15:
 Solano HCP Draft List of Special Management Species and Associated Habitats

		Va Fl Gras and V P(lley oor sland Vernal ool	Inne	er Co	ast Ra	inge	Rij F	paria Freshv	n, Stro water	eam, a Mars	and sh	Coa Ma	nstal nrsh	Ot	her	
	Common Name/ Scientific Name	Valley Floor Grasslands	Vernal Pools System Grasslands ¹	Inner Coast Range Grasslands	Oak Woodland	Oak Savanna	Scrub/Chaparral	Riparian	Freshwater Marsh	Streams/Sloughs	Levee	Ponds/Lakes	Coastal Marsh	Tidal Flats	Agricultural	Urban	Status/Comments ²
	Mountain Plover/ Charadrius montanus	•	•														CSC/ Winter migrant to region; concerns for population based on nesting; winter habitat conservation if necessary could be addressed through conservation measures for other required/recommended species.
	Short-eared Owl/ Asio flammeus	•	•										•				CSC/ Could generally be covered under conservation strategies for Covered Species.
	San Francisco Common Yellowthroat/ Geothlypis trichas sinuosa												•				CSC/ Could generally be covered under conservation strategies for Covered Species
	Yellow-breasted Chat/ Icteria virens				●			●				•					CSC/ Could generally be covered under conservation strategies for Covered Species
	Loggerhead Shrike/ Lanius ludovicianus	•	٠	•		•			•		•		•		•	•	CSC/ Open country for foraging; dense shrubs for nesting
	Grasshopper Sparrow/ Ammodramus savannarum	•															CSC/This species requires special management of reserves and preserves
L S	Song Sparrow-Modesto Population/ Melospiza melodia	•						•	•								CSC/ Could generally be covered under conservation strategies for Covered Species
>	Suisun Song Sparrow/ Melospiza melodia maxillaries												•				CSC/ Could generally be covered under conservation strategies for Covered Species

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			-									-		1			
	Va Flo Gras and V Po	lley oor sland /ernal ool	Inn	Inner Coast Range				paria Freshv	n, Stro water	eam, a Mars	and sh	Coastal Marsh		Other		_	
Common Name/ Scientific Name	Valley Floor Grasslands	Vernal Pools System Grasslands ¹	Inner Coast Range Grasslands	Oak Woodland	Oak Savanna	Scrub/Chaparral	Riparian	Freshwater Marsh	Streams/Sloughs	Levee	Ponds/Lakes	Coastal Marsh	Tidal Flats	Agricultural	Urban	Status/Comments ²	
Samuels Song Sparrow/ Melospiza melodia samuelis												•				CSC/ Could generally be covered under conservation strategies for Covered Species	
Yellow-headed Blackbird/ Xanthocephalus xanthocephalus	•	•	•			•	•	•	•		•	•		•	•	CSC/ Could possible require special management.	
Foothill Yellow-legged Frog/ Rana boylii			•	•		•	•		•							CSC/ Could generally be covered under conservation strategies for other required or recommended species.	
Western Pond Turtle/ Actinemys marmorata			•	•	•	•	٠	•	•	•	•	•				CSC/ Conservation actions will likely be addressed through Covered Species.	
Suisun Shrew/ Sorex ornatus sinuosus												•				CSC/ Conservation actions can be addressed through Covered Species.	
Ricksecker's Water Beetle/ Hydrochara rickseckeri		•														Conservation actions can likely be addressed through Covered Species.	

Table 3.15: Solano HCP Draft List of Special Management Species and Associated Habitats

Plants that are also found in chenopod scrub habitats.

² Status:

CNPS (California Native Plant Society):

List 1B = Plant rare, threatened or endangered in California and elsewhere

List 2 = Plant rare, threatened or endangered in California but common elsewhere

- List 3 = Plant for which more information is needed for assignment to a list
- List 4 = Plant of limited distribution (a watch list)

State: CSC = California Species of Special Concern



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Table 3.16: Protected Lands within the
Solano HCP Plan Area

No. ¹	Name	Acres
	Conservation Lands	
1	Grasslands County Park/Davis Comm. Facility	640
2	Yolo Bypass WA	188
3	City of Vacaville	5
4	William Smith Trust	437
5	Liberty Island	3,881
6	Little Holland Tract	513
7	Prospect Island	1,535
8	Bennedsen Easement	10
9	City of Fairfield, County of Solano	278
10	City of Fairfield	103
11	City of Fairfield	25
12	City of Fairfield	532
13	Wilcox Ranch	3,420
14	Barker Slough Ecological Reserve	267
15	Jepson Prairie Preserve	1,544
16	Calhoun Cut Ecological Reserve	1,015
17	DWR Mitigation	213
18	Vallejo Lakes	1
19	Rose Easement	9
20	Suisun Ranch	83
21	Vintage Park	56
22	City of Fairfield	6
23	City of Fairfield	13
24	City of Fairfield	11
25	Peytonia Slough Ecological Reserve	296
26	Hill Slough Wildlife Area	1,620
27	Grey Goose Unit	69
28	Rush Ranch Open Space	2,175
29	Joice Island Wildlife Area	1,877
30	Montezuma Slough Unit	10
31	Gold Hills Unit	58
32	Cordelia Slough Area	563
33	Island Slough Unit	523
34	Crescent Unit	390
35	Grizzly Island Wildlife Area	8,519
36	Napa-Sonoma Marshes (in Napa)	2,877
37	San Pablo Bay National Wildlife Refuge	6,946
38	Open Space, City of Vallejo	63
39	White Slough	467
40	Guadalcanal Village	55
41	City of Vallejo	21
42	Mare Island - H1 Landfill	234
43	South Hampton Marsh	211
44	Benicia State Recreation Area	278
45	Goodyear Slough Unit	651
46	Marsh, City of Benicia	22
	Total	42,709
4=	Individual Mitigation Project	220
47	North Village Mitigation - Seeno	220
48	Centennial Park	13
49	Beelard Agricultural Preservation	453
50	Muzzy Ranch Swainson's Hawk	360



CONSERV

No. ¹	Name	Acres
51	North Village	322
52	Villages at Fairfield	136
53	Pond Clayback	29
54	City of Fairfield	5
55	Jehovah's Witness Complex	9
56	Aero Club	92
57	Muzzy Easement	159
58	Meyer Cookware Wetland Preserve	6
59	Potrero Hills Landfill	25
60	Director's Guild	87
61	City of Fairfield	55
62	Foxboro Mitigation Site	41
63	Peabody Road Mitigation Site	7
64	Griffith Ranch (North)	61
65	Griffith Ranch (South)	84
66	Eastern Valley	305
67	Pond 5 Buffer Area	37
68	Southern Hills	442
69	Sky Valley Open Space	604
70	Hiddenbrooke Open Space	48
71	Orchards Parcel A Open Space	22
, 1	Total	3622
	Mitigation Bank	
72	Jenny Farms	431
73	Noonan Ranch Conservation Bank 4	16
74	Noonan Ranch Conservation Bank 1	190
75	Muzzy Ranch	1,346
76	Burke Ranch	981
77	Campbell Ranch Mitigation Bank	158
78	Gridley Preserve	1,883
79	Goldfield Conservation Bank	155
80	North Suisun Mitigation Bank	615
-	Total	5,775
	Open Space Lands	,
81	Solano County Holdings	2,316
82	Napa County Holdings	43
83	Vacaville-Dixon Greenbelt	942
84	Dixon Pond II	123
85	Open Space, City of Vacaville	552
86	City of Vacaville	22
87	Boulder Valley Park & Open Space	21
88	Sunrise Woodcrest Open Space	20
89	Centennial Park	51
90	City of Vacaville	129
91	Blue Ridge	1,891
92	Hidden Valley	14
93	City of Vacaville	1
94	City of Vacaville	1
95	Tate Open Space	46
96	Lagoon Valley Hills Open Space	1,293
97	Lagoon Valley Open Space	74
98	Triangle by Lagoon Valley	65
99	McCuen-Lagoon Valley Open Space, City of	356

Table 3.16: Protected Lands within the
Solano HCP Plan Area



No. ¹	Name	Acres
	Vacaville	
100	Fairfield / Vacaville Greenbelt	11
101	Vallejo Lakes	2,738
102	Dover Hill Open Space	271
103	Serpas Ranch	766
104	Castle Rock Open Space	8
105	Gregory Hill Open Space	29
106	Rockville Hills Park	640
107	City of Fairfield	62
108	Lynch Canyon	1,094
109	Open Space	35
110	Former Naval Res	68
111	Open Space	22
112	Northgate	427
113	Western Swett Ranch	903
114	Eastern Swett Ranch	1,702
115	King Ranch	1,293
116	McCormack/Anderson Ranch	4,031
117	Corcoran Ct	141
118	Lake Herman/OS Area	540
119	Braito Open Space	159
120	XX holding	52
121	Tourtelot Open Space	154
122	Braito Open Space	52
123	XX holding	44
	Total	23,199
	Potential Mitigation Bank	
124	Noonan Ranch Open Space	1,297
125	Frietas Ranch	158
126	Lang-Tule Ranch	255
127	Mallard Slough	541
	Total	2.250

Table 3.16: Protected Lands within the
Solano HCP Plan Area

Property numbers correspond with numbers on Figure 3-11.

- *Open space lands* include any parcel or area of land or water owned or controlled in some manner by a private party, municipality, or NGO for a purpose other than natural resource protection (Note: The term "open space lands" does not imply lands are accessible to the public.) Examples include lands with conservation and agricultural easements designed primarily to preclude development and maintain the current land uses for production of resources (food, fiber, and energy) or protection of visual resources, outdoor recreation (parks), or public health and safety.
- *Individual mitigation projects* are lands set aside and managed typically by the government or the private sector to provide for mitigation for impacts to natural resources through individual development projects.
- *Mitigation and Conservation banks* are commercial, institutional, or privately operated sites, or a suite of sites, where natural resources (e.g., endangered species, wetlands, streams, riparian areas) are restored, established, enhanced, and/or preserved for the purpose of providing compensatory mitigation for project impacts completed by third-parties. The distinction



between the two types of banks is that species or habitat preservation is the primary emphasis of a conservation bank while mitigation banks emphasize or include a significant habitat restoration or creation component.

In addition to these existing banks, proposed banks and conservation lands are also classified separately and, once established, may also provide habitat mitigation or additional protection under the Solano HCP.

A review of Figures 3-10 and 3-11 indicates that marsh and tidal flat habitat currently have the most protection as a result of ongoing conservation efforts in the San Francisco Bay Area to protect estuarine marsh habitats, including Suisun Marsh. CDFG owns and manages large portions of Suisun Marsh, including important remnant "natural" tidal marsh habitats in the Hill Slough and Peytonia Slough Wildlife Areas that support most of the known populations of covered threatened and endangered endemic plant species. CDFG has also purchased substantial portions of the Napa Marshes in Napa and Solano Counties and is developing plans to restore these areas to tidal marsh for the purpose of endangered species restoration and recovery. In the Delta region, CDFG also owns and manages the Calhoun Cut Ecological Reserve, which contains the upper portions of marsh and riparian habitats. USFWS owns and manages the majority of the tidal marshes fronting San Pablo Bay, including the bay marshes on Mare Island, and is working on plans to restore approximately 1,560 ac of the former Cullinan Ranch along Highway 37 just east of Vallejo to tidal marsh.

Development and use of Suisun Marsh is highly regulated under State law. In 1974, the California legislature passed the Nejedly-Bagley-Zberg Suisun Marsh Preservation Act to protect the Marsh from potential residential, commercial, and industrial development in order to preserve the Marsh for future generations. The Act directed the San Francisco Bay Conservation and Development Commission (BCDC) and the CDFG to prepare the Suisun Marsh Protection Plan "to preserve the integrity and assure continued wildlife use" of the Suisun Marsh (BCDC 1976). The primary benefit of the Act will be the enhancement of habitat for wintering waterfowl.

The Suisun Marsh Protection Plan divides Suisun Marsh into two zones: a primary management zone and a secondary management zone (Figure 3-11). The primary management zone encompasses 86,000 ac of tidal marsh, managed wetlands, adjacent grasslands, and waterways under the jurisdiction of BCDC. The secondary management zone encompasses approximately 22,000 ac of upland buffer habitat. Solano County administers the local protection program; BCDC represents the interests of the State and serves as the permitting agency for major land use projects in the primary management zone.

The principal consideration in the primary management zone is the protection of environmental values and existing uses. Urban development is precluded, and other uses such as oil and gas exploration and construction and operation of utilities and other facilities are highly regulated by BCDC. Activities that conflict with the protection of the Marsh are not permitted provided other practicable alternatives are available. Activities within the secondary management zone are also severely restricted to activities that will not adversely impact the Marsh, although several areas are designated for various uses that would continue or allow expansion of existing industrial or commercial uses.

As a result of above-mentioned actions, public ownership in the Suisun Marsh, Southampton Marsh, and Napa and San Pablo Bay marshes, and the special regulatory restrictions in Suisun



Marsh, over 95 percent of the coastal marsh habitats in Solano County are protected from conversion to other land uses (Figure 3-9).

Substantial areas of vernal pool grassland, upland grassland, and oak woodland/savanna habitats have also been preserved by public entities and conservation groups (Figure 3-9). The Solano Land Trust, the Cities of Vacaville and Dixon, and others have established conservation easements on existing farmlands to maintain community separators and protect agricultural lands from development, resulting in the preservation of large areas of agricultural land.

3.6 RISK ANALYSIS

In order to determine where future reserves should be established, the potential risk (likelihood) that natural communities could be converted/developed had to be assessed. A variety of factors were considered including: slope (e.g., areas with greater than 30 percent slope are generally unsuitable for significant development), soil capability classes, parcel size (e.g., smaller parcels are more at risk for conversion, or effects of development such as fragmentation are more significant), existing preserves and reserves, and existing regulatory mechanisms (e.g., zoning, State regulations such as the Suisun Marsh Preservation Act). A review of these factors revealed that current Solano County zoning reflects many of these risk factors and provides a reasonable substitute for assessing the cumulative risk of these environmental features. Identifying those areas at high risk will help to identify and prioritize areas for future conservation (see Section 4.3.11 for more details).

Six "risk" categories were defined: very high, high, moderate, low, very low, and preserve depending on the extent to which land could be converted to a land use incompatible with the conservation of the particular Covered Species and/or natural communities currently occupying that land. The process for designating land into each risk category is described below and the results of the analysis are shown on Figure 3-12.

• Very High: Urban growth and the resulting conversion of natural and agricultural lands to urban uses represent the primary threat to rare, threatened and endangered species within Solano County. The Solano County 2008 General Plan Update directs future development within the Urban Growth Boundaries (UGBs) of the seven incorporated cities: the six HCP participating cities of Fairfield, Suisun City, Vacaville, Vallejo, Rio Vista and Dixon, and the City of Benicia that is not participating in the HCP. Given this growth assumption, the UGBs, as outlined on Figure 2-1 minus the area in Fairfield designated as Travis Reserve, were classified as being at very high risk of potential future development.

Potential urban growth in unincorporated Solano County is limited to a few areas designated as industrial, rural residential, and estate residential (Figure 2-2). These areas were also classified as being at very high risk of potential future development.

• **High:** In 1994, Solano County voters approved the Solano County Orderly Growth Initiative (Measure A). This initiative amended the Solano County General Plan to restrict the re-zoning of lands designated "Agriculture" or "Open Space" as shown on the Solano County Land Use and Circulation Map, through December 31, 2010 (Solano County 1994). It also placed limits on the density of residential and other development on agricultural lands. In 2008, Solano County voters passed Measure T, extending the provisions of the Solano County Orderly Growth Initiative to December 31, 2028.

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Within Solano County, four agricultural land uses have been designated based on a maximum residential density of one resident per 20, 40, 80, and 160 ac. Based on the Solano County Orderly Growth Initiative, land within any of these four agricultural designations may be redesignated as "Rural Residential" (maximum density of 1 unit per 2.5 to 10 ac) if: (1) it does not alter the stability of surrounding land use patterns, (2) it is not designated as prime agricultural land pursuant to California Government Code Section 51202, (3) it can be shown to have no substantial market or rental value under the agricultural designation, (4) that the use and density proposed is compatible with land immediately adjacent to existing comparably developed areas, and (5) that the proposed redesignation density will not interfere with existing agricultural practices.

For the risk analysis, lands designated as "Agriculture" with a 20 ac minimum residential density were considered to have limited viability for agricultural uses. These lands generally occur on Class IV or lower soils based on the Natural Resource Conservation Service land use capability classifications. Class I and II soils are the only classes that are designated as prime agricultural lands under California Government Code Section 51202. Because these lands have already been designated as having limited viability for agricultural uses, are located in close proximity to currently developed areas, and are capable of receiving vital public services (e.g., water, sewer), lands within this designation were classified as being at high risk of conversion to incompatible land uses (i.e., at high risk of development). The area zoned as Travis Reserve in the City of Fairfield was also classified as being at high risk of conversion to incompatible land uses (i.e., at high risk of development).

The risk analysis primarily considers incompatible land uses to mean development; however, for Swainson's hawk, the risk analysis considers the potential threat of conversion to unsuitable foraging habitat through agricultural crop types (i.e., switch from field crops to orchards or vineyards), urban development, and development of alternative energy solar and multiple, large-turbine wind resources for commercial electrical production. While all agricultural lands are potentially at risk for conversion to orchards and vineyards, certain soil types in the Plan Area have been identified as being well-suited for such uses (i.e., do not require extensive management). Agricultural lands within the northeastern portion of the Plan Area with such soil types were categorized as being at a high risk of potential conversion to an incompatible land use (i.e., at high risk of being converted to a crop type not suitable for Swainson's Hawk foraging).

Moderate: Lands at moderate risk of being converted to incompatible land uses include County lands designated as "Agriculture" with a maximum permitted residential density of one dwelling unit per 40, 80 or 160 ac (with the exception of soil types suitable for orchards and vineyards as described above). The majority of these lands are also designated as Prime Farmland under the Farmland Mapping and Monitoring Program of the California Division of Land Resource Protection. Soil quality on lands zoned "Agriculture" with a 40 or 80 ac minimum fall within Capability Classes I and II in the Natural Resource Conservation Service land use capability classifications, and the majority of agricultural lands with a 40 ac minimum parcel size rate from 80 to 100 on the Storie Index Rating. These two classification systems qualify the land as being "prime agricultural land" under the California Land Conservation Act of 1965.

Under the Solano County Orderly Growth Initiative, prime agricultural land, as defined by California Government Code Section 51202 (the California Land Conservation Act of 1965, also known as the Williamson Act), cannot be redesignated as rural residential. Therefore, all

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land currently designated "Agriculture" that can be classified as prime agricultural land was considered to be at moderate risk of being developed or re-zoned for development.

As described above, the Solano County Orderly Growth Initiative also prohibits large-scale residential or mixed-use developments in large agricultural areas or outside of municipal areas. Lands zoned as "Agriculture" with a 160 ac minimum occur primarily on lower grade soils (Capability Class III or lower) and in areas with varying amounts of salinity and alkalinity, limiting the productivity of the land as pasture. Therefore, these lands are not considered prime agricultural land under the Williamson Act. In addition, these lands fall outside of the Solano Project Service Area (Figure 1-2) thereby restricting the availability of water and limiting the potential for urban growth into these areas. The low-quality soils and lack of irrigation also render these areas unsuitable for intensive agriculture, which is an incompatible land use for valley floor grassland and vernal pool species. These factors justify the classification of land zoned "Agriculture" with a 160 ac residential minimum as being at moderate risk of being converted or re-zoned for development or another incompatible land use.

- Low: The low risk category corresponds to lands designated by the Solano County Orderly Growth Initiative as "Watershed." Within the "Watershed" land use designation, the maximum permitted residential density is 1 dwelling unit per 160 ac. Watershed lands are predominantly restricted to the steeper regions of the Vaca Mountains and West Hills, where slope significantly hinders development. The Cities of Vallejo and Fairfield have both adopted restrictions on development in areas where slopes exceed 30 percent. Lands with slopes greater than 30 percent are generally unsuitable for building and are thus included in the low risk category.
- Very Low: The very low risk category applies to all land that falls under the primary and secondary management zones identified by the Suisun Marsh Protection Plan, with the exception of specific areas identified for industrial or other related uses (e.g., expansion of Potrero Hills Landfill (see Section 3.5). In 1974, the California Legislature passed the Suisun Marsh Protection Act, designed to preserve Suisun Marsh from residential, commercial, and industrial development. Based on provisions included in this Act, land within Suisun Marsh is considered to be at very low risk of being converted to incompatible land uses.
- **Preserve:** This category includes Federal, State, local, and privately-owned conservation lands or lands protected by a conservation easement.

The majority of the Plan Area falls within the moderate, low, and very low risk categories (Figure 3-12). Figure 3-13 shows the breakdown of risk by vegetation type mapped for the Solano HCP (Section 3.3.1). The vegetation communities most at risk in the Plan Area are grasslands and oak savanna habitat within the Inner Coast Range, riparian vegetation, and to a lesser extent vernal pool grasslands (Figure 3-13).

The risk analysis relies heavily on County zoning restrictions set forth by the Solano County Orderly Growth Initiative. While County and local growth controls have sunset provisions and all land use regulations can be changed with voter approval, experience has shown that once passed and implemented, such urban growth management measures are unlikely to be overturned or removed (Pendall and Martin 2002; see Changed Circumstances, Section 9.7.3.7). Solano County recently updated its General Plan in 2008. The General Plan was adopted by the Board of Supervisors on August 5, 2008, and came before the voters as Measure T on the November 4, 2008, ballot. Measure T was passed by the voters, confirming the approval of the new General Plan and an ordinance to amend the Orderly Growth Initiative and extend it until December 31, 2028.



The updated General Plan continues to focus on city-centered growth and the protection of key watershed lands in the western hills and agricultural production in the eastern portions of the County consistent with the original Orderly Growth Initiative (Solano County 2005b). Therefore, any changes to the policies enacted under the Solano County Orderly Growth Initiative and any redesignation of "Agricultural" or "Open Space" land would be submitted to Solano County voters for approval. In addition, County zoning designations correspond closely with environmental conditions (e.g., soil and slope) that influence land use patterns within the County.

3.6.1 Additional City-Adopted Measures

Several city-adopted measures also restrict urban growth within the Plan Area but were not considered in the risk analysis. These measures provide additional short-term protection to certain areas that would fall within the high risk category according to the criteria described above.

3.6.1.1 Tri-City and County Cooperative Plan

An agreement between Solano County and the Cities of Benicia, Fairfield, and Vallejo resulted in the formation of the Tri-City and County Cooperative Planning Group (Group). In 1994, the Group adopted a formal plan (Tri-City and County Cooperative Plan) to protect approximately 10,000 ac of open space between Benicia, Fairfield, and Vallejo in Solano County. The goals of the plan are to protect open space, promote existing agricultural uses, offer recreational opportunities, and provide for habitat protection and restoration. The Group is a joint powers agency dedicated to planning for and protecting certain agricultural and open space lands in Solano County.

3.6.1.2 Fairfield General Plan Amendment

In June 2002, the Fairfield City Council adopted a set of comprehensive General Plan amendments designed to protect the unique character of Fairfield (City of Fairfield 2002). The Fairfield General Plan, which emphasizes the concept of maintaining a livable city, focuses growth within the UGB and protects agricultural areas outside the UGB. As amended, the General Plan protects Travis Air Force Base (AFB) by establishing the UGB, designating the Travis Reserve, and adopting policies that prohibit residential development in areas where aircraft noise exceeds 60 decibels (dB) Community Noise Equivalent Level (CNEL). In November 2003, City of Fairfield voters approved Measure L (City of Fairfield 2003). Measure L reaffirms and re-adopts the General Plan Land Use Diagram, as amended, as well as the policies creating the Travis Reserve and UGB and directing residential development away from areas affected by aircraft noise. Any change to these policies through December 31, 2020, would require voter approval, except in certain limited circumstances.

3.6.1.3 City of Benicia Measure K

In November 2003, voters in Benicia approved Measure K, an urban growth boundary initiative to prevent development in a hilly area northeast of town known as Sky Valley. As depicted on the City of Benicia General Plan Land Use Diagram, the Urban Growth Boundary was established to separate the City's urban area from the surrounding greenbelt and to maintain lands near Lake Herman and north of Lake Herman Road in permanent agriculture/open space use (City of Benicia 2003). No urban development is allowed beyond the Urban Growth Boundary. Prior to December 31, 2023, the Urban Growth Boundary, as designated, may be amended only by a vote of the people of Benicia.



3.6.2 Collinsville-Montezuma Hills Wind Resource Area

The Collinsville-Montezuma Hills Wind Resource Area (WRA) and proposed future WRA expansion lands (Figure 3-13) were also considered but not included in the risk analysis. These areas encompass the majority of the Montezuma Hills and are designated as "Agriculture" with a 160 ac minimum (moderate risk, as defined above). Wind turbines are a well-documented source of avian mortality, particularly for raptors (Howell and DiDonato 1991; Orloff and Flannery 1992; Smallwood and Thelander 2004) and may have an adverse effect on Swainson's hawk. Therefore, Swainson's hawk preserves in or adjacent to the WRA should be avoided. The Solano HCP does not want to establish preserves for Swainson's hawk within 2 mi of existing or potential commercial wind resource development (see Section 10.5.1.3). Only preserves designed specifically for California tiger salamanders and other vernal pool species could potentially be acceptable in this area.

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Figure 3-1: Biodiversity Hotspots in the Continental U.S. and Hawaii



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Figure 3-2: Major Geographical Provinces in Solano County Modified from Whittig and Janitsky (1963) as cited in Noss et al. (2002).



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Figure 3-3: Potential Historic Vegetation Based on Kuchler 1977



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Figure 3-4: Solano County Watersheds



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Figure 3-5: Natural Communities



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Figure 3-6: Vegetation and Cover Types



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Figure 3-7: Historic and Current Extent of Vernal Pool Habitat in Solano County



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Figure 3-8: Historic and Current Extent of Coastal Marsh Communities in Solano County



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Figure 3-9: Solano County Agricultural Crop Trends 1990 to 2009

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Figure 3-10: Habitat Protection in the Solano HCP Plan Area

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Figure 3-11: Protected Lands within the Solano HCP Plan Area

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Figure 3-12: Risk Analysis



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Figure 3-13: Vegetation Categories and their Relative Risk of Conversion in the Solano HCP Plan Area

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