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## **3.0 ENVIRONMENTAL SETTING, BIOLOGICAL RESOURCES AND COVERED SPECIES**

### **3.1 REGIONAL AND HISTORICAL CONTEXT**

Adapted from the report prepared by the HCP Science Advisors (Noss et al. 2002), the following section 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 section 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 in Figure 3-1. The Greater San Francisco Bay Area region, including both coastal and inland habitats, is one of the five highest peaks in the U.S. 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 resulting from the disruption of typical dispersal processes. Urban development, agriculture, roads, hydrological alterations and invasive species have profoundly affected the structure, composition, and functionality of 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).

For the purposes of this document, the major geographical provinces in Solano County have been classified according to the system utilized by the United States Department of Agriculture (USDA) in the Soil Survey of Solano County (Bates et al. 1977). Each major division contains important ecological subdivisions.

**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). Part of the Coast Range, the mountains and hills of Solano County 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 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.** This region 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 feet 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 50 cm 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 pre-agricultural conditions (Burcham [1957] as cited in Bates et al. [1977]).

**3.1.2.3 Alluvial Fans, Terraces, and Basins.** This province comprises a significant portion of Solano County, including most of the valley floor and has 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 sub-regions and associated habitats are described below:

**Well Drained to Poorly Drained Recent Alluvial Fans and Basin Deposits.** This region, often referred to as Dixon Ridge (Figure 3-2), is located in the northeastern quarter of Solano County 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.** This region consists primarily of older alluvial fan deposits that have been incised by streams and elevated above the major drainage systems of the region; younger deposits, described above, are also located in this region. This landscape can be divided into two distinct landscapes based on their geologic age and hydrology.

**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 Claypan Vernal Pool habitat types (classifications based on Holland 1986, see Section 3.3.2 for additional information).

**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 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 (NaHCO<sub>3</sub>) 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 installation of large pumping plants, tidal gates, etc. lowered the ground water 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 feet 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 (Figure 3-4).

**3.1.2.5 Suisun Bay Marshlands.** Located adjacent to Suisun Bay, the Suisun 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).

### **3.2.2 Hydrology**

Solano County is divided into two drainage regions or Drainage Provinces (State of California, Department of Water Resources [DWR]) (Figure 3-5). 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 in Figure 3-5.

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 0.3-5 inches of annual runoff while the western mountains receive 3-20 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. However, much of the native habitat in the County has been impacted or modified by historical agricultural activities and development associated with recent population and industrial growth that have resulted in the large-scale introduction and spread of non-native plant species and loss of native habitats. Nevertheless, many native habitats still exist and Solano County still supports a rich mosaic of natural communities.

Native habitats found in Solano County include upland and seasonally wet grasslands/vernal pools, fresh and saltwater marshes, riparian forests and scrub, oak woodland, chaparral, and open water. Interspersed with these native habitats are several non-native plant communities including non-native annual grasslands, agricultural lands, and developed areas. Native communities are dominated by a large component of non-native species (e.g., the prevalence of non-native annual grasses in oak woodlands and grassland communities).

CDFG and CNPS have identified several native plant communities that are rare and/or diminishing within California. These communities represent important biological resources and are unique to California. While they have no legal, protective status, impacts to these plant communities may be considered "significant" under CEQA. Sensitive plant communities identified by CDFG in Solano County are Coastal and Valley Freshwater Marsh, Coastal Brackish Marsh, Northern Coastal Saltmarsh, Northern Claypan Vernal Pool, Northern Hardpan Vernal Pool, and Valley Needlegrass Grassland (CNDDDB) (CDFG 2001).

### **3.3.1 Habitat Mapping and Classification**

Baseline mapping relied on existing sources of information to categorize and map the various habitat types and land uses within the County. Mapping was completed using a GIS-based format (ArcInfo/ArcView) compatible with USFWS and USBR systems. After evaluating previous mapping

efforts, a useful base map was generated by merging the existing SCWA base map with the appropriate USGS 7.5-minute topographic quadrangles.

Existing data for Solano County habitat types and land uses was 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 habitats. To ascertain more detailed information on natural habitats, two sets of aerial imagery (1999 aerial photographs at a scale of 1" equals 2,000 ft) were 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.

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 foot outside of urban areas).

The following habitats and land uses were included in the baseline mapping. Where possible, the primary categories were subdivided to provide more detailed classifications/special modifiers for identifying threatened, endangered, and special-status species habitats.

The basic habitat categories and modifiers include:

Agriculture

- Row crop
- Orchard
- Irrigated hay/pasture
- Dryland farmed
- Agricultural bay land (agricultural lands within the historic marsh margin of the estuary)

Grassland

- Vernal pool/swale complexes
  - Northern hardpan
  - Northern claypan
- Moist grassland
- Annual grassland
- Ruderal

Marsh

- Shallow and deep bay/channel
- Tidal flat
- Tidal marsh

- Salt marsh
- Brackish marsh
- Diked wetland
- Freshwater marsh

#### Riparian

- Scrub-shrub
- Woodland/forest
- Herbaceous

#### Open Water

- Lakes
- Ponds
- Storage or treatment ponds
- Rivers
- Streams and creeks
  - Perennial
  - Intermittent

#### Woodland

- Oak woodland
- Oak savanna
- Mixed evergreen

#### Scrub/Chaparral

#### Urban

- Developed (commercial, industrial, and residential development at a density greater than 1 unit/acre)
- Undeveloped lots
- Rural residential (residential densities at a density of 1 dwelling unit/acre to 1 dwelling unit/10 acres)

The habitat/vegetation community base map (Figure 3-4) shows only the broader community types, not the sub-types.

### **3.3.2 Plant Community Descriptions**

Brief descriptions of the plant communities found within the Plan Area are provided below. Table 3-1 gives the extent of each community within the Plan Area.

**3.3.2.1 Grasslands.** 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 non-native species and livestock grazing following European settlement in the mid-19<sup>th</sup> century have substantially reduced or eliminated most of the native grasses in California, including Solano County. As a result, non-native grassland, characterized by non-native

and native grasses and non-native forb species, has largely replaced native grassland and is currently the dominant grassland community in Solano County.

While this broad category contains a number of recognized grassland community types, for the purposes of the HCP, grasslands in Solano County were divided into two primary associations - Inner Coast Range and Valley Floor Grassland – based on land form and geographic region. The Valley Floor association contains a further subdivision to identify vernal pool associations (based on soil types). Descriptions of these communities are included below.

**Grasslands within the Inner Coast Range.** Grasslands associated with dry conditions fall into this category; these grasslands typically occur on hillsides, slopes, ridges, and flat areas with well-drained soil within the Inner Coast Range and foothill terraces. Non-native grass and forb species are well adapted to colonize and persist in disturbed landscapes and, as a result, out-compete native species. The introduction of these non-native species, along with grazing and agriculture, has resulted in the widespread dominance of annual non-native grasses and forbs in most of the grasslands in Solano County. These non-native species also characterize the upland grassland community. This grassland community is common in southwestern Solano County, but also occurs within other communities, including oak woodland/oak savanna, on levees within marsh communities, and in agricultural and developed areas (mapped as Ruderal Disturbed). This community corresponds with the “Non-native Grassland” community identified by Holland (element code 42200, Holland 1986).

Common non-native grassland/ruderal species in Solano County include: wild oats (*Avena* spp.), bromes (*Bromus diandrus*, *B. hordeaceus*), hare barley (*Hordeum murinum* ssp. *leporinum*), 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 non-native 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.).

Despite the large-scale introduction and spread of non-native grasses and forbs, some native, perennial grasses persist as small patches or intermixed stands with non-native grasses depending on various environmental factors and the severity of disturbance. 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).

Typical native grass species include purple needlegrass (*Nassella pulchra*), one-sided blue-grass (*Poa secunda*), California fescue (*Festuca californica*), and creeping wildrye (*Leymus triticoides*). Other grasses that occur in lesser densities include blue wild-rye (*Elymus glaucus*) in shady areas, such as in the understory of oak woodland/oak savanna and melic grasses (*Melica* spp.) and nodding needlegrass (*Nassella cernua*), which commonly grow in dry, often rocky grasslands. Wildflowers (forbs) often found in grasslands with a native component include yarrow (*Achillea borealis*), sanicles/snakeroots (*Sanicula* spp.), California dandelion (*Agoseris grandiflora*), California goldfields, brodiaeas (*Brodiaea* spp., *Triteleia* spp. *Dichelostemma* spp.), and mariposa lilies (*Calochortus* spp.).

**Valley Floor Grasslands.** While both the Inner Coast Range and Valley Floor Grassland communities share many of the same plant species (particularly introduced annual grasses and forbs), the historical function, association of natural communities, and importance for Covered Species differentiate these two community associations. The Valley Floor Grasslands are dominated by two, typically intermixed associations: vernal pool grasslands and grasslands associated with the low hills (Montezuma Hills and Potrero Hills) and upper terraces along the valley floor.

The vernal pool grassland association is characterized by large expanses of seasonal wetlands formed in soils where dense clays beneath the soil surface impede water infiltration. Within the vernal pool grasslands, wetland vernal pool and swale plant communities comprise a small portion (5 to 50 percent) of the broader grassland matrix. Vernal pool habitats are often found in 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 and between 1994 and 1997 the rate of loss as continued at 1.5 percent per year (Solano County Farmlands & Open Space Foundation 2001). Historically, Solano County supported approximately 118,000 acres of potential vernal pool grassland (Figure 3-6). Currently, approximately 51,000 acres of potential vernal pool grassland habitat remain (43 percent of the historical potential) (Figure 3-6), although much of the remaining vernal pool habitat has been highly disturbed as a result of past land use practices (Figure 3-6).

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.

**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** (element code 44110, Holland 1986) occur in a relatively small area north of Vacaville (Figure 3-6) 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) as 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 a paintbrush (*Castilleja campestris*).

Other types of seasonal wetlands are also present in the Plan Area. Seasonal wetlands are typically distinguished from vernal pools by a longer or altered hydrology, the presence of more persistent emergent vegetation dominated by taxa of species 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.

The characteristic dominant species in the broader upland grassland matrix of vernal pool habitats includes many of the same introduced annual grasses and forbs that characterize upland grasslands including wild oats, various bromes and barleys (*Bromus* spp. and *Hordeum* ssp.), Italian wildrye, filarees, mustards, wild radish, mallows, vetches, and starthistles. In portions of Solano County, particularly in the Montezuma Hills, Valley Floor Grasslands are 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 rather than the primarily irrigated agricultural community described below (note that the HCP habitat mapping distinguished cultivated grasslands from non-cultivated lands as a component of the baseline mapping).

The Valley Floor Grassland and Vernal Pool Conservation Strategy also incorporate several other recognized plant communities: alkali playa, alkali meadow, and chenopod scrub. These community types often support similar species to and often intergrade with vernal pools in Solano County (the Northern Claypan Vernal Pools tend to exhibit some alkalinity), but several plant species are found exclusively in these communities. The level of detail provided by the HCP habitat mapping is not sufficient to distinguish these community types from the broader vernal pool/seasonal wetland habitat type.

The **Alkali Playa** 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. This type of community, which includes **Chenopod Scrub**, is commonly found in closed basins in deserts but also occurs in the Central Valley. Vegetation in this community consists of low-growing, grayish, small-leaved, often succulent shrubs that grow to 1 meter in height, although in Solano County the height

averages less than ½ meter. 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** 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 non-native grassland and Northern Claypan Vernal Pools on drier, less alkaline soils. Characteristic species of this 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., 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.

**3.3.2.2 Marshes and Other Wetlands.** Within Solano County, 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 from less than a foot to over 12 feet in height. These marsh communities include marshes with relatively natural hydrological regimes (e.g., tidal influence) as well as marshes with highly altered, managed hydrologic systems.

**Northern Coastal Salt Marsh.** Northern Coastal Salt Marsh is restricted to the upper intertidal zone of protected shallow bays, lagoons, and estuaries. Salt marsh is a highly “productive” plant community consisting of plants that are tolerant of saline soils and regular tidal inundations. The diking and filling of marshlands for agriculture and development in the 19<sup>th</sup> and 20<sup>th</sup> 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 3-7 shows both the historic extent of marshland communities and the current marshland communities within Solano County.

The salt marsh community is composed of relatively low-growing plants, ranging in height from a few inches to about three feet. Small differences in elevation along the marsh edges affect the frequency and duration of tidal flooding and change the plant composition in these areas. This community corresponds to the Northern Coastal Salt Marsh community identified by Holland (element code 52110, Holland 1986).

Typically, bare mudflats are bordered by pure stands of the native cordgrass (*Spartina foliosa*) that are replaced by a dense cover of pickleweed (*Salicornia virginica*) at the mean high water level. In the last 20 years, several invasive non-native cordgrasses (*Spartina 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. Non-native cordgrass readily hybridize with native cordgrass and threaten the natural ecology of the San Francisco Bay.

Characteristic salt-tolerant plants of the upper pickleweed zone include alkali heath (*Frankenia salina*), marsh rosemary (*Limonium californicum*), jaumea (*Jaumea carnosa*), sand-spurreys (*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.

Coastal salt marsh vegetation exhibiting the typical characteristics described above is present along San Pablo Bay and Suisun Bay. Coastal salt marsh communities also occur in tidal and non-tidal or diked variants. 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 Valley and Freshwater Marsh.** Typical freshwater marsh develops in shallow, standing or slow-moving water at the edge of ponds and streams, and at other sites that lack currents and are permanently flooded by fresh water. This community corresponds to the Coastal and Valley Freshwater Marsh community identified by Holland (element code 52410, Holland 1986).

This plant community is typically dominated by up to 12-foot 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*).

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.

**Coastal Brackish Marsh.** 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. This community corresponds to the Coastal Brackish Marsh community identified by Holland (element code 52200, Holland 1986).

Brackish marsh generally contains similar species to both coastal saltmarsh and freshwater marsh and is typically dominated by perennial, emergent, herbaceous plants up to two meters in height. The most common species are cattails (*Typha* spp.) and species of bulrush (*Scirpus* spp.), especially alkali rush (*Scirpus robustus*). Depending on the salinity, other species of sedge (*Carex* spp.), rush (*Juncus* spp.), pickleweed, and others, may be present.

In Solano County, brackish marsh is extensively developed around Suisun Bay in Solano County, including Suisun Marsh, 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 habitat values (nesting, feeding, resting, and hunting). 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.

**3.3.2.3 Riparian Vegetation.** 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 areas, known for high species diversity and productivity, are distinct from surrounding communities due to soil and vegetation characteristics that are strongly influenced by presence of water. 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 habitats are very important biologically because they support a great diversity of plant and animal species, providing wildlife with important food, cover, and breeding sites in close proximity to water. Many animal species are restricted to riparian habitats, especially migratory and resident birds and many amphibians.

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. Their biological importance, especially for declining animal species that depend on it, have made preservation of riparian habitats a focus for many conservation efforts.

**Riparian Woodland.** Riparian woodland is dominated by winter-deciduous, broadleaved trees, up to 60 feet 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 (*Quercus lobata*) 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 (*Quercus agrifolia*) and California bay (*Umbellularia californica*) 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 might include: Great Valley Cottonwood Riparian Forest (element code 61410), Great Valley Mixed Riparian Forest (element code 61420), Great Valley Oak Riparian Forest (element code 61430), White Alder Riparian Forest (61510), and Central Coast Live Oak Riparian Forest (element code 61220; Holland 1986).

Riparian areas in Solano County have been severely degraded as a result of residential, commercial, and agricultural development. Although the structure (i.e., vertical stratification of the riparian vegetation) has been maintained along some of the major streams in the County, the widths of riparian corridors have been greatly reduced due to human activities and are now

commonly only as wide as the diameter of one tree's canopy. In addition, sections of most major streams have been channelized and the natural riparian vegetation removed.

Well-developed riparian plant communities are limited to small portions along the banks of major creeks such as Putah Creek, Alamo Creek, Ulatis Creek, Dan Wilson Creek, Green Valley Creek, Ledgewood Creek, and Suisun Creek. In those remaining well-developed riparian areas, the tree canopy is dominated by Fremont's cottonwood (*Populus fremontii*) and willows, including red willow (*Salix laevigata*), Pacific willow (*S. lucida* ssp. *lasiandra*), arroyo willow (*S. lasiolepis*), and sandbar willow (*S. exigua*), but other trees associated with riparian areas are also present. Scattered stands of willows and riparian shrubs (see below) are present along other minor streams and drainages.

**Riparian Scrub.** Riparian vegetation typically contains a layer of 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 (*Salix* spp.), 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 (*Toxicodendron diversilobum*), 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).

**Levees.** Over the last century or more, numerous levees have been created in Solano County for flood protection and water transport, primarily for agricultural use. While these levees contain ample water to support riparian vegetation, vegetation is typically cleared for maintenance purposes. As a result, few trees or shrubs exist and vegetation consists primarily of the non-native grasses and forbs typically associated with upland situations and a few water tolerant species in more saturated zones. Vegetation is maintained through mowing and spraying of herbicides to maintain levee integrity.

Presently, stands of willows (commonly *Salix lasiolepis* and *S. gooddingii*) occur in scattered areas on and near the water's edge of some levees. Depending on the geographical location of the levee and the salt concentration of the waterbody, herbaceous species adapted to fresh or salt water are present.

**3.3.2.4 Oak Woodland/Oak Savanna.** While both oak woodland and oak savanna are dominated by oaks (*Quercus* spp.), 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. These plant communities include broadleaved upland forest and cismontane woodland, as designated by CNPS (2001). Similar communities identified by Holland 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; Holland 1986).

Oak woodlands, while not as diverse floristically, support an unusual diversity of animal species as a result of the many resources that oaks provide, including nesting sites and abundant food (i.e., large acorn crops). Many oak woodlands have been lost due to intensive agriculture and urban development and oak woodlands that do persist have been significantly altered, as evidenced by the predominance of non-native 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 non-native grasses.

**Oak Woodland.** 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 (*Quercus agrifolia*), a broad-crowned, evergreen tree up to 75 feet tall, and blue oak (*Q. douglasii*), a deciduous oak up to 60 feet tall, commonly dominate oak woodlands of Solano County. Other broad-leaved, evergreen or deciduous trees, including interior live oak (*Q. wislizenii*), 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 (*Ribes* spp.), woodland rose (*Rosa gymnocarpa*), poison oak (*Toxicodendron diversilobum*), and California hazelnut (*Cornus cornuta* var. *californica*). A variety of native grasses, forbs and ferns may also be present including California fescue (*Festuca californica*), blue wildrye (*Elymus glaucus*), hound's-tongue (*Cynoglossum grande*), Dutchman's pipe (*Aristolochia californica*), Pacific pea (*Lathyrus vestitus*), California polypody (*Polypodium californicum*), goldback fern (*Pentagramma triangularis*), and woodfern (*Dryopteris arguta*).

Oak woodland is one of the dominant plant communities in the Vaca Mountains at the eastern edge of the Coast Range.

**Oak Savanna.** The canopy cover in oak savanna typically ranges from 10 to 30 percent. In Solano County, dominant oak species include valley oak (*Quercus lobata*), growing on deep, alluvial soils on the Central Valley floor, and blue oak (*Q. douglasii*) and Oregon oak (*Q. garryana*), occurring on shallow soils and in xeric areas at higher elevations. Blue oak savanna commonly grades into blue oak woodland. In areas grazed by livestock, the shrubby understory in oak savanna is poorly developed, if present. In such areas, the herbaceous understory consists of non-native grasses and forbs; however, native wildflowers and grasses may 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.

**3.3.2.5 Mixed Chaparral/Scrub.** Scrub/chaparral communities are characterized by dense growth of low-growing scrub and brush species. Solano County supports two basic scrub communities.

**Northern Mixed Chaparral.** Northern Mixed 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 four meters 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*).

**Scrub.** 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 (*Artemisia californica*) and sticky monkey flower (*Mimulus aurantiacus*) on dry sites.

**3.3.2.6 Agricultural Lands.** Approximately 57 percent of Solano County lands are in agricultural cultivation. Even when taken out of active production, agricultural land supports very few native plants. The majority of non-cultivated species are ruderal, weedy grass and forb species. The value of these lands for wildlife depends on the vegetation characteristics, cultivation practices, and flooding regimes conducted in these agricultural areas

**Croplands (Intensive Agriculture).** Croplands are typically established on flat terrain with fertile soils and require extensive manipulation in terms of soils, irrigation, crop rotation, and fertilization. Croplands are usually grown in a monoculture, using tillage or 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. Agricultural fields cover the northeastern/eastern portion of Solano County, including the diked areas of the Delta.

Within Solano County, agricultural lands provide important habitat for numerous raptors, including burrowing owl (*Athene cunicularia*) and Swainson's hawk (*Buteo swainsoni*).

**Cultivated Grassland/Dry-land Farming.** A less intensive form of agriculture is conducted in the Montezuma Hills and in a few other areas in Solano County where irrigation water is not readily available and/or the topography is not suitable for irrigation. In dry-land farming areas, periodic fall tillage and seeding is employed to grow various crops, including oats (*Avena* sp.),

barley (*Hordeum* sp.), and wheat (*Triticum* sp.). In these areas, few native herbaceous species remain.

Cultivated grassland and dry-land farming areas are similar to the non-native annual grasslands described above and provide similar wildlife habitat. Therefore, conservation measures for these dry-land agricultural areas are incorporated into the applicable Upland or Valley Floor Grassland Community Conservation Strategy.

**3.3.2.7 Developed Areas.** Urban areas occur throughout Solano County and are concentrated along Interstate 80, the main transportation artery that runs northeast to the southwest. Urban vegetation consists of non-native, 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.

For the Solano HCP, two urban habitat 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 acres) and may contain remnants of native or naturalized plant communities. However, human activities, development, and ornamental vegetation typically dominate these areas.

## 3.4 COVERED SPECIES

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 CESA, ESA, or other state or federal regulations (see Section 1.6), and 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 ESA.

- 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 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.
- 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 within the Plan Area whose conservation, if such species were verified in the future, would be best addressed through individual, site-specific protection measures and consultation with the Resource Agencies.

Based on these additional criteria, the initial list of 92 species was pared down to 35 species to be covered under the HCP. 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 bringing the total to 37 species (Table 3-2).

Of the 37 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 3 animal species are listed as California Species of Special Concern by CDFG (Table 3-2). The three California Species of Special Concern are burrowing owl, Suisun song sparrow, and tricolored black bird. The last species, the mid valley fairy shrimp, was proposed for federal listing in 2001, but the listing was found to be not warranted at that time. As it may warrant listing in the future, it was kept on the Covered Species list.

Table 3-2 lists the 37 Covered Species and provides information on their 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 that will be covered under the federal Section 10(a)1(B) “incidental take permit” will be covered by the State Permit issued under Section 2081 of the California Fish and Game Code. Twelve (12) species are currently listed as either threatened or endangered under CESA and two species are candidates for listing (Table 3-3). These 14 species are the only species that will 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), take authorization is only being requested for Covered Activities associated with efforts to recover the species, such as habitat management, enhancement and restoration (see Section 2.5.5). The two plant species, soft bird's-beak and Mason's lilaopsis, that are listed as rare under the Native Plant Protection Act (NPPA) of 1977 (California Fish and Game Code Section 1900-1913) are not included in CESA and therefore, can not be included in the State Incidental Take Permit under Section 2081. For these two species, the Plan Participants are requesting a formal agreement, such as a Memorandum of Understanding, with CDFG for impacts to these species resulting from Covered Activities.

### **3.4.2 Special Management Species**

Special Management Species represent those special-status plants and animals that are considered under CEQA to be threatened or endangered (CEQA Guidelines 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, sufficient information on their life history and management is not available to allow the federal agencies (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 nonfederal landowners participating in habitat conservation planning under the ESA 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 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 Sections 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 the 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 1-2). 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 Section 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 acres of open space lands are located within the Plan Area (Figure 3-8), roughly 13 percent of the Plan Area. These open space lands range in size from a

few acres to thousands of acres such as CDFG's Grizzly Island Wildlife Management Area at over 8,500 acres. Figure 3-9 shows the extent of existing reserves and preserves within the Plan Area.

Reserves and preserves have been designated into four categories: conservation lands, open space lands, individual mitigation projects 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 natural resources. 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. Examples include lands with conservation 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. Finally, mitigation banks are commercial or privately operated sites, or 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. Mitigation banks were included as a separate category because several of these established banks may provide habitat mitigation under the Solano HCP. 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 3-8 and 3-9 indicates that coastal marsh habitat currently has 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 acres 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 to preserve the Marsh for future generations. The Act directed 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 3-9). The primary management zone encompasses 86,000 acres of tidal marsh, managed wetlands, adjacent grasslands, and waterways under the jurisdiction of BCDC. The secondary management zone encompasses approximately 22,000 acres 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.

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 3-8).

Substantial areas of vernal pool grassland, upland grassland and oak woodland/savanna habitats have also been preserved by public entities and conservation groups (Figure 3-8). 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 3-10.

**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 Limit Lines 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 Urban Limit Line, as outlined in

Figure 2-1, minus the area in Fairfield designated as Travis Reserve, was 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. 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.

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 acres. Based on the Solano County Orderly Growth Initiative, land within any of these four agricultural designations may be re-designated as “Rural Residential” (maximum density of one unit per 2.5 to 10 acres) 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 re-designation density will not interfere with existing agricultural practices.

For the risk analysis, lands designated as “Agriculture” with a 20 acre minimum residential density were considered to have limited viability for agricultural uses. These lands 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 (i.e., conversion to orchards or vineyards) and development of wind resources. 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 acres, (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 acre 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 acre 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 (Measure A), prime agricultural land, as defined by California Government Code Section 51202 (the California Land Conservation Act of 1965, also known as the Williamson Act), can not be re-designated as rural residential. Therefore, all 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 acre 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, an incompatible land use for valley floor grassland and vernal pool species. These factors justify the classification of land zoned “Agriculture” with a 160 acre 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 one dwelling unit per 160 acres. Watershed lands are predominantly restricted to the steeper regions of the Vaca Mountains and West Hills where slope significantly hinders development. 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 (Suisun Marsh Program 2005) (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 federally, state, locally 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 3-10). Figure 3-11 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 3-11).

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 the cities of Benicia, Fairfield and Vallejo and Solano County 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 acres 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 Urban Limit Line and protects agricultural areas outside the

Urban Limit Line. As amended, the General Plan protects Travis Air Force Base by establishing the Urban Limit Line, designating the Travis Reserve, and adopting policies that prohibit residential development in areas where aircraft noise exceeds 60 dB Community Noise Equivalent Level (CNEL). In November 2003, City of Fairfield voters approved Measure L (City of Fairfield 2003). Measure L reaffirms and readopts the General Plan Land Use Diagram, as amended, as well as the policies creating the Travis Reserve and Urban Limit Line 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 3-10) 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 acre minimum (moderate risk, as defined above). The WRA was considered in the risk analysis because 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 affect on Swainson's hawks. However, it was determined that this area should not be protected from conversion; rather Swainson's hawk preserves in or adjacent to the WRA should be avoided. Therefore, it was not officially included in the risk analysis. It is unknown to what degree future expansion of the WRA (i.e., Shiloh II Project Area, proposed expansion north of Highway 12) may affect Swainson's hawks, but the Solano HCP does not want to establish preserves for Swainson's hawks adjacent to existing or potential Wind Resources. Only preserves designed specifically for California tiger salamanders (*Ambystoma californiense*) and other vernal pool species would be acceptable in this area.

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

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

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

Figure 3-4: Vegetation and Cover Types

Figure 3-5: Solano County Watersheds

Figure 3-6: Historic and Current Extent of Vernal Pool Habitat in Solano County

Figure 3-7: Historic and Current Extent of Coastal Marsh Communities in Solano County

Figure 3-8: Habitat Protection in the Solano HCP Plan Area

Figure 3-9: Protected Lands within the Solano HCP Plan Area

Figure 3-10: Risk Analysis

Figure 3-11: Vegetation Categories and their Relative Risk of Conversion in the Solano HCP Plan Area

**Table 3-1: Vegetation/Community Cover Types within the Solano HCP Plan Area**

**Table 3-2: Solano HCP Covered Species List**

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**Table 3-3: Species Covered Under the State 2081 Permit**