CHAPTER 3. ECOLOGICAL BASELINE CONDITIONS

3.1 INTRODUCTION

This chapter describes the current environmental conditions present in the Butte Regional Conservation Plan (BRCP) Plan Area and other information specific to meeting the requirements of the federal Endangered Species Act (ESA) and Natural Community Conservation Planning Act (NCCPA). The ecological information presented in this chapter will be used to identify the potential impacts of covered activities on proposed covered species and natural communities and to develop measures to address impacts on and conservation of covered species and natural communities. Section 3.2, *Geographic Scope*, describes the geographic extent of the BRCP Plan Area; Section 3.3, *Environment*, describes the general physical environmental conditions of the Plan Area; Section 3.4, *Land Cover Type Mapping*, defines the land cover types present in the Plan Area and describes how they were delineated; Section 3.5, *Covered Natural Communities*, describes the ecological attributes and functions of the covered natural communities; Section 3.6, *Proposed Covered Species* and Appendix A, *Covered Species Accounts*, describe the covered species selection process and the status of the proposed covered species, respectively; Section 3.7, *Local Concern Species* and Section 3.8, *Migratory Deer Herds in the Plan Area* focus on additional species of special concern within the Plan Area; and Section 3.9, *Extent of Potential Jurisdictional Wetlands and Other Waters in the Plan Area* describes the extent of wetland and aquatic land cover types that may be regulated under Section 404 of the Clean Water Act (CWA).

Figures depicting physical and biological attributes of the Plan Area include the boundaries of Conservation Acquisitions Zones (CAZs). The design and purpose of the CAZs are described in Section 5.2.3.3, *Landscape Context—Conservation Acquisition Zones*. The CAZs are shown for reference because they were used to develop the Conservation Strategy described in Chapter 5 and to conduct the impact analysis described in Chapter 4, *Impact Assessment and Estimated Level of Take*.

3.2 GEOGRAPHIC SCOPE

The Plan Area is shown in Figure 3–1, *Butte Regional Conservation Plan Conservation Acquisition Zones (CAZ)* (see separate file) and encompasses 564,203 acres (228,352 hectares) of land.[1] The Plan Area includes the western lowlands and foothills of Butte County bounded on the west by the County's boundaries with Tehama, Glenn, and Colusa counties; bounded on the south by the boundaries with Sutter and Yuba counties; bounded on the north by the boundary with Tehama County; and bounded on the east by the upper extent of landscape dominated by oak woodland natural communities. The eastern oak woodland boundary is defined by a line

[1] Note that this value is 16 acres less than the total Plan Area acreage shown in Tables 3-5 and 5-3. This 0.005 percent difference is attributed to the difference between the total acreage present within the Plan Area boundary and calculating the sum acreage of several thousand land cover type polygons that comprise the Plan Area as shown in Tables 3-5 and 5-3.

below which land cover types dominated by oak trees comprise more than one-half of the land cover present (referred to hereafter as the oak zone) plus a small portion of the City of Chico that extends above the oak zone. The upper elevation range of the oak zone varies from about 800 to 1,500 feet above mean sea level.

Typically oak tree–dominated land cover types are replaced with either chaparral or conifer-dominated land cover types at higher elevations. Although the Plan Area includes portions of the Sacramento River within Butte County, the BRCP does not address activities that could affect listed fish species in the Sacramento River; such activities are addressed under other regional conservation planning efforts for the Sacramento River (e.g., the Anadromous Fish Restoration Program). The Sacramento River floodplain within Butte County is included in the BRCP for implementing conservation measures for covered species and natural communities.

The Plan Area was designed to encompass the area within which covered activities would be implemented and to provide sufficient land and resources to implement measures to provide for the conservation of covered species and habitats impacted by the proposed covered activities.

3.3 PHYSICAL ENVIRONMENT

3.3.1 Data Sources

Data sources used to describe the physical environment of the Plan Area include the following:

- Geologic Map of Chico Quadrangle (California Department of Conservation 1992);
- Geology Map of California (Saucedo et al. 2000);
- Late Cenozoic Tectonism of the Sacramento Valley, California (Harwood and Helley 1987);
- The Red Bluff Pediment – A Datum Plane for Locating Quaternary Structures in the Sacramento Valley, California (Helley and Jaworowski 1985);
- Geologic Map of the Late Cenozoic Deposits of the Sacramento Valley and Northern Sierran Foothills, California (Helley and Harwood 1985);
- Soil Survey of Butte Area, California, Parts of Butte and Plumas Counties (Natural Resources Conservation Service [NRCS] 2006);
- Big Chico Creek Existing Conditions Report (Big Chico Creek Watershed Alliance 1999);
- Butte Creek Existing Conditions Report (California State University [CSU] Chico 1998);
- Department of Water Resources Lake Oroville website; and
- Various other technical reports and documents.

3.3.2 Topography

Elevation within the Plan Area generally ranges from about 100 feet above mean sea level along the west boundary of the Plan Area to approximately 1,500 feet associated with the foothills of the Sierra Nevada and Cascade Mountains to the east (see Figure 3–2, *Topography of the Plan Area* [separate file]).

The lowest elevation in the Plan Area is 46 feet and the highest elevation is 2,073 feet. Topography of the Plan Area is generally defined by discrete geological features: Central Valley, alluvial fans and terraces, and foothills of the northern Sierra Nevada and southern Cascade Mountains.

The western part of the Plan Area is naturally flat valley basin topography with the Sacramento and Feather rivers (and their tributaries) cutting channels across the Plan Area. Most of the valley basin that occurs within the Plan Area has been artificially leveled to accommodate agricultural production. Agriculture-related infrastructure maintains irrigation and natural drainage flowing across the valley for agricultural use. Most of the valley in this area gently slopes to the southwest.

The elevation within the Plan Area increases to the east, and the slope of the landscape more noticeably increases with a western facing aspect. The foothills of both the southern Cascade and the Sierra Nevada ranges are gradually undulating features ranging in elevation from the valley basin at approximately 100 feet to 1,500 feet above mean sea level within the Plan Area. Like the mountain ranges, the foothills run north-south and can be most easily discerned from northeast of the City of Chico to south of Lake Oroville. The sole exception to this pattern is the east-west distribution of the Lovejoy basalt that formed Table Mountain. Major streams have cut deep valleys with steep sides through the foothill terrain.

A description of landforms and geology within the Plan Area is included as Section 3.3.5, *Geology and Soils*.

3.3.3 Climate

Climate within the Plan Area is temperate, annually averaging about 46.5 degrees Fahrenheit (°F) during winter and 75.4 °F during summer at elevations below 1,500 feet in Butte County. Mean annual air temperatures range from about 60 °F to 62 °F (see Figure 3–3, *Mean Annual Air Temperature (Fahrenheit)* [separate file]). The coolest months of the year are January and December, with minimum low temperatures of about 35 °F at Chico and 37 °F at Oroville. The warmest months of the year are July and August, with average high temperatures ranging from about 93 °F at Chico to 95 °F at Oroville. The average annual number of frost-free days in the Plan Area ranges from about 240 to 260 days (see Figure 3–4, *Frost-Free Days (above 32 degrees F)* [separate file]) (NRCS 2006).

Precipitation is almost exclusively from rainfall and annually averages about 26 inches at Chico and 30 inches at Oroville. Figure 3–5, *Mean Annual Precipitation in Inches (Based on the 30-year period from1951-1980)* (see separate file) shows average annual distribution of precipitation for the Plan Area and Butte County. About 90 percent of the annual precipitation is received from October through April, with the greatest average amount of monthly precipitation occurring in January (NRCS 2006).

3.3.4 Watersheds

The Plan Area lies within the Sacramento River Basin. Plan Area watersheds that are tributary to the Sacramento River include those of Big Chico Creek, Butte Creek, Dry Creek, Honcut Creek, the Feather River, and the Sutter Bypass. Watersheds of the Plan Area are defined in the USGS National Hydrography Dataset (2012). The classifications of watersheds are hierarchical and are shown at the hydrologic area level for the Plan Area in Figure 3–6, *Hydrologic Units of the Plan Area* (see separate file). The Plan Area includes portions of 11 watersheds, the largest of which is the Butte Basin watershed that drains 165,636 acres of the Plan Area. Table 3–1, *Watersheds Present in the Plan Area (10-digit HUC)* summarizes the drainage area of each watershed within the Plan Area.

Table 3-1. Watersheds Present in the Plan Area (10-digit HUC)

Watershed	Acres
Angel Slough	39,153
Big Chico Creek	8,842
Gilsizer Slough-Snake River	21,819
Honcut Creek	88,590
Jewett Creek-Sacramento River	8,017
Lower Butte Creek	165,636
Lower Feather River	210
Lower Middle Fork Feather River	1,149
Lower North Ford Feather River	2,124
Middle Butte Creek	89,965
Mud Creek	52,602
Pine Creek	30,824
Sacramento River	6,242
Upper Feather River	47,171
West Branch Feather River	1,860
Total	**564,204**

Source: USGS National Hydrography Dataset (NHD) (2012).

3.3.5 Geology and Soils

3.3.5.1 Geology and Landforms of the Plan Area

The Plan Area occurs at the junction of several distinct landforms and geological features, including a large section of wide and relatively level valley alluvium, which is linked to the eastern Cascade and Sierra Nevada mountain ranges by foothills of volcanic lahars and volcanic mudflows. The Plan Area includes portions of the Great Valley, Cascade Range, and the Sierra Nevada geomorphic provinces.

The western half of the Plan Area, dominated by the floodplains, basins, and fans of the Sacramento Valley, is characterized by Holocene and Quaternary sedimentary rocks and alluvium (Helley and Harwood 1985, California Department of Mines and Geology [CDMG]

2000[2]). The generally flat sections encompassing the Valley extend east-west approximately 10 miles and north-south approximately 50 miles within the Plan Area. Most areas within the Valley (outside of the active or recently active river channels) have been leveled for agricultural production because of the excellent soil properties on the floodplains (NRCS 2006).

East of the Valley, the northeastern section of the Plan Area is dominated by foothills associated with the southern Cascade Range (northeast and east of Chico). The foothills are characterized by Tertiary volcanic mudflows (Tuscan Formation) with small inclusions of Cretaceous marine sedimentary rocks near the eastern boundary. The foothills are marked by a series of dissected ridges of breccias, sandstones, and conglomerates cut by numerous creeks, including Pine, Rock, Mud, Sycamore, Big Chico, Little Chico, Butte, Little Butte, Little Dry, Clear, and Dry Creeks (NRCS 2006). The foothills north of the Feather River are geologically distinct from the southern foothills in that they originated from volcanic- and pyroclastic-derived mudflows associated with the Cascade Range. They also have been abruptly elevated above the valley plain by the Chico monocline with the effect diminishing to the south (Harwood and Helley 1987).

The southeastern part of the Plan Area is associated with the Sierra Nevada foothills. The foothills of the Sierra Nevada are also dominated by large sections of igneous and metamorphic rocks, volcanic mud flow features, and are generally older in origin (Paleozoic–Mesozoic) than the Cascade foothills to the north. Continuing eastward, the higher foothills are present as large complexes of Mesozoic granitic basement rock.

The distinctive geology of this area has produced a series of physiographic features, including most notably foothills covered with large stands of mature oak woodland slowly eroding and draining west into expanses of low relief; slow-draining grasslands at the base of the eastern foothills; and wide, flat valley floor lands fed by high precipitation rates in the Cascade and Sierra Nevada Mountain Ranges. The Sacramento and Feather River systems also define the lowland formation with wide areas of riparian forest, river bar, and open water features meandering north to south.

3.3.5.2 Geologic Formations and Natural Community Relationships

Major geologic formations and features in the Plan Area include landforms of alluvial, volcanic, and plutonic origin (Figure 3–7, *Geology of the Plan Area* [see separate file]). This section provides summary descriptions of the major geologic landforms in the Plan Area and the present and historical dominant vegetation associated with each landform.

Modesto Formation. The Modesto Formation is a late Pleistocene alluvial terrace generally bordering and probably deposited by streams still running today (Helley and Harwood 1985, Blake et al. 1999). This youngest alluvial terrace is derived from a heterogeneous mix of alluvium derived from metamorphic, sedimentary, and volcanic rock 10–16 feet thick (Blake et al. 1999). Modesto Formation is estimated to have formed 10–40 thousand years ago (kya)

[2] CDMG, California Department of Mining and Geology, is now called California Geological Survey.

(California Department of Conservation 1992). Modesto Formation historically supported grasslands, grasslands with vernal pools, and valley oak savanna. Vernal pools are classified as Northern Hardpan Vernal Pools. Vernal pools on Modesto Formation are typically at lower density but are, on average, larger than vernal pools on other alluvial terraces (Platenkamp 1998). Present vegetation is dominated by orchards, mostly of almond and prune trees, to the west and southwest of Chico.

Riverbank Formation. Riverbank Formation is a mid-Pleistocene alluvial terrace. It is similar to Modesto Formation, but is older and at a higher topographic position (Helley and Harwood 1985, Blake et al. 1999). This young terrace is estimated to have formed between 100 and 300 kya. Riverbank Formation supports grasslands with vernal pool and swale terrain (Smith and Verrill 1998). Vernal pool densities on Riverbank Formation tend to be higher and pool sizes larger than on other geologic formations with vernal pools (Platenkamp 1998). Vernal pools on Riverbank Formation are classified as Northern Hardpan Vernal Pools and are often associated with Eastbiggs and Kimball soil series (NRCS 2006).

Red Bluff Pediment. Red Bluff pediment is an early Pleistocene alluvial terrace of coarse red gravel derived from Tuscan Formation volcanic material of the Cascades (Helley and Harwood 1985, Helley and Jaworowski 1985, California Department of Conservation 1992, Blake et al. 1999). Red Bluff is older and at a higher geomorphic position than Riverbank Formation. This high terrace supports mound-swale relief with a cemented duripan (NRCS 2006). Red Bluff Formation supports grassland with vernal pools classified as Northern Hardpan Vernal Pools (Smith and Verrill 1998). Typical soils include Redsluff, Redtough (mounds), and Redswale (swales) series (NRCS 2006).

Turlock Lake Formation. Turlock Lake Formation is an early Pleistocene alluvial fan derived primarily from plutonic rocks of the Sierra Nevada that evidences significant erosional relief and only exists within the Plan Area south of the Feather River (Helley and Harwood 1985). It overlies the Mehrten Formation and underlies the Red Bluff pediment. This terrace supports grassland with vernal pools classified as Northern Hardpan Vernal Pools.

Laguna Formation. The Laguna Formation is a mid-Pliocene alluvial terrace of interbedded gravel, sand, and silt derived from the Sierran metamorphic rocks (Helley and Harwood 1985, California Department of Conservation 1992). This formation is estimated to have formed between 1.6 and 2.0 million years ago. This terrace supports grassland with vernal pools classified as Northern Hardpan Vernal Pools typically on Oroville and Vistarobles soil series (Smith and Verrill 1998, NRCS 2006). Vernal pools on Laguna Formation typically are smaller and occur at moderate densities relative to vernal pools on other formations (Platenkamp 1998).

Tuscan Formation. The Tuscan Formation is a mid-Pliocene geologic formation composed of lahars (volcanic mudflows), volcanic conglomerate, volcanic sandstone and siltstone, and pumiceous tuffs resulting from volcanic activity in the Cascade Mountains (Helley and Harwood 1985, California Department of Conservation 1992). The Tuscan formation supports grassland with vernal pools classified as Northern Hardpan Vernal Pools often on Doemill and Jokerst soil series (NRCS 2006). Vernal pools on Tuscan Formation are typically small, rocky, and shallow (Jokerst 1990). Above its contact point where it is overlapped by the Redbluff Pediment, portions of the Tuscan Formation support Blue Oak Woodland and Savanna and Grassland without vernal pools.

Lovejoy Basalt. The Lovejoy Basalt is an early Miocene feature created by basaltic lava flows running westward in ancient river beds. The Lovejoy Balsalt forms Table Mountain in the central eastside of the Plan Area and the Cohasset Ridge near the City of Chico (Harwood and Helley 1987). Lovejoy Basalt is mostly grassland with vernal pools and swales, classified as Northern Basalt Flow Vernal Pools, with some oak woodland.

Basin. The Basin feature dominates the southwestern portion of the Plan Area. The Basin is composed of recent (Holocene) alluvium of fine-grained deposits of silt and clay and organic marsh deposits on broad flats between modern water courses (California Department of Conservation 1992, Smith and Verrill 1998). The Basin is associated with overflow areas of the Sacramento and Feather Rivers and distributaries of smaller streams. Historically, prior to construction of levees and dams, the basin would flood annually and supported tule and cattail marshes. Today, rice farming dominates the basin. Managed wetlands, including federal and state wildlife refuges and private duck clubs, have been created in the basin and support biological communities similar to the historical marshes with controlled hydrology.

Sierran Foothill Metamorphics and Volcanics. Sierran Foothill Metamorphics and Volcanics is a group of geologic features originating in the Jurassic, Miocene, and Eocene in the southeast portion of the Plan Area. These geologic formations support oak woodland, grassland, and chaparral.

Cascade Foothill Volcanics. Cascade Foothill Volcanics is a group of geologic features originating in the mid-Pliocene in the northeast portion of the Plan Area. These geologic formations support oak woodland and savanna.

Natural Levees and Channel Deposits. Natural Levees and Channel Deposits are associated with Sacramento and Feather rivers. These recent (Holocene) alluvial deposits formed within the past 10,000 years in the active stream channels, floodplains, and natural levees of these major rivers. Historically, the natural vegetation on these deposits was a broad band of riparian forests (cottonwood-willow and valley oak riparian forests).

Today, most of this landform is cultivated as orchards (almond and prune trees) along the Sacramento and lower Feather Rivers. This landform has been heavily disturbed by dredger mining along the Feather River west of Oroville where the landscape is now dominated by mine tailings. Remnants of riparian forest and scrub remain along the Sacramento and Feather Rivers.

Table 3–2, *General Soil Units* and Figure 3–8, *Soils of the Plan Area* (see separate file) identify soils present in the Plan Area (NRCS 2006). To simplify the presentation, soils have been broken down into General Soil Units within the Plan Area, as influenced by the physical and biological environment in which they were formed. Local geology, source material, topography, aspect, climate, and time have the greatest influence on soil formation.

Table 3-2. General Soil Units

General Soil Type (Soil Complexes)	Plan Area Setting	Soil Properties	Area (acres)
Sacramento Valley Flood Plain Thermic 1. Parrott-Gianella-Farwell 2. Xerothents, Tailings-Gianella	Landscape: Sacramento Valley Slope range: 0 to 50 percent Typical vegetation: Walnut and almond orchards, valley oak, Fremont cottonwood, coyotebrush, sycamore, and willow.	Very deep, nearly level to steep, moderately well-drained to that formed in Sacramento River alluvium to somewhat excessively drained soils that formed in Feather River and Butte Creek alluvium derived from mixed rock sources; on flood plains and stream terraces; fine to coarse loamy and sandy.	53,351
Sacramento Valley Flood Basins Thermic 3. Lofgren-Blavo 4. Esquon-Neerdobe 5. Bosquejo-Galt 6. Gridley Taxadjunct-Subaco Taxadjunct	Landscape: Sacramento Valley Slope range: 0 to 2 percent Typical vegetation: Rice, carex, spikerush, swampgrass, willow, and cottonwood; Italian ryegrass, curly dock, valley oak in areas adjacent to Butte Creek, safflower; wheat; alfalfa; sugar beet, prune, and almond orchards; and annual grasses and forbs.	Moderately deep and deep, nearly level, somewhat poorly drained soils that formed in alluvium derived from mixed rock; on low terraces and in flood basins; very fine to fine.	162,692
Sacramento Valley Alluvium Fan Thermic 7. Olashes 8. Conejo-Almendra-Vina 9. Haploxerolls-Durixerolls	Landscape: Sacramento Valley Slope range: 0 to 2 percent Typical vegetation: Almond, walnut, and prune orchards, rice, and beans, valley oak, and annual grasses and forbs, wheat, alfalfa, and safflower.	Deep, moderately deep, and very deep; nearly level; somewhat poorly drained, moderately well-drained and well-drained soils that formed in alluvium derived from volcanic and mixed rock sources; on alluvial fans; fine-loamy and course-loamy particle size.	62,478
Thermic Soils That Formed in Cascade Alluvium; on Fan Terraces in the Sacramento Valley 10. Redsluff-Redtough-Redswale	Landscape: Sacramento Valley Slope range: 0 to 35 percent Typical vegetation: Annual grasses and forbs.	Very deep, shallow, and very shallow; nearly level to steep; moderately well-drained, somewhat poorly drained, and poorly drained soils that formed in alluvium; on fan terraces; loamy alluvium over cemented, gravelly alluvium derived from volcanic and mixed rock sources; fine-loamy and loamy.	28,995
Thermic Soils on Feather River Terraces in the Sacramento Valley 11. Liveoak-Boga-Loemstone	Landscape: Sacramento Valley Slope range: 0 to 2 percent Typical vegetation: Walnut, prune, kiwi, peach, and nectarine orchards; valley oak; and annual grasses and forbs.	Very deep and deep, nearly level, moderately well-drained soils that formed in Feather River alluvium; on terraces; loamy alluvium over dense, silty alluvium derived from mixed rock sources; fine-loamy.	16,602
Thermic Soils That Formed in Sierra Nevada Alluvium; on Low Fan Terraces in the Sacramento Valley 12. Eastbiggs-Duric Xerarents-Kimball	Landscape: Sacramento Valley Slope range: 0 to 3 percent Typical vegetation: Annual grasses and forbs, rice, prune orchards, and valley oak.	Moderately deep, shallow, and very deep, nearly level, somewhat poorly drained and well-drained soils that formed in alluvium; on low terraces; clayey and loamy alluvium over cemented and loamy alluvium derived from mixed rock sources; fine.	30,649

Table 3–2. General Soil Units (Continued)

General Soil Type (Soil Complexes)	Plan Area Setting	Soil Properties	Area (acres)
Thermic Soils That Formed in Sierra Nevada Alluvium; on Intermediate and High Fan Terraces in the Sacramento Valley 13. Thompson flat-Oroville-Vistarobles	Landscape: Sacramento Valley Slope range: 0 to 30 percent Typical vegetation: Annual grasses and forbs, blue oak, interior live oak, buckbrush, toyon, and whiteleaf Manzanita.	Very deep, moderately deep, and shallow, nearly level to moderately steep, moderately well-drained and poorly drained soils that formed in alluvium; on intermediate and high fan terraces; loamy alluvium over clayey alluvium over gravelly and cemented alluvium derived from mixed rock sources; clayey, fine and fine-loamy.	37,826
Thermic Soils on Lovejoy Basalt and Ione Sediments on Sierra Nevada Foothills 14. Palexerults-Rock Outcrop, Basalt-Coalcanyon, Thermal rocks, Campbellhills	Landscape: Sierra Nevada foothills Slope range: 2 to 50 percent Typical vegetation: Annual grasses and forbs, lichens, interior live oak, blue oak, and valley oak.	Exposed bedrock and very deep, nearly level to very steep, well-drained soils that formed in colluvium and residuum; on foothills and basalt plateaus; rock outcrops of Lovejoy basalt; loamy colluvium derived from volcanic rocks over clayey residuum derived from Ione Formation claystone, gravelly colluvium derived from Lovejoy basalt; loamy-skeletal, fine-loamy and fine.	18,384
Thermic Soils on Strath Terraces on Volcanic Cascade Foothills 15. Tuscan-Clearhayes-Typic Xerofluvents-Redtough-Redswale-Anita	Landscape: Cascade foothills Slope range: 0 to 2 percent Typical vegetation: Annual grasses and forbs, cottonwood, sycamore, black walnut, and valley oak.	Shallow, deep, and very deep, nearly level, somewhat poorly drained and well-drained soils that formed in alluvium; on strath terraces on volcanic foothills; loamy alluvium over clayey alluvium over cemented, gravelly alluvium derived from volcanic rocks, loamy overbank deposits over gravelly channel deposits derived from volcanic rocks, sandy alluvium derived from hydraulic mine deposition; clayey, coarse-loamy, fine-loamy and sandy-skeletal.	18,868
Thermic Soils on Volcanic Cascade Foothills 16. Lucksev-Butteside-Carhart 17. Doemill-Jokerst 18. Xerorthents, Shallow-Typic Haploxeralfs-Doemill	Landscape: Cascade foothills Slope range: 2 to 100 percent Typical vegetation: Annual grasses and forbs, blue oak, interior live oak, canyon live oak, foothill pine, buckbrush, and Manzanita.	Very shallow, shallow, moderately deep and deep, nearly level to very steep, moderately well-drained, well-drained, somewhat poorly and poorly drained soils that formed in alluvium, residuum, and colluvium; on foothills; ridgetops, side slopes, and strath terraces, basins and footslopes on volcanic foothills; fine, clayey and loamy.	62,385
Thermic Soils on Metamorphic Sierra Nevada Foothills 19. Dunstone-Loafercreek-Argonaut Taxadjunct 20. Dunstone-Loafercreek-Oroshore 21. Mounthope-Hartsmill 22. Ultic Haploxeralfs, Thermic, High Terrace	Landscape: Sierra Nevada foothills Slope range: 1 to 90 percent Typical vegetation: Annual grasses and forbs, interior live oak, blue oak, foothill pine, whiteleaf manzanita, buckbrush, toyon, Pacific madrone, and scattered ponderosa pine.	Shallow and moderately deep, very deep and deep, nearly level to very steep, well-drained and moderately well-drained soils that formed in alluvium, residuum and colluvium derived from metasedimentary metavolcanic and mixed rocks; on foothills and high terraces; fine, fine-loamy, loamy and loamy-skeletal.	48,925

Table 3–2. General Soil Units (Continued)

General Soil Type (Soil Complexes)	Plan Area Setting	Soil Properties	Area (acres)
Thermic Soils on Plutons on Sierra Nevada Foothills 23. Flanly-Swedesflat-Parkshill 24. Crystalhill-Oregongulch-Craigsaddle	Landscape: Sierra Nevada foothills Slope range: 2 to 70 percent Typical vegetation: Annual grasses and forbs, interior live oak, blue oak, canyon live oak, foothill pine, and buckbrush, Whiteleaf manzanita, toyon, Pacific madrone, and scattered ponderosa pine.	Moderately deep, shallow, and very deep, nearly level to very steep, somewhat excessively drained and well-drained soils that formed in residuum and colluvium from quartz diorite or gabbro and intrusive igneous rocks; ridgetops and side slopes on plutons in foothills; fine-loamy, loamy, coarse-loamy	10,407
Mesic Soils on Volcanic Cascade Foothills 25. Rockstripe-Ultic Haploxeralfs, Mesic-Ultic Haploxeralfs	Landscape: Cascade foothills Slope range: 2 to 100 percent Typical vegetation: Buckbrush, scrub oak, manzanita, annual grasses and forbs, interior live oak, canyon live oak, California black oak, and foothill pine.	Very shallow, moderately deep, and deep, nearly level to very steep, somewhat poorly drained and well-drained soils that formed in residuum and colluvium; on volcanic foothills; fine-loamy, fine, loamy-skeletal, clayey-skeletal.	2,003
Mesic Soils on Metamorphic Sierra Nevada Foothills 26. Bigridge-Minniecreek	Landscape: Sierra Nevada foothills Slope range: 2 to 70 percent Typical vegetation: Whiteleaf manzanita, toyon, interior live oak, Pacific madrone, canyon live oak, foothill pine, ponderosa pine, and poison oak.	Deep and moderately deep, nearly level to very steep, well-drained soils that formed in residuum and colluvium; ridgetops and side slopes on metamorphic foothills; fine-loamy.	12
39.	Sierra Nevada and Cascade foothills	Frigid soils on moraines	207
99.	Throughout Plan Area	Water	7,651

Source: Modified from NRCS 2006.

Hundreds of soil series occur within the Plan Area. As a result, soils are categorized below by soil complex (grouping of series that have common characteristics) and general soil units (general grouping of soils that have similar characteristics in source material, region, and climate during formation). Soils in the western part of the Plan Area are all representative of low energy floodplain, flood basin, and lower relief alluvial fan terrace development in geologically young alluvium; however, soils associated with the Sacramento and Feather Rivers have developed on plain features and are generally moderate to well-drained and indicative of a historically higher energy environment (active river system) than neighboring basin soils. These soil units are limited to within and immediately adjacent to the river system.

Soils in the southwestern section of the Plan Area are generally flood basin–developed, deep and poorly drained, and representative of low energy formation. These areas occur within the Plan Area between the Sacramento and Feather River systems where the alluvial basins are internally draining (or would be in the absence of modifications to surface flow patterns associated with agriculture production).

Soils in the foothills of the Plan Area have developed at the base of the Cascade and Sierra Nevada Mountains. Geologically the foothills are alluvial terraces derived from upslope volcanic rock and mudflow associated with the ranges. Soils are diagnostic of their material of origin and, as a result, soils associated with the Cascade foothills are different than soils associated with Sierra Nevada foothills; however, soils associated with both ranges are generally poorly to moderately drained alluvium over clay or cemented gravelly alluvium. They range from red soils associated with the Tuscan series of the northeast Plan Area to dark volcanic rocky soils in the southeast.

3.3.6 Hydrology

Butte County has numerous surface water bodies, and drainage is primarily to the southwest (see Figure 3–9, *Hydrologic Features in the Plan Area* [separate file]). These water bodies include rivers and streams, impoundments, vernal pools, irrigation canals, managed wetlands and managed seasonal wetlands (for waterfowl), stock ponds, and rice fields (when flooded). The Plan Area is within the drainage basin of the Feather River and the Sacramento River. The Sacramento River flows along the western edge of Butte County. Big Chico Creek and Butte Creek are the primary tributaries to the Sacramento River, and they drain much of the Plan Area. The streams generally have a high gradient in the steep terrain of the mountains and foothills and then flow slowly across the nearly flat valley floor. Most streams on the valley floor have been altered for flood control and water diversions.

Big Chico Creek. Big Chico Creek drains most of the northwestern portion of the Plan Area and flows into the Sacramento River at the western edge of the county just southwest of Chico. Its main tributary is Mud Creek, which includes Rock Creek. Big Chico Creek channel on the valley floor is dry in dry years (Big Chico Creek Watershed Alliance 1999). Mud Creek, a tributary to Big Chico Creek, has a 69-foot waterfall at Richardson Springs that is a barrier to fish. Rock Creek originally flowed into a large marsh near Nord, but it is now a tributary to Mud Creek.

Butte Creek. Butte Creek drains the central to southwestern portion of the Plan Area. South of Chico, it flows along the western boundary of the county with Glenn and Colusa counties. It enters Butte Slough south of Butte County (CSU Chico 1998), then flows into the Sutter Bypass and then into the Sacramento River. A portion of Butte Sink is located in the southwestern corner of the county. Levees are present along one or both sides of the creek from Chico to just downstream of the Glenn-Butte County boundary. The annual mean flow above Parrott-Phelan Dam (southeast of Chico) is 409 cubic feet per second (cfs) (1931 to 1997 data) with a lowest daily mean flow of 44 cfs and a highest daily mean flow of 26,600 cfs. On a monthly basis, the mean flows were highest in January through April and lowest in September (CSU Chico 1998). Within the Butte Creek watershed are a number of natural streams that were never connected to

Butte Creek or that have been modified so that they no longer connect. These are now used for water conveyance and storage.

Feather River. The Feather River originates in the Sierra Nevada east of the Plan Area. The river and its tributaries downstream of Oroville Dam drain the southeastern part of the Plan Area. Flows below Oroville Dam are highly regulated for hydroelectric power production, flood control, water supply, and fish and wildlife. Flows in the river vary seasonally with peaks in the winter to spring and lows in November to December. Measurements at Gridley from 1995 through 1998 recorded a peak of just over 40,000 cfs and a low of 1,000 cfs (Bratovich et al. 2004). Flow in the Low-Flow Channel, from the Fish Barrier Dam to the Thermalito Afterbay Outlet, is relatively constant with low water temperatures all year. Flows at the other facilities are discussed below in Section 3.3.6.1, *Dams and Diversions*.

Other Water Bodies. In addition to the rivers and their tributaries, other natural water bodies in the county include thousands of vernal pools, seeps, and marshes. The vernal pools occur in grassland and blue oak savanna; some vernal pools are connected through swales and ephemeral drainages to surface tributary systems, which connect to major creeks and rivers, and other vernal pools are isolated from stream drainages. Their water source is direct precipitation and runoff from the surrounding uplands. Vernal pools generally contain water during the rainy season and into spring or summer when they dry out until the following wet season. Marshes can be isolated or connected to streams, and their water sources include runoff from precipitation, overbank flooding, backwater flooding, and shallow groundwater. Seeps are typically isolated and their water source is typically groundwater discharge. Marshes (emergent wetlands) and seeps can have water seasonally or all year, depending on location and water source.

Artificial water bodies include impoundments, irrigation canals, agricultural drains, waterfowl ponds (managed wetlands and managed seasonal wetlands), and rice fields (when flooded). The largest impoundments in the Plan Area are the Thermalito Afterbay and Thermalito Forebay, both associated with Lake Oroville (see Figure 3–10, *Lake Oroville Facilities: State Water Project* [separate file]). These are discussed below in Section 3.3.6.1.

Ponds, smaller impoundments for water storage and livestock, are also present. Large areas of managed wetlands are present in the southwestern and western portions of the Plan Area and a smaller area of managed seasonal wetlands are present in the southeastern part of the Plan Area. These are relatively flat areas that are flooded, particularly during the winter, to provide habitat for wintering or migrating waterfowl and for hunting opportunities. Water depths are shallow and support emergent aquatic vegetation if soils are moist much to all of the year. More information on managed wetlands is provided in Section 3.5.4, *Wetlands*.

3.3.6.1 Dams and Diversions

Feather River. Oroville Dam is located at the eastern edge of the Plan Area. This dam provides flood control, water storage, and power production as well as recreational opportunities. The

Oroville-Thermalito Pumped Storage Power Complex (California Department of Water Resources [DWR] no date(a)) is located at and below Oroville Dam (see Figure 3–10). This complex includes the following elements:

- Hyatt Power Plant at the dam (645 megawatts).
- Thermalito Pumping-Generating Plant (114 megawatts).
- Thermalito Dam Power Plant (3 megawatts), which generates electricity from water released from Oroville Dam for fish habitat between the diversion dam and the Thermalito Afterbay river outlet.
- Thermalito Power Canal, which carries water in either direction for pumping back into Lake Oroville.
- Thermalito Diversion Dam, which diverts water in the Thermalito Power Canal to the Thermalito Pumping-Generating Plant, provides a tailwater pool for the Hyatt Power Plant, and acts as a forebay when water is pumped back into Lake Oroville.
- Thermalito Forebay, an offstream reservoir to convey generating and pumping water between the Thermalito Power Canal and the Thermalito Power Plant, which provides regulatory storage and surge damping for the Oroville-Thermalito Power Complex.
- Thermalito Afterbay, an offstream reservoir for pumpback water storage, which is a major agricultural water supply diversion; it also helps regulate the power system, helps control flows in the river, and provides recreational opportunities.

The maximum controlled release from Oroville Dam is 150,000 cfs (Bratovich et al. 2004). Flows at the facilities are as follows (Bratovich et al. 2004, Bogener 2004):

- Hyatt Power Plant – maximum of 17,400 cfs.
- Diversion Dam – minimum of 600 cfs.
- Diversion Dam Power Plant – maximum of 615 cfs.
- Thermalito Power Canal – maximum capacity of 16,900 cfs.
- Pump-back facilities – 9,120 cfs.
- Below Thermalito Afterbay – minimum 1,700 cfs October through March and 1,000 cfs April through September, with maximum of 2,500 cfs October 15 to November 30. In dry years with less than 1,942,000 acre-feet of runoff in April through July, the minimum can be reduced to 1,200 cfs October through February and 1,000 cfs in March.

When flows are less than 2,500 cfs, reductions must be less than 200 cfs per 24 hours, except for flood management. Agricultural irrigation diversions of up to 800,000 acre-feet occur from the Thermalito Complex from May through August (Bogener 2004). The Thermalito Afterbay water surface elevation can vary by up to 12 feet.

Butte Creek. A number of dams and diversions are present on Butte Creek and its tributaries. Eight agricultural/wildlife enhancement water diversion dams are present from the southern county boundary to southeast of Chico, and three power generation diversions are present upstream of the Plan Area (CSU Chico 1998). The Centerville Powerhouse is within the Plan Area. The Centerville Head Dam, located upstream of the Plan Area, is a barrier to fish migration. Water is diverted from that dam into the Lower Centerville Canal to the Centerville Powerhouse at up to 180 cfs. Water diverted from the West Fork of the Feather River is released into Butte Creek at the DeSabla Powerhouse above the Centerville Head Dam at an average rate of 65.8 cfs. These diversions are non-consumptive. Two dams on Little Butte Creek provide water for the town of Paradise (CSU Chico 1998).

The Parrott-Phelan Dam near Chico is the first consumptive use diversion of water from Butte Creek and takes 25.4 percent of the flow from April through September. This dam has a fish ladder and the diversion is screened. The Durham Mutual, Adams, and Gorrill Dams are south of Chico. These dams were retrofitted with fish ladders and screens in the late 1990s as part of the CALFED Bay-Delta Program's (CALFED) Ecosystem Restoration Program Fish Passage Improvement element (DWR 2005). In 1998, Western Canal Water District, in conjunction with CALFED and the Department of the Interior, also removed Point Four, McGowan, McPherrin, Western Canal East Channel, and Western Canal Main Dams to improve anadromous fish passage on Butte Creek (DWR 2005).

The Sanborn Slough Bifurcation takes much of the Butte Creek flow into waterfowl clubs in Butte Sink. In 1998 CALFED completed initial improvements of the structure to enhance fish passage and water control (DWR 2005). White Mallard Dam diverts water into White Mallard Canal.

Big Chico Creek. Flood flows in Big Chico Creek are diverted into Lindo Channel, which has a capacity of 14,500 cfs. These flows are further diverted into Sycamore Creek (up to 8,500 cfs). Lindo Channel is 8 miles long and returns to Big Chico Creek about 2.5 miles from its confluence with the Sacramento River (Big Chico Creek Watershed Alliance 1999). A fish ladder constructed in the 1950s, located on Big Chico Creek in Upper Bidwell Park, is in disrepair and impeding passage of anadromous fish upstream of the ladder. DWR has completed designs to improve passage at the site (DWR no date(b)).

3.3.6.2 Agriculture

Rice fields are the dominant form of agriculture in the southwestern portion of the Plan Area, with orchards and vineyards to the north and southeast, primarily west of Highway 99. Rice fields are flooded from April to September for the rice growing season and are flooded again from October to January for rice decomposition, disease control, and waterfowl needs. Orchards and vineyards are also irrigated during the growing season.

3.4 LAND COVER TYPE MAPPING

A land cover dataset was created for the BRCP for use in developing the BRCP conservation strategy and conducting the assessment of impacts of the covered activities on natural communities and covered species. This section describes the land cover classification system and the methods used to map the land cover types. The land cover dataset was generated at a scale and level of resolution appropriate for regional resources planning and reflect ground conditions as of October 2011; it was not developed for use in project-level planning.

3.4.1 Data Sources

Land cover was mapped primarily using 2005 National Agriculture Imagery Program (NAIP) color orthorectified aerial imagery (at 1-meter resolution; flown from June 30 through September 30). Additional aerial imagery flown on February 28, 2002 (1-meter resolution) and in May 2006 (1-meter resolution) was used to assist in the land cover mapping. Data from the Soil Survey of Butte County Area (NRCS 2006) was used to support the land cover mapping, establish mapping criteria, and develop land cover type definitions. Additional 1-meter imagery from October 2011 was reviewed to update the land cover mapping with any changes to land cover since the 2006 mapping.

3.4.2 Land Cover Type Classification

The land cover classification system was specifically developed for the BRCP. Existing classification systems were incorporated or adapted where appropriate to maximize the use of existing land cover data and to reduce the potential number of land cover types.

Existing classification systems considered included Terrestrial Natural Communities in California (Holland 1986), California Natural Diversity Database (California Department of Fish and Game [DFG] 2007a), Manual of California Vegetation (Sawyer and Keeler-Wolf 1995), and Fire and Resource Assessment Program (FRAP)/California Wildlife Habitat Relationships System (CWHR). FRAP is used by the California Department of Forestry (CDF) as a tool to assess California's forest and rangeland resources. A total of 30 BRCP land cover types were identified and mapped. The BRCP land cover types and corresponding land cover types from these other classification systems are presented in Table 3-3, *BRCP Land Cover Type Classification and Corresponding Land Cover Types under Other Classification Systems*.

3.4.3 Mapping Methods

BRCP land cover types were mapped using the ArcGIS 9.1 Geographic Information System (GIS) to establish the perimeter or point location of each unit of each land cover type. Classification of land cover types was based on a visual interpretation of their appearance using 2005 aerial imagery as a base map. Aerial imagery from February 2002 and May 2006 was used for more detailed image interpretation as needed. Table 3-4, *Land Cover Type Mapping Criteria* presents land cover type definitions and the minimum mapping unit (MMU) for each land cover type. Reconnaissance-level site visits were made to selected areas to verify the accuracy of the land cover mapping process for five-day periods in September and November 2006.

A 10-acre MMU resolution was used for most upland, agriculture, and disturbed/developed land cover types to allow for cost efficiency and local uniformity in mapping the large Plan Area. The 10-acre MMU is sufficient to identify significant patches of covered species habitat. Smaller MMUs—0.01 acre for larger vernal pools and altered vernal pools, 5 acres for grassland with vernal swale complex, and 1 acre for other wetland and riparian habitats—were used due to the relatively higher importance of these habitats to covered species and their typically small size.

Cover type classification was determined based on the visual signature (i.e., color and texture) of a given area on the aerial imagery. For example, grasslands were generally dull green while emergent wetland was bright green. Orchards were indicated by distinct regular rows of trees while woodlands containing trees were randomly distributed or clumped. Tree-dominated land cover had a larger canopy size and rougher appearance than shrub-dominated land cover. Table 3-4 provides some basic information on the criteria used to map land cover. Additional information on each land cover type designation and typical inclusions of other land cover types is provided below.

Table 3-3. BRCP Land Cover Type Classification and Corresponding Land Cover Types under Other Classification Systems

BRCP Land Cover Type	Holland 1986	Sawyer and Keeler-Wolf 1995	California Natural Diversity Database Plant Community[1]	FRAP/CWHR
Grassland	Valley Needlegrass Grassland, Nonnative Grassland, Wildflower Field	Nodding Needlegrass Series, Purple Needlegrass Series, Ashy Ryegrass Series, Creeping Ryegrass Series, California Annual Grassland Series, Cheatgrass Series	Native Grassland, Nonnative Grassland	Annual Grassland, Perennial Grassland
Grassland with Vernal Swale Complex	Valley Needlegrass Grassland, Nonnative Grassland, Wildflower Field, Northern Hardpan Vernal Pool, Northern Volcano Mudflow Vernal Pool	Nodding Needlegrass Series, Purple Needlegrass Series, Ashy Ryegrass Series, Creeping Ryegrass Series, California Annual Grassland Series, Cheatgrass Series	Native Grassland, Nonnative Grassland, Vernal Pools	Annual Grassland, Perennial Grassland
Vernal Pools	Valley Needlegrass Grassland, Nonnative Grassland, Wildflower Field, Northern Hardpan Vernal Pool, Northern Volcano Mudflow Vernal Pool	Nodding Needlegrass Series, Purple Needlegrass Series, Ashy Ryegrass Series, Creeping Ryegrass Series, California Annual Grassland Series, Cheatgrass Series	Native Grassland, Nonnative Grassland, Vernal Pools	Not applicable
Altered Vernal Pools	Not applicable	Not applicable	Not applicable	Not applicable
Stock Ponds	Not applicable	Not applicable	Not applicable	Not applicable
Cottonwood-Willow Riparian Forest	Great Valley Cottonwood Riparian Forest, Great Valley Mixed Riparian Forest	Arroyo Willow Series, Fremont Cottonwood Series, California Sycamore Series, Mixed Willow Series, Pacific Willow Series, Red Willow Series, Sandbar Willow Series	Riparian Forest and Woodland	Valley Foothill Riparian, Riverine
Valley Oak Riparian Forest	Great Valley Oak Riparian Forest	California Sycamore Series, Valley Oaks Series	Riparian Forest and Woodland, Oak Woodlands and Forest	Valley Oak Woodland, Valley Foothill Riparian
Willow Scrub	Great Valley Willow Scrub	Arroyo Willow Series, Mixed Willow Series, Pacific Willow Series, Red Willow Series, Sandbar Willow Series	Riparian Forest and Woodland; High to Low Elevation Riparian Scrub	Riverine

Table 3–3. BRCP Land Cover Type Classification and Corresponding Land Cover Types under Other Classification Systems (Continued)

BRCP Land Cover Type	Holland 1986	Sawyer and Keeler-Wolf 1995	California Natural Diversity Database Plant Community[1]	FRAP/CWHR
Herbaceous Riparian and River Bar	Not applicable	Sandbar Willow Series	Nonnative Grasslands	Riverine
Dredger Tailings with Sparse Herbaceous Vegetation	Not applicable	Not applicable	Not applicable	Barren
Dredger Tailings with Riparian Forest and Scrub	Great Valley Cottonwood Riparian Forest, Great Valley Mixed Riparian Forest, Coastal and Valley Freshwater Marsh	Arroyo Willow Series, Fremont Cottonwood Series, Mixed Willow Series, Pacific Willow Series, Red Willow Series, Sandbar Willow Series, Bulrush Series, Bulrush-Cattail Series, Cattail Series, Common Reed Series	Not applicable	Barren
Emergent Wetland	Coastal and Valley Freshwater Marsh	Bulrush Series, Bulrush-Cattail Series, Cattail Series, Common Reed Series	Meadows and Seeps not Dominated by Grasses, Marsh,	Fresh Emergent Wetland, Riverine
Managed Wetland	Freshwater Swamp	Bulrush Series, Bulrush-Cattail Series, Cattail Series, Arrow Weed Series, Common Reed Series, Arroyo Willow Series, Fremont Cottonwood Series, Mixed Willow Series, Pacific Willow Series, Red Willow Series, Sandbar Willow Series	Meadows and Seeps not Dominated by Grasses, Marsh	Fresh Emergent Wetland, Valley Foothill Riparian
Managed Seasonal Wetland				Not applicable
Open Water	Not applicable	Not applicable	Not applicable	Riverine, Lacustrine
Major Canal	Not applicable	Bulrush Series, Bulrush-Cattail Series, Cattail Series, Arrow Weed Series, Common Reed Series, Arroyo Willow Series	Meadows and Seeps not Dominated by Grasses, Marsh	Fresh Emergent Wetland, Riverine
Chaparral	Not applicable	Not applicable	Not applicable	Montane Chaparral, Mixed Chaparral, Chamise-Redshank Chaparral
Blue Oak Woodland	Blue Oak Woodland	Blue Oak Series	Oak Woodlands and Forests	Blue Oak Woodland

Table 3–3. BRCP Land Cover Type Classification and Corresponding Land Cover Types under Other Classification Systems (Continued)

BRCP Land Cover Type	Holland 1986	Sawyer and Keeler-Wolf 1995	California Natural Diversity Database Plant Community[1]	FRAP/CWHR
Blue Oak Savanna	Blue Oak Woodland	Blue Oak Series	Oak Woodlands and Forests	Blue Oak Woodland
Interior Live Oak Woodland	Interior Live Oak Woodland	Interior Live Oak Series	Oak Woodlands and Forests	Blue Oak-Foothill Pine
Mixed Oak Woodland	Blue Oak Woodland, Interior Live Oak Woodland, Open Digger Pine Woodland, Digger Pine Oak Woodland	Blue Oak Series, Foothill Pine Series, Interior Live Oak Series, Mixed Oak Series	Oak Woodlands and Forests	Blue Oak-Foothill Pine
Conifer-Dominated Forest	Not applicable	Not applicable	Not applicable	Ponderosa Pine
Nonnative Woodlands	Not applicable	Eucalyptus Series	Not applicable	Eucalyptus
Orchards / Vineyards	Not applicable	Not applicable	Not applicable	Orchard-Vineyard, Deciduous Orchard, Evergreen Orchard, Vineyard
Rice	Not applicable	Not applicable	Not applicable	Rice
Cropland (Non-Rice)	Not applicable	Not applicable	Not applicable	Irrigated grain Crops, Irrigated Hayfield, Irrigated Row and Field Crops
Irrigated Pasture	Nonnative Grassland	Creeping Ryegrass Series, California Annual Grassland Series	Nonnative Grassland	Irrigated Hayfield
Urban	Not applicable	Not applicable	Not applicable	Urban
Ranchettes – Wooded	Blue Oak Woodland, Interior Live Oak Woodland, Open Digger Pine Woodland, Digger Pine Oak Woodland	Blue Oak Series, Foothill Pine Series, Interior Live Oak Series, Mixed Oak Series	Oak Woodlands and Forests	NA
Ranchettes – Open	Nonnative Grassland	Nodding Needlegrass Series, Purple Needlegrass Series, Ashy Ryegrass Series, Creeping Ryegrass Series, California Annual Grassland Series, Cheatgrass Series	Nonnative Grassland	NA
Disturbed Ground	Not applicable	Not applicable	Not applicable	Barren

[1] California Department of Fish and Game (DFG) California Natural Diversity Database (CNDDB) plant community list (DFG 2007a).

Table 3-4. Land Cover Type Mapping Criteria

Land Cover Type	Symbol	Minimum Mapping Unit (MMU)	Criteria for Designation by Remote Sensing
Grassland	G	10 acres	Herbaceous vegetation generally lacking vernal pool-type features (e.g., vernal swale pattern, indications of ponding water in the winter and spring). Polygons mapped as grasslands support inclusions of vernal swale complex, vernal pool, and altered vernal pool land cover types that are too small or too sparse to meet the mapping criteria for these other land cover types (see descriptions in Section 3.4.4, *Land Cover Type Descriptions*). Grasses are generally nonnative with varying amounts of native herbaceous species and occasionally oaks with less than 3 percent cover, and disturbed areas (ranch buildings, development, and agriculture less than 10 acres in size).
Grassland with Vernal Swale Complex	GVSC	10 acres	Grassland with vernal swale complex was mapped using 2005 imagery to construct polygons around swales and individual vernal pools that were previously mapped in a mapping feasibility study based on February 2002 imagery. Swales often appear as complex networks of channels with a highly variable distribution and density of vernal pools and associated with mound and inter-mound topography. The MMU may be less for some polygons that were retained from the feasibility study. Vernal pools and altered vernal pools greater than 0.01 acre were mapped individually. Occasional blue oaks with less than 3 percent cover may be present.
Vernal Pools	VP	0.01 acres	Vernal pools were mapped using February 2002 imagery as areas within the grassland vegetation matrix with seasonally ponded water. They are distinguished by their rounded shape, as well as their darker color relative to the surrounding vegetation. Occasionally they can have a lighter color relative to the surrounding vegetation due to reflectance off the ponded water.
Altered Vernal Pools	AVP	0.01 acres	Altered vernal pools were mapped using the February 2002 imagery. These features meet the same selection criteria as vernal pools but have been disturbed by farming, roads, ditches, fence lines, or other features or activities.
Stock Ponds	SP	Less than 1 acre	Stock ponds were mapped as point data based on indications of summer ponded water in the October 2005 imagery and may support emergent wetland land cover.
Cottonwood-Willow Riparian Forest	CWRF	1 acre	Deciduous trees along streams and rivers. Differentiated from valley oak riparian forest by the color of trees in summer and by general distribution within Butte County. Can include areas dominated by herbaceous or shrubby riparian vegetation if less than 1 acre in size.
Valley Oak Riparian Forest	VORF	1 acre	Deciduous trees along streams and rivers. Differentiated from cottonwood-willow forest by the color of trees in summer and by general distribution. Can include areas dominated by herbaceous or shrubby riparian vegetation if less than 1 acre in size.
Willow Scrub	WS	1 acre	Scrubby vegetation along streams and at the margins of rivers. Can include areas dominated by herbaceous or shrubby riparian vegetation if less than 1 acre in size.

Table 3–4. Land Cover Type Mapping Criteria (Continued)

Land Cover Type	Symbol	Minimum Mapping Unit (MMU)	Criteria for Designation by Remote Sensing
Herbaceous Riparian and River Bar	HRRB	1 acre	Rock, gravel, and sand bars along the Feather and Sacramento rivers with very low cover (less than 15 percent cover). Can include areas dominated by herbaceous or shrubby riparian vegetation if less than 1 acre in size.
Dredger Tailings with Sparse Herbaceous Vegetation	DT-H	10 acres	Areas formerly dredged for gold mining with regular patterns of tailings and ponds. Areas within tailings with no cover or sparse cover of herbaceous vegetation. Recently regraded mine tailings are mapped as disturbed ground.
Dredger Tailings with Riparian Forest and Scrub	DT-R	10 acres	Areas formerly dredged for gold mining with regular patterns of tailings and ponds. Areas within tailings with dense cover of woody riparian vegetation.
Emergent Wetland	EW	1 acre	Herbaceous emergent wetland vegetation along streams and rivers, and at the margins of ponds with some areas of open water.
Managed Wetland	MW	1 acre	Areas with controlled hydrology and management practices to support wetlands to provide waterfowl and shorebird habitat. In addition to interpretation of aerial imagery, boundaries of state and federal refuges were used. Includes many vegetative land cover categories which are not separated (e.g., emergent wetland, cottonwood-willow riparian forest, willow scrub, etc.).
Managed Seasonal Wetland	MSW	1 acre	Areas with controlled hydrology that are managed to support created wetlands on a seasonal basis to provide habitat for waterfowl. Scraped grassland and vernal pool/swale terrain with field berms.
Open Water	OW	1 acre	Large areas of open water, such as lakes, ponds, and wide perennial portions of rivers.
Major Canal	MC	1 acre	Man-made canals of approximately 70 feet or greater in width. Smaller canals are mapped as part of surrounding cover type.
Chaparral	C	10 acres	Areas of scrubby vegetation in uplands not associated with streams in landscape positions in proximity to oak woodlands or conifer-dominated forest.
Blue Oak Woodland	BOW	10 acres	Areas dominated by naturally occurring deciduous trees not associated with streams. Minimum tree canopy cover 15 percent.
Blue Oak Savanna	BOS	10 acres	Areas dominated by naturally occurring deciduous trees not associated with streams. Tree canopy cover 3 to 15 percent.
Interior Live Oak Woodland	ILOW	10 acres	Areas dominated by naturally occurring evergreen hardwood trees not associated with streams
Mixed Oak Woodland	MOW	10 acres	Areas dominated by naturally occurring evergreen and/or deciduous hardwood trees and/or foothill pine. No single oak species makes up more than 80 percent of the canopy cover.

Table 3–4. Land Cover Type Mapping Criteria (Continued)

Land Cover Type	Symbol	Minimum Mapping Unit (MMU)	Criteria for Designation by Remote Sensing
Conifer-Dominated Forest	CDM	10 acres	Areas are generally dominated by Ponderosa pine (*Pinus ponderosa*), but can include black oak (*Quercus kelloggii*) and incense cedar (*Calocedrus decurrens*). It consists of a relatively dense canopy cover in areas that are generally higher in elevation than the Plan Area.
Nonnative woodlands	NNW	10 acres	Large areas of nonnative trees. Typically plantings associated with ranchette-dominated landscapes.
Orchards / Vineyards	O/V	10 acres	Trees or vines planted in regular rows.
Rice	R	10 acres	Agricultural fields that are designed for periodic flooding, either contour or laser leveled, unusually shaped polygons with berms between fields.
Cropland (Non-Rice)	IC	10 acres	Plowed fields with irrigated or dryland farmed herbaceous crops.
Irrigated Pasture	IP	10 acres	Non-tilled or lightly tilled areas with herbaceous species that are green in the late summer.
Urban	U	10 acres	Developed areas including buildings, parking lots, developed parks, golf courses, airports, and cemeteries.
Ranchettes – Wooded	RW	10 acres	Areas within oak-dominated landscape with houses and ranch structures that cover or disturb at least 20 percent of the ground surface.
Ranchettes – Open	RO	10 acres	Areas within grass-dominated landscape with small agricultural fields, houses, and ranch structures that cover or disturb at least 20 percent of the ground surface.
Disturbed Ground	DG	10 acres	Recently graded areas with bare soil.

3.4.4 Land Cover Type Descriptions

3.4.4.1 Grassland (G)

Grassland, without high densities of vernal swale complex or vernal pools, was mapped at a 10-acre MMU. Grassland generally occurs on slopes and in areas with fallow agricultural fields. As such, it has been subject to varying degrees of disturbance, including activities related to past farming, land clearing, and oak tree removal. On the aerial imagery, grassland is generally uniform in color and lacks naturally ponded water during the wet season. Stock ponds within the grassland land cover were mapped as separate point data or as open water if greater than 1 acre in size. Scattered oak trees as well as clusters of oak trees that do not exceed 10 acres in size were included as were roads, small developments that are less than 10 acres, and other man-made structures. Some grassland polygons support scattered trees (mainly oaks) up to 3 percent cover. Polygons mapped as grasslands support inclusions of vernal swale complex, vernal pool, and altered vernal pool land cover types that are too small or too sparse to meet the mapping criteria for these other land cover types (see descriptions in sections below). Grassland land cover type also has inclusions of small developed areas (e.g., scattered buildings and roads).

3.4.4.2 Grassland with Vernal Swale Complex (G/VSC)

Grassland with vernal swale complex was mapped at 1:12,000 using 2005 NAIP imagery to construct polygons (MMU 10 acres) around areas supporting high densities of vernal swales and vernal pools based on signatures in February 28, 2002 imagery. Mapping of grassland with swale complex used a preliminary mapping effort for BRCP conducted by the Chico Geographic Information Center (GIC) for a mapping feasibility study (see BRCP Appendix I, *Vernal Pool and Other Seasonal Wetland Mapping Methods*). This land cover type is marked by a darker color due to wetter conditions and a different vegetation type than the surrounding vegetation. Swales appear as complex networks of meandering channels with a highly variable distribution and density of vernal pools and are associated with mound and inter-mound topography. The GIC-mapped vernal swale networks were used as a guide to generate larger vernal swale complex polygons that encompassed the GIC mapping units. High density groupings of swales that were separated by more than 100 meters were delineated into separate complexes. Isolated swale complexes that were less than 10 acres and separated by a distance greater than 100 meters from other swale complexes were not included in polygons of grassland with vernal swale complex. Additional areas not identified in the GIC study having dense vernal swale signatures were incorporated within the grassland with vernal swale complex land cover type. The National Hydrography Dataset (NHD)[3] hydrography layer (in particular intermittent streams) was used to provide divisions among the complexes, creating general sub-basin boundaries based on hydrology and geomorphology. For instances where the swale network straddled a NHD mapped stream the vernal swale complex feature was not split but mapped as a single polygon. Polygons of grassland with vernal swale complex land cover type may include occasional blue

[3] U.S. Geological Survey. 2012. National Hydrography High-Resolution Dataset. http://nhd.usgs.gov/index.html.

oaks at less than 3 percent cover and support inclusions of vernal pool and altered vernal pool land cover types. This land cover type also has inclusions of small developed areas (e.g., scattered buildings and roads).

3.4.4.3 Vernal Pool (VP)

Vernal pools were mapped by GIC using the February 28, 2002 aerial imagery. The mapped vernal pools almost exclusively fall within the grassland with vernal swale complex, but are also found in Grassland, and are distinguished by their rounded shape and darker color relative to the surrounding vegetation. These vernal pool features are small inclusions within larger land cover types that encompass them. For this reason the acreages of these features have been incorporated within the acreages of the land cover types within which they occur. The mapped vernal pool features have been used to support the development of species habitat models where it was necessary to incorporate this level of detail. Occasionally they can have a lighter color relative to the surrounding vegetation due to reflectance off the ponded water. The MMU for the vernal pool land cover type is 0.01 acre. Vernal pools smaller than 0.01 acre are mostly found within grassland with vernal swale complex land cover type (Appendix I.1, *Methods Used to Map BRCP Vernal Swale Complex and Vernal Pools and the Resolution of Mapping Issues*). A separate method was used to estimate the extent of vernal pools and other seasonal wetlands using estimates of wetland density within different grassland land cover types (see Section 3.4.5.1, *Vernal Pools and Other Seasonal Wetlands* and Appendix I.2, *USACE-Verified Wetland Delineations Used to Estimate Density of Vernal Pools and Other Seasonal Wetlands in Grassland Land Cover Types*).

3.4.4.4 Altered Vernal Pool (AVP)

Altered vernal pools were mapped by GIC using the February 28, 2002 aerial imagery. These features meet the same identification criteria as vernal pools (see description above), but have some indication of disturbance. Examples of disturbance include evidence of roads or ditches, fence lines, road sides, and other disturbances. This mapping unit includes vernal pools that have been impounded and vernal pools in areas that appear in aerial imagery to have been disked (but with no or little apparent disruption to the duripan). The MMU for altered vernal pool land cover type is 0.01 acre. These vernal pool features are small inclusions within larger land cover types that encompass them. For this reason the acreages of these features have been incorporated within the acreages of the land cover types within which they occur. These features have been used to support the development of species habitat models where it was necessary to incorporate this level of detail. Altered vernal pools smaller than 0.01 acre are mostly found within grassland with vernal swale complex land cover type (Appendix I.1). A separate method was used to estimate the extent of vernal pools and other seasonal wetlands using estimates of wetland density within different grassland land cover types (see Section 3.4.5.1 and Appendix I.2).

3.4.4.5 Stock Ponds/Ponds (SP)

Stock ponds/ponds (ponds) were mapped based on presence of ponded water during the dry season using the 2005 aerial imagery. As defined, these units are smaller than 1 acre and were mapped as point data. Ponds support open water and may include patches of emergent wetland.

3.4.4.6 Cottonwood-Willow Riparian Forest (CWRF)

Cottonwood-willow riparian forest is characterized by deciduous trees of varying size along major streams and rivers mapped to a 1-acre MMU. It includes small areas of river bar and open water areas that are less than 1 acre. Minor roads are also included. Within the Plan Area, cottonwood-willow riparian forest is distributed along the Sacramento River and along the Feather River and its tributaries.

3.4.4.7 Valley Oak Riparian Forest (VORF)

Valley oak riparian forest was identified by the visual signal of dark green deciduous trees growing along stream courses mapped to a 1-acre MMU. In general, valley oak riparian forest occurs along creeks with a smaller extent of surface water and less active flowing channels than cottonwood-willow riparian forest. The trees can be very dense, forming a more or less continuous canopy, or more open. As with cottonwood-willow riparian forest, valley oak riparian forest includes small areas of other riparian land cover types that are less than 1 acre and small roads. Within the Plan Area, valley oak riparian forest is common in remnant floodplains of the Sacramento River and along tributaries to the Sacramento River such Big Chico Creek. At some locations, particularly where it occurs near the foothills, valley oak riparian forest may include sycamore and alder.

3.4.4.8 Willow Scrub (WS)

Willow scrub is characterized by relatively small trees that are scattered along drainage courses with continuous or fairly open canopies (in some cases as low as 5 percent cover) mapped to a 1-acre MMU. Where canopy cover was less than 5 percent, the land cover was characterized as the same type as that of the surrounding land cover. Small inclusions of roads, herbaceous riparian and river bar, and emergent wetland were included where they were smaller than 1 acre.

3.4.4.9 Herbaceous Riparian and River Bar (HRRB)

Herbaceous riparian and river bar land cover occurs along major streams and rivers. These are areas that have been scoured recently or the woody vegetation has been artificially removed, resulting in low cover of vegetation, and are generally above the low flow water level.

3.4.4.10 Dredger Tailings with Riparian Forest and Scrub (DT-R)

Dredger tailings are characterized by excessively uneven ground, typically in a regular pattern of long mounds and depressions with numerous ponds, clumps of riparian vegetation, and unvegetated ground. Polygons of dredger tailings with riparian forest and scrub are mapped in areas within tailings with dense cover of riparian trees and shrubs (willows, cottonwoods, valley oaks). They typically occur along drainages and natural riparian land cover categories (i.e., cottonwood-willow riparian and valley oak riparian) predominate upstream and downstream. Dredger tailings associated with the Feather River west of Oroville were mapped as a mosaic of dredger tailings with sparse herbaceous vegetation and woody vegetation. Dredger tailings with riparian forest and scrub were mapped using a GIS-driven supervised classification combined with hand-mapped classification DWR developed for the Oroville Facilities Relicensing (Federal Energy Regulatory Commission [FERC] Project No. 2100) provided information to Leidos ecologists.

Dredger tailings with riparian forest and scrub are subdivided into two categories based on the association within streams: 1) dredger tailings riparian – stream-associated and 2) dredger tailings riparian – not stream-associated. Methods for identification of these two types are described below.

3.4.4.10.1 Dredger Tailings Riparian – Stream-Associated

Stream-associated dredger tailings riparian forest and scrub were identified by proximity to an existing waterway as mapped by the NHD. This determination was made by overlaying the NHD dataset and the BRCP GIS Land Cover Database and through visual analysis determining those that were directly associated with an existing waterway.

3.4.4.10.2 Dredger Tailings Riparian – Not Stream-Associated

Dredger tailings riparian forest and scrub not associated with streams were identified by proximity to an existing waterway as mapped by the NHD. This determination was made by overlaying the NHD dataset and the BRCP GIS Land Cover Database and through visual analysis determining those forest and scrub habitats that were not directly associated with an existing waterway. This analysis included both proximity to mapped streams and also inspection of ground contours visible on aerial imagery. Trees and shrubs are typically sparse and understory comprised of grassland.

3.4.4.11 Dredger Tailings with Sparse Herbaceous Vegetation (DT-H)

Dredger tailings are characterized by excessively uneven ground, typically in a regular pattern of long mounds and depressions with numerous ponds, clumps of riparian vegetation, and unvegetated ground. Polygons of dredger tailings with sparse herbaceous vegetation are mapped in areas within tailings with no cover or sparse cover of herbaceous vegetation. Large areas of dredger tailings with sparse herbaceous vegetation are associated with the Feather River west of Oroville. Recently regraded mine tailings are mapped as disturbed ground (see below).

3.4.4.12 Emergent Wetlands (EW)

Emergent wetlands were identified as areas of shallow water that support herbaceous marsh species, such as tules and cattails. Emergent wetlands were generally found along slow-moving portions of streams and rivers. Scattered riparian trees, particularly willows, are sometimes present in emergent wetlands. Where tules and cattails were present along the edges of agricultural fields in drainage and supply ditches they were mapped as the agricultural land cover type.

3.4.4.13 Managed Wetlands (MW)

Managed wetlands were mapped using polygons imported from other data sources and verified by their distinct aerial imagery signature. Managed wetlands have modified surface or berms and artificially controlled water sources and most are flooded in winter for waterfowl habitat. Managed wetlands include a mosaic of open water, emergent wetland, riparian scrub, and riparian forest habitats supported by artificial management.

3.4.4.14 Managed Seasonal Wetlands (MSW)

Managed seasonal wetlands were mapped based on the presence of scraped grassland and vernal pool swale terrain that are flooded in fall/winter periods. Managed seasonal wetlands support a mix of native and non-native plants adapted to seasonally flooded and dry soil conditions.

3.4.4.15 Open Water (OW)

Open water was mapped as areas of standing water with relatively little or no vegetation. Open water is typically found along major low gradient streams and rivers and in medium to large reservoirs. Ponds less than 1 acre were mapped as separate point data. Ponds less than 1 acre within active agricultural lands are included in the relevant agricultural coverage.

3.4.4.16 Major Canal (MC)

Major canals are man-made features in agricultural areas that are used for water for irrigation and for drainage. Canals less than approximately 70 feet wide were mapped as part of the surrounding agricultural cover type (e.g., rice fields).

3.4.4.17 Blue Oak Woodland (BOW)

Blue oak woodland is characterized by canopy cover exceeding 15 percent, as estimated from aerial imagery. It is dominated by blue oaks, which appear blue-grey on the aerial imagery and are deciduous trees that are not restricted to stream courses. It also supports scattered foothill pines, which appear very grey and produce longer shadows than blue oaks. Small developments and structures that cover less than 10 acres are also included. In addition, widely spaced ranchettes with minimal mechanical disturbance to the woodland are included.

3.4.4.18 Blue Oak Savanna (BOS)

Blue oak savanna was mapped where blue oak tree canopy cover varied between 3 percent and 15 percent. Individual blue oak trees are generally widely spaced with non-contiguous canopies. In some cases, widely scattered dense clusters of five to 10 trees were also mapped as BOS. The exterior boundary of blue oak savanna when adjacent to grassland extended approximately three canopy widths into the grassland land cover. Blue oak savanna generally occurs at the lower elevation edge of oak woodland, but it is also present in areas with thinner soil such as rocky areas on the Tuscan Formation and in areas of blue oak woodland that were partially cleared. As was the case for, BOW, this type includes minor development and ranchettes where the BOS appeared to be relatively undisturbed. Polygons of blue oak savanna may have inclusions of grassland with vernal swale complex, vernal pool, and altered vernal pool land cover types that did not meet the criteria for mapping each of these land cover types.

3.4.4.19 Interior Live Oak Woodland (ILOW)

Interior live oak woodland is dominated by interior live oak and generally was mapped on slightly higher elevation and slopes than blue oak. It intergrades with blue oak woodland and blue oak savanna. Interior live oak trees are distinguished from other oak species on aerial photographs because they are darker green and are not deciduous. Interior live oak woodland is more common in the southern foothills of Butte County. Where interior live oak woodland was mapped in the northern foothills, it tended to be mixed with blue oak woodland and blue oak savanna. Included in this category are interior live oak woodland that are primarily dominated by interior live oak (i.e., where at least 80 percent of the canopy cover is interior live oak). In addition, small developments and roads were included when less than 10 acres.

3.4.4.20 Mixed Oak Woodland (MOW)

Mixed oak woodlands are woodlands in which one oak species does not make up at least 80 percent of the tree canopy cover. In many cases, this is due to heavy dominance by foothill pine, although some polygons are mostly a mixture of blue oaks and interior live oaks. As with other oak woodland types, inclusions of minor development, roads, grassland, and ranchettes with intact understory of less than 10 acres were mapped within this land cover type.

3.4.4.21 Chaparral (C)

Various forms of chaparral are present at the upper limit of the occurrence of oak-dominated land cover. The majority of chaparral in Butte County occurs outside of the Plan Area.

3.4.4.22 Nonnative Woodland (NNW)

Nonnative woodlands that are 10 acres or more in size are very uncommon. A few instances of the cover type were found, and they are largely dominated by eucalyptus trees. They typically were mapped on the small farms and ranchettes of the foothills south of Oroville.

3.4.4.23 Rice (R)

The mapping of rice land cover type includes infrastructure for this crop, roads, and irrigation facilities. Rice fields are typically bordered by irrigation ditches that are often as wide as 30 feet and vegetated with emergent wetland vegetation (e.g., tules and cattails). This category also includes fields that were recently fallowed with the expectation that they will be replanted. Rice fields that appear to have been fallow for longer periods of time were mapped as grassland.

3.4.4.24 Irrigated Pasture (IP)

Irrigated pasture was generally mapped at slightly higher elevations than most cropland agriculture. It is irrigated to increase production for grazing livestock. As with other agricultural land cover types, small developments and roads were not included.

3.4.4.25 Cropland (IC)

Cropland included hayfields and other irrigated and unirrigated agriculture that was mapped in low-lying areas with predominately agricultural land cover. As with other agricultural types, IC included areas with minor developments, small irrigation ditches, and roads.

3.4.4.26 Orchards/Vineyards (O/V)

Orchards and vineyards mapping included the infrastructure necessary for growing these crops and included features such as irrigation channels, small ponds, and roads (both farm roads and public roads). Other facilities, particularly houses and other structures, were included where they covered less than 10 acres. Areas that were orchards in 2002, but with different visual signatures in later aerial imagery, were assumed to be orchards in the process of being replanted. This assumption was used because small trees can be difficult to discern on aerial imagery.

3.4.4.27 Urban (U)

The urban land cover type includes developments that exceeded 10 acres and was typically situated around cities and towns. It includes buildings, roads, developed parks, golf courses, landscaped areas, and airports. Developments in more rural areas, such as trailer parks, are also included. Small inclusions(less than 10 acres) of various agricultural types were common at the edges of urban development and were included in the mapping of the type.

3.4.4.28 Ranchettes – Wooded (RW)

Wooded ranchettes were mapped in areas otherwise mapped as oak woodlands. Generally they consist of development, and sometimes landscaping surrounding houses, that are scattered within the woodland. Development comprises greater than 20 percent of the cover in this land cover type. In cases with widely separated ranchettes, minimal landscaping, or other mechanical disturbance of the understory, was mapped as an oak woodland type.

3.4.4.29 Ranchettes – Open (RO)

Non-wooded ranchettes generally were mapped on the alluvial fans above the valley bottom in predominately agricultural areas or between agricultural areas and urban areas. They are characterized by isolated houses and small farms. Development comprises more than 20 percent of the cover in this land cover type. Small inclusions (less than 10 acres) of irrigated agriculture and orchards were common. Polygons mapped as ranchettes – open may have inclusions of grassland, grassland with vernal swale complex, vernal pool, and altered vernal pool land cover types that did not meet the criteria for mapping each of these land cover types. Access roads are also included in this type.

3.4.4.30 Disturbed Ground (DG)

Disturbed ground was mapped as areas that had been recently graded, including mining sites and landfills. These occur in various locations throughout the Plan Area. Areas that were clearly graded for new residential, commercial, or industrial development were mapped as urban. Polygons mapped as disturbed ground may have inclusions of the altered vernal pool land cover type that did not meet the criteria for mapping of this land cover type.

3.4.4.31 Rivers, Streams, and Agricultural Channels

Rivers, streams, and agricultural channels were mapped by clipping the NHD to the Plan Area. The NHD is a feature-based database produced by the U.S. Geological Survey in cooperation with U.S. Environmental Protection Agency, U.S. Forest Service, and other federal, state and local partners. The high-resolution data is generally mapped at a scale of 1:24,000/1:12,000. Data is coded with attributes describing stream segments by type, name, and flow direction. These are linear data only and are included within the two-dimensionally mapped land cover types. As such, the extent of streams and agricultural channels is presented in lineal feet or miles and not in acres as with the other land cover types.

3.4.5 Potential Jurisdictional Wetlands and Other Waters

Jurisdictional waters of the United States, including wetlands, regulated under the CWA section 404 are found in the Plan Area within the various land cover types mapped for the BRCP GIS database. Some land cover types, such as emergent wetlands, are likely entirely or nearly entirely jurisdictional wetlands. Other land cover types include jurisdictional wetlands within a larger matrix of uplands, such as grassland with vernal swale complex. Methods used to estimate the extent of jurisdictional wetlands and other waters are described in this section. The methods used here are for the purpose of estimating U.S. Army Corps of Engineers (USACE) jurisdictional wetlands and other waters; actual jurisdictional areas will be determined during plan implementation (see Chapter 8, *Plan Implementation*).

Jurisdictional streams, lakes, and associated riparian habitats, regulated under the California Fish and Game Code section 1602 are found in the Plan Area within the various land cover types mapped for the BRCP GIS database. All riparian habitat land cover types and wetlands mapped in the BRCP GIS that are associated in the database with streams and lakes are likely jurisdictional under section 1602 and require streambed alteration agreements with CDFW. The methods used here are for the purpose of estimating CDFW jurisdictional streams, lakes, and associated riparian habitat; actual jurisdictional areas will be determined during plan implementation (see Chapter 8, *Plan Implementation*).

3.4.5.1 Vernal Pools and Other Seasonal Wetlands

Within the BCAG Plan Area there are 68,124 acres of mapped grasslands and 34,110 acres of mapped grassland with vernal swale complex. Individual vernal pools were mapped to a 0.01-acre MMU; however, a significant number of small vernal pools (less than 0.01 acre) were not captured in the BRCP GIS Land Cover Database (see Appendix I). A method was developed and implemented to estimate the relative cover of jurisdictional vernal pools and other seasonal wetlands within grassland natural community. In order to produce estimated density (as percent cover) for seasonal wetlands in grassland and grassland with vernal swale complex land cover types, Leidos sampled verified USACE wetland delineations within the study area to develop an estimate of density of vernal pools and other seasonal wetlands[4] within different land cover types (Appendix I.2).

Vernal pool and other seasonal wetlands densities were estimated for three landscape areas:

- Grassland with vernal swale complex land cover type,
- Grassland land cover type not associated with streams (upland grasslands more than 250 feet from stream centerline), and
- Grassland land cover type associated with streams (within 250 feet on either side of stream centerline).

These landscape areas were selected because they represent three different hydrological conditions that support recognizably different densities of wetlands. The methods for estimating densities of vernal pools and swales are described below.

All USACE delineation information was provided in paper report and map form and digital portable document format files; no GIS-based data was provided. Due to the lack of GIS-based wetlands data and the inconsistent nature of the various USACE delineation information provided, Leidos used two different techniques to produce the wetland density estimates of each sample site. Out of the 20 delineations provided by USACE that overlapped with BRCP mapped grassland and grassland with vernal swale complex land cover type polygons, 13 delineations

[4] The various USACE delineations of wetlands used to develop the wetland density estimates included various classifications of seasonal wetlands. Some of these seasonal wetlands were characterized as vernal pools, some as swales, and some as other types of seasonal wetlands. There was no consistency in classification systems across the different delineations, especially where different individual field delineators were involved. The term “other seasonal wetlands” is used here to group all types of seasonal wetlands other than those that meet the definition of vernal pool (i.e., vernal pool hydrology and species composition).

were detailed enough to use the "summation" method. In this method the delineations included annotated individual wetlands polygons and acreages for each polygon. The data were captured by summing all the wetlands that fell within the grassland or grassland with vernal swale complex land cover type polygons. BRCP grassland polygons were clipped to the study area boundaries of the wetland delineation. Dividing the total acreage of the jurisdictional wetlands that fell within the grassland polygon by acreage of the grassland polygon produced a proportion of wetlands per acre of grassland (e.g., 4 acres of wetlands within 100 acres of grassland yields a 0.04 proportion or 4 percent wetland cover). Any wetlands that crossed multiple land cover types were split and corresponding portions were allocated to each land cover type. Seven of the USACE delineations used did not include itemized acreages for each wetland polygon, but only total acres for each wetland type within the survey boundary. For these sample sites it was necessary to estimate by visual analysis the percentage of each wetland type included within the BRCP mapped grassland polygons. Spot checking of the estimates using digitized samples showed that estimates were within 10 percent of digitized values.

The initial results, using the methods described above, indicated an overestimation of seasonal wetlands in grassland land cover type. This result was due to the fact that stream floodplain corridors are included as part of grasslands land cover type in the BRCP GIS Land Cover Database and the very high density of wetlands within these relatively small areas associated with stream corridors were included with the calculation for wetlands within grassland land cover. There is a bimodal distribution of wetland density in grasslands with much higher densities in grasslands associated with stream corridors. In order to parse out these higher wetland density areas in the grasslands associated with stream corridors from the upland grassland community, the stream corridors were buffered by 250 feet on each side using the GIS and wetland density within these areas associated with streams were calculated separately. The buffer distance of 250 feet was chosen by trial and error to determine the breakpoint where density differences are greatest. All the streams in the USACE delineation sites were buffered by distances ranging from 100 to 800 feet and then analyzed to find the distance that captured the most stream-related wetlands and the distance at which wetland density dropped to low levels associated with the upland grassland community. Once the streams were buffered at 250 feet on each side, the wetland densities within the corridors were estimated using the same two procedures used for the grassland and grassland with vernal swale complex areas.

The total area of all delineated seasonal wetlands (including vernal pools) within each of three land cover types was divided by the total area of that land cover type within delineated sites. Results of the analysis produced the following density estimates for USACE jurisdictional vernal pools and other seasonal wetlands:

- 0.0454 (4.45 percent cover) per acre of grassland with vernal swale complex land cover type,
- 0.0088 (0.88 percent cover) per acre of grassland land cover type not associated with streams, and

- 0.2294 (22.94 percent cover) per acre of grassland land cover type associated with streams.

The mean and standard deviation of density for delineation sites were calculated for each of the three groupings of seasonal wetlands. A decision was made to use density values resulting from dividing the total seasonal wetland acres for all sites by the total acres of all sites rather than the mean density for the sites because of the large variation in the size of delineation sites. Data and results are presented in Appendix I-2. A summary of statistics for seasonal wetlands are:

- Grassland with vernal swale complex. A mean of 5.45 percent seasonal wetland cover per acre of grassland with vernal swale complex land cover type with a standard deviation of 5.19 from a sample of 13 sites. Sample site sizes varied from 2.56 acres to 1598.70 acres and the range of densities from 1.17 to 19.28 percent.
- Grassland not associated with streams. A mean of 1.39 percent cover of seasonal wetlands per acre of grassland land cover type not associated with streams with a standard deviation of 1.14 from a sample of 10 sites. Sample site sizes varied from 27.16 acres to 1317.40 acres and the range of densities from 0.00 to 3.60 percent.
- Grassland associated with stream corridor. A mean of 21.63 percent cover of seasonal wetlands per acre of grassland land cover type associated with streams with a standard deviation of 22.32 from a sample of 13 sites. Sample site sizes varied from 3.94 acres to 47.00 acres and the range of densities from 0.00 to 71.98 percent.

As noted above, these mean values were not used in the calculations estimating total acreage of vernal pools and other seasonal wetlands large range in sample site size and large variance in percent wetland cover.

3.4.5.2 Riparian Habitats

Riparian habitats include the land cover types: cottonwood-willow riparian forest, valley oak riparian forest, willow scrub, herbaceous riparian and river bar, and dredger tailings with riparian forest and scrub. The boundaries of riparian habitats were mapped directly into the BRCP GIS Land Cover Database – see methods described in Section 3.4.3, *Mapping Methods*. Typically some portion of each of these riparian communities will meet the requirements for USACE jurisdiction and other portions will not, depending on the frequency and duration of flooding. Often the lower elevation areas of riparian vegetation closer to the stream channel will meet jurisdictional criteria for hydrology, and portions farther from the stream on higher floodplains will not meet the criteria. No attempt was made to differentiate in the BRCP database and all riparian habitats are identified as potential jurisdictional wetlands. Additionally, all of these riparian habitats, where they are associated with stream, pond, or lake, would likely be considered jurisdictional by CDFW under California Fish and Game Code Section 1602.

3.4.5.3 Permanent Emergent Wetlands

The boundaries of permanent emergent wetlands were mapped directly into the BRCP GIS Land Cover Database – see methods described in Section 3.4.3. All areas within the boundaries of mapped emergent wetlands are assumed to meet USACE criteria for jurisdictional wetlands though on-ground delineations would be of higher resolution and likely vary from these boundaries.

3.4.5.4 Managed and Managed Seasonal Wetlands

The boundaries of managed wetlands and managed seasonal wetlands were mapped directly into the BRCP GIS Land Cover Database – see methods described in Section 3.4.3. The mapping units used for managed wetlands and managed seasonal wetlands have inclusions of upland habitats, therefore the acreage calculations for jurisdictional wetlands are overestimated in these land cover types. In addition, these wetlands are, for the most part, maintained by artificial hydrology (i.e., water applied to the land) and therefore all or portions of these wetlands may not meet USACE jurisdictional criteria for hydrology. The aerial extent of the mapped managed wetlands and managed seasonal wetlands that meets the three-parameter USACE jurisdictional criteria would need to be determined following removal of artificial inputs of water (i.e., the unassisted hydrology of the site would need to be determined). For this reason, including all managed wetlands and managed seasonal wetlands as potentially jurisdictional is an overestimation of USACE jurisdictional acreage.

3.4.5.5 Agricultural Wetlands

Rice lands, irrigated pasture, and irrigated cropland are maintained by artificial hydrology (i.e., irrigation water); therefore, all or portions of these wetlands may not meet USACE jurisdictional criteria for hydrology. The aerial extent of the mapped rice lands, irrigated pasture, and irrigated cropland that meets the three-parameter USAC jurisdictional criteria would need to be determined following removal of artificial inputs of water. One verified delineation was provided by USACE for the rice lands at the Richter site that supported 5.02 percent cover of wetlands (Appendix I.2). USACE could not provide any other representative examples of jurisdictional delineations on rice lands or for any of the other agricultural land cover types in or near the Plan Area. Estimates of the likely proportion of rice lands, irrigated pasture, and irrigated cropland that may support USACE jurisdictional wetlands following cessation of artificial water inputs, based on best professional judgment, are:

- Rice lands land – 5 percent jurisdictional wetlands,
- Irrigated pasture – 1 percent jurisdictional wetlands, and
- Irrigated cropland – 1 percent jurisdictional wetlands.

The boundaries of rice lands, irrigated pasture, and irrigated cropland were mapped directly into the BRCP GIS Land Cover Database – see methods described in Section 3.4.3. The mapped acreage of these land cover types was multiplied by the percent cover to estimate the potential extent of USACE jurisdictional wetlands.

3.4.5.6 Non-wetland Waters

A wide range of non-wetland aquatic habitats supporting flowing and standing water in the Plan Area are likely jurisdictional waters of the United States. These waters range from Lake Oroville to ponds less than an acre and from the Feather River channel to agricultural drainage channels across rice lands. These waters were mapped in the BRCP GIS Land Cover Database as ponds, open water, dredger tailings–channels and ponds, major canal, rivers, streams, and agricultural channels. The boundaries of these waters (except for small ponds and the channels and ponds within dredger tailings) were captured for the BRCP GIS Land Cover Database using the methods described in Section 3.4.3.

Small ponds (under 1 acre) were mapped as points in the GIS database. To estimate the total extent of jurisdictional waters across all of these small ponds, an average size was estimated by sampling the area of 30 ponds. A mean size of 0.48 acres (standard deviation of 0.65) was multiplied by the 465 ponds in the Plan Area to estimate a total extent of 223.20 acres.

3.5 COVERED NATURAL COMMUNITIES

The natural communities proposed for coverage under the BRCP include oak woodland and savanna, grassland, riparian, wetland, aquatic, and agriculture. Each of the natural communities is comprised of the land cover types shown in Table 3-5, *Extent of Natural Communities and Other Land Cover Types in the Plan Area (acres)*. Developed/disturbed land cover types (see Table 3-3) are not proposed as a natural community because they provide low-value habitat for native species and are subject to ongoing human disturbances. Chaparral and conifer-dominated forest, although natural land cover types, are not proposed as natural communities, because the BRCP is focused on conservation of lowland communities, and chaparral and conifer-dominated forest are higher elevation communities located primarily outside of the Plan Area and occurring in the Plan Area only as relatively small inclusions.

The distribution of the natural communities and land cover types in the Plan Area is presented in Figure 3–11, *Distribution of Natural Communities in the Plan Area* and Figure 3–12, *Distribution of Land Cover Types in the Plan Area* (see separate files), respectively, and the extent of natural communities and land cover types is presented in Table 3-5. Agriculture is the most extensive natural community, comprising over 49 percent of the total extent of natural communities in the Plan Area and 44 percent of all land cover types. The following sections describe physical and biological attributes associated with each natural community.

Table 3-5. Extent of Natural Communities and Other Land Cover Types in the Plan Area (acres)

Natural Community and Constituent Land Cover Types[1]	Acres
Oak Woodland and Savanna	
Blue oak savanna	10,581
Blue oak woodland	34,735
Interior live oak woodland	2,382
Mixed oak woodland	44,893
Subtotal	***92,590***
Grassland	
Grassland	68,124
Grassland with swale complex	34,110
Subtotal	***102,234***
Riparian	
Cottonwood-willow riparian forest	7,509
Valley oak riparian forest	4,331
Willow scrub	2,995
Herbaceous riparian and river bar	1,658
Dredger tailings with riparian forest/scrub	
stream-associated	5,489
non-stream-associated	167
Subtotal	***22,148***
Wetland	
Emergent wetland	4,440
Managed wetland	25,486
Managed seasonal wetland	2,097
Subtotal	**32,024**
Aquatic	
Open water	8,401
Major canal	1,897
Pond[2]	465 ponds
Subtotal	***10,298***
Agriculture	
Rice	120,316
Irrigated cropland	20,413
Irrigated pasture	1,160
Orchard/vineyard	108,698
Nonnative woodland	48
Subtotal	***250,634***
Total Natural Communities	***509,929***
Other Land Cover Types	
Chaparral	
Chaparral	8,317
Subtotal	***8,317***
Developed	
Urban	25,445
Ranchettes – wooded	6,406
Ranchettes – open	7,654
Disturbed ground	3,534
Dredger tailings with sparse herbaceous vegetation	2,918
Subtotal	***45,958***
Conifer-dominated forest	
Conifer-dominated forest[3]	*15*
Total All Land Cover Types	***564,219***[4]

[1] Vernal pool and altered vernal pool features were mapped separately and used to support species habitat model development. These features are small inclusions within larger land cover types that are subsumed within the total acreages of these land cover types.
[2] Recorded as point data in the GIS database and not shown in Figure 3–12.
[3] Not visible in Figure 3–12 because of its limited extent in the Plan Area.
[4] Note that this number is 16 acres more than the total Plan Area acreage shown in Section 3.2. This 0.005 percent difference is attributed to the difference between calculating the sum acreage of several thousand polygons and the total acreage of one polygon.

3.5.1 Oak Woodland and Savanna

The woodland and savanna natural community is comprised of the following land cover types: blue oak woodland, blue oak savanna, interior live oak woodland, and mixed oak woodland. All are tree-dominated and have a minimum tree canopy cover of 3 percent. The minimum cover value for oak savannas was established to distinguish tree-dominated habitats from those dominated by herbaceous species (e.g., grassland). Tree-dominated habitats have different implications for wildlife from those dominated by herbaceous species. The distribution of the oak woodland and savanna community and its constituent land cover types in the Plan Area are shown in Figure 3–13, *Distribution of the Oak Woodland and Savanna Natural Community in the Plan Area* (see separate file) and the extent of the community and land cover types are presented in Table 3-5. Mixed oak woodland is the dominant land cover type (comprising about 48 percent of the community), followed by blue oak woodland (comprising 38 percent of the community).

3.5.1.1 Environmental Conditions

Oak woodland and savanna is a community with a relatively constant species composition. Blue oaks, the dominant oak species, are very slow-growing and can live for several centuries. Understory vegetation during succession in oak woodlands typically comprises the same grassland understory species through all seral stages with a change in structure as trees establish over time. Natural or artificial clearing, such as by fire or mechanical clearing, returns the community to grassland. A lack of recruitment of blue oak trees has been observed in oak woodlands across much of California and long-term survival of this natural community may be limited in some locations (Bartolome et al. 2002a, Swiecki and Bernhardt 1998, Mensing 1991, Muick and Bartolome 1987). In particular, the age structure of these stands suggests that saplings are a limiting stage in recruitment (Muick and Bartolome 1987). Potential causes for low or lack of recruitment include grazing by deer and livestock, competition with nonnative annual grasses, increased rodent populations, changes in fire regime, and inappropriate climate conditions for recruitment (McCreary 2001). The other dominant oak species in the Plan Area, interior live oak and canyon live oak, have not been found to have the same problems with recruitment.

3.5.1.1.1 Land Use

Oak woodlands and savanna are used for a variety of purposes, including livestock grazing, particularly of cattle and sheep. Oak woodlands have historically been used as a source of firewood. They also support small developments such as rural ranchettes, particularly on the east side of Oroville. Ranchettes are discussed as a land cover type in Section 3.4.4, *Land Cover Type Descriptions*.

3.5.1.1.2 Physical Environment

The oak woodland and savanna natural community occurs along the eastern edge of the Plan Area in the foothills of the Sierra Nevada and Cascade Mountains. Foothills topography includes flat to very steep slopes, terraces, steep ridges, and wide, flat hilltops and valleys. The elevation of occurrence ranges from approximately 800 to 1,500 feet above mean sea level, but elevational extent varies north to south (see Section 3.5.1.2, *Environmental Gradients* for a complete description of distribution patterns).

The oak zone generally includes the foothill volcanic rock and mudflow features with variable slopes. Soils are generally shallow to moderately deep and moderately well-drained from alluvial and colluvial origins associated with their respective ranges. The aspect of the slopes generally faces west to southwest towards the valley within the Plan Area. Soil types that predominately support oak woodland and savanna cover types are presented in Table 3–6, *Soil Types Supporting Woodland and Savanna*.

Table 3–6. Soil Types Supporting Woodland and Savanna

Soil Grouping* Soil Complex	Blue Oak Woodland	Blue Oak Savanna	Mixed Oak Woodland	Interior Live Oak Woodland
Thermic Soils on Volcanic Cascade Foothills				
Lucksev-Butteside-Carhart	X	X	X	X
Doemill-Jokerst	X	X	X	X
Xerorthents, Shallow-Typic Haploxeralfs-Doemill	X	X	X	X
Thermic Soils on Metamorphic Sierra Nevada Foothills				
Dunstone-Loafercreek-Argonaut Taxadjunct	X	X	X	X
Dunstone-Loafercreek-Oroshore	X	X	X	X
Mounthope-Hartsmill	X	X	X	X
Ultic Haploxeralfs, Thermic, High Terrace	X	X	X	X

Source: Modified from NRCS (2006).
*A description of specific soil complexes is presented in Table 3–2.

3.5.1.1.3 Vegetation

Oak woodlands and savannas in the Plan Area are comprised of an overstory of a mixture of oak species, including blue oak, canyon live oak, interior live oak, and foothill pine. In general, the midstory is very open without much vegetation. In more mesic sites, poison oak, toyon, and buckeye are present in the mid-layer. Nonnative grasses and forbs dominate the understory, but native forbs are common. Plant species that are associated with woodland and savanna land cover types in California are listed in Appendix D, *Native Species Supported by BRCP Natural Communities*.

Oak trees are able to tap deeper water and maintain photosynthesis during the dry season at a time when the shallow-rooted herbaceous understory annuals die and turn brown. Blue oak is winter deciduous; however, it is also well-suited to extreme drought and will shed its leaves in the late dry season to enhance moisture retention during extreme drought (McCreary 1990).

Sudden Oak Death (SOD) is an emerging forest disease that has killed tens of thousands of oaks in California (Rizzo and Garbelotto 2003). While the current extent of SOD is restricted to coastal counties, it has the potential to become more widespread. Using a rule-based model, Meentemeyer et al. (2004) created a map of California counties to determine varying levels of risk of spread. The majority of Butte County's woodlands were ranked in the very low and low risk category (882.5 square kilometers [km^2] and 3320.2 km^2, respectively), but it had regions in the high and moderate risk category (5.3 km^2 and 135.7 km^2, respectively). The regions in the higher risk categories, however, tended to be at higher elevations outside the Plan Area, in communities containing black oak with co-occurring species of tanoak, bay laurel, and madrone.

3.5.1.1.4 Wildlife

Oak woodlands and savannas in the Plan Area are diverse and biologically rich. These communities are essential to the maintenance and sustainability of wildlife populations in the eastern portion of the Plan Area. Oak communities provide habitat for over 330 species of wildlife, including reptiles, small and large mammals, and birds (California Partners in Flight 2002). These areas function as breeding, foraging, nesting, denning, protection, and migration habitats. Among the most productive and diverse wildlife habitats in the state (Verner 1980, Barrett 1980, Block and Morrison 1998, Giusti et al. 2004), oak woodlands and savannas are valuable because they provide abundant nesting, roosting, and cover opportunities for wildlife species in association with grassland foraging habitats. They also support large decadent trees that are important because they provide abundant cavities that provide nesting sites for birds and foraging opportunities for insect-eating birds. Oak trees are particularly valuable because of the production of acorns, which are an abundant high quality food for many birds and mammals. Downed wood from oak trees also provides food and cover for a variety of arthropods, fungi, and wildlife species (Standiford et al. 2002).

Common wildlife associated with the oak woodland and savanna natural community within the Plan Area include Columbian black-tailed deer, acorn woodpecker, barn owl, wild turkey, California quail, big brown bat, cottontail, and many other mammal, reptile, and bird species (Butte County 2005). Wildlife associated with the oak woodland and savanna community are listed in Appendix D.

Bird Populations

Many bird species are dependent on oak woodland habitats for food and nesting. Maintenance of healthy, intact oak woodland habitats is essential to provide the necessary habitat elements (e.g., nesting cavities, acorn crops, standing dead trees, down wood, shrub layer, etc.) for these species. Concern regarding the health of oak woodlands in California has resulted in efforts to monitor bird populations and to develop conservation strategies to protect and enhance woodland habitats. In addition to a continuing loss and fragmentation of oak woodlands from urbanization and agricultural expansion, a variety of other factors, including loss of habitat structure (e.g., dead standing trees, trees with cavities, intact shrub layer), lack of oak regeneration, and the spread of SOD, has further raised concerns about the long-term status of dependent bird populations (California Partners in Flight 2002). To assess the possible effects on bird populations, California Partners in Flight (2002) conducted a 10-year monitoring study using 120 monitoring sites across California. Of the seven “focal” species selected to represent bird populations in oak woodlands, six experienced population declines. Four of these experienced significant population declines, local extirpations, or both. Loss of habitat structure was implicated as the likely cause of decline of five of these species. This study and others emphasize the importance of oak woodlands to birds and other wildlife species and the need for conservation and enhancement in order to maintain the value of oak woodlands and sustain dependent wildlife populations. This study also provides recommendations and strategies for conservation and enhancement of oak woodland habitats that could potentially be applied to the BRCP during implementation.

Deer Herds

Black-tailed deer are common in Butte County and the County’s oak woodland and savanna communities provide important winter range for migratory and resident deer herds. Oak woodland and savanna is used by three separate migratory herds, the East Tehama, Bucks Mountain, and Mooretown herds, which occupy the eastern foothills and mountains in Butte County and depend on these areas for all or part of their habitat requirements. Resident deer herds in Butte County are the Camp Beale and Sacramento Valley herds. A detailed description of deer herds in the Plan Area is presented in Section 3.8.

3.5.1.2 Environmental Gradients

Oak woodlands and savanna are bordered on the east (upslope) by chaparral and conifer forests dominated by ponderosa pine. At higher elevations, California black oak is found as an understory to conifer forests or as a dominant in seral stands to conifer-dominated communities. The gradation from oak woodlands to chaparral manifests itself differently in the southern part of the county (Sierran foothills) than the northern part (Cascade foothills). In the southern part of the County, from approximately Lake Oroville south, the transition to chaparral occurs as a decrease in the stature of oaks and an increase in the density of chaparral species (most commonly manzanita). In the northern part of the County, chaparral and oak-dominated land covers are more distinct and do not typically intergrade. The change to chaparral is in mosaics of the two types with chaparral becoming more abundant and occupying a greater extent of the habitat upslope.

The transition to chaparral is apparently due to several factors. Chaparral occurs on steeper, south-facing slopes, and thinner soils in the transition zone. Lack of foothill oak species at higher elevation may be due to lower winter temperatures at those elevations. The range of elevations at which foothill oak species are absent is highly variable, from approximately 800 to 1,500 feet. However, where these oaks disappear at lower elevations in the Plan Area, it is in steep canyons that are surrounded by lands of substantially higher elevation. Cold air flows from higher elevation locations downsloping into canyons (a process called cold air drainage or frost pockets) may be a factor limiting oaks in these locations. The process works as follows: air at higher elevation cools faster than lower elevation areas after sunset. The cooler air has a higher density than the warmer air at lower elevation, and cold air flows downslope until it reaches an impediment or air that is either equally or more dense. For that reason, low elevation locations can have lower night time and early morning temperatures than adjacent areas of higher elevation. Oaks occur at higher elevation areas primarily in the southern part of the county. Exposure, soil, or other factors may increase survivability for oak trees at this location.

The downslope limit of foothill oak woodlands and savannas is determined by soil depth and water retention qualities of the soil and by artificial clearing. Soils of the valley are deeper, and in some locations a hardpan layer restricts water percolation. In areas with hardpan, rooting depth is restricted and the soils retain water for extended periods, making them largely unsuitable for oak trees. This transition occurs gradually downslope, with oak woodlands and savannas becoming less dense and grassland and vernal pool grassland land cover becoming dominant. In addition to natural factors that limit the extent of oak woodlands, humans have historically cleared oak trees for a variety of purposes such as range management, firewood, and land conversion. Because blue oaks are long-lived and take a time long to reestablish, cleared areas generally remain so for decades to centuries.

3.5.1.3 Invasive Species

Nonnative invasive species can impact the condition of many natural communities, altering fundamental ecological processes and threatening biodiversity. Nationally, invasive species rank as the second-greatest threat to endangered species, after habitat destruction (Pimentel et. al. 2005).

In oak woodlands and savanna, invasive species can alter soil moisture levels, change fire cycles, impede oak regeneration, and transform the composition of the understory. It is thought that California grasslands have undergone a major shift in the last two centuries from perennial-dominated (native) grassland to annual-dominated (nonnative, invasive) grassland. Increases in nonnative invasive annual grasses have often been cited as an interfering factor in oak woodland regeneration in California (McCreary 2001, Jackson and Roy 1986). Research suggests that invasive annual grasses and forbs, such as the yellow starthistle, may compete with oak seedlings for water and light, or may harm them indirectly through subsidizing high densities of small mammals (Gordon and Rice 2000).

Numerous invasive plants that are unpalatable to native and domestic grazers may also be locally abundant in oak woodlands and savannas, particularly in areas with past or current inappropriate livestock management practices. These species may include grasses such as Medusa-head, barbed goatgrass, cheatgrass, and invasive forbs like yellow starthistle, and several species of mustard. Cheatgrass and barbed goatgrass, in particular, have also been shown to promote shorter fire cycles in ecosystems (D’Antonio and Vitousek 1992). In a myriad of ways, invasive plants can have large-scale changes in the oak woodland and savanna community.

3.5.1.4 Ecosystem Functions

Intact, functioning woodland and savanna communities provide many ecosystem services and benefits to humans. Important functions of these communities range from water and air filtration, nutrient cycling, carbon storage, and soil formation and prevention of erosion, to forage and shade for domestic livestock and support for wildlife habitats. Additionally, they provide open space and recreational benefits as well as symbolic value. Oaks in particular span many of California's diverse climatic zones and define the landscape for many of its residents.

Unique benefits provided by the woodland and savannas for Butte County residents include recreational opportunities such as hiking, hunting and wildlife viewing, and aesthetic benefits, including rural and open space views. Woodlands and savannas in the Plan Area are predominantly found on private lands grazed by domestic livestock, thereby fostering and supporting working landscapes that harbor low-intensity agricultural uses such as ranching. Additionally, woodlands and savanna provide important watershed protection for Butte Creek and Big Chico Creek and other open water bodies in the Plan Area.

The woodlands and savanna ecosystems of Butte County are part of the California Floristic Province, a globally recognized conservation hotspot. In California, oak woodland and savanna is one of the most biologically diverse communities, providing habitat for approximately 2,000 plant, 5,000 insect, 80 amphibian and reptile, 160 bird, and 80 mammal species (Merenlender and Crawford 1998). This high biodiversity is partly due to the provisioning of oak mast, a critically important food for many wildlife species.

Many important wildlife habitat elements occur in oak woodlands, including wetlands, riparian corridors, rock outcrops, dead and downed logs and other woody debris, brush piles, and snags. Oaks provide woody substrate for insect prey, important nesting and roosting habitat for birds, and buffered temperatures and cover from predators for bird, mammal, amphibian, and reptile species.

Adding to their value to wildlife and domestic livestock, understory plant communities beneath oak canopies are often more productive relative to adjacent plant communities as a result of natural soil enhancement, which results in enhanced forage benefits. Dahlgren et al. (1997) describe soils beneath oak canopy as "islands of fertility" because of greater carbon, nitrogen, and phosphorous reserves relative to adjacent open grassland sites. In an investigation of soil conditions under different tree species canopy and in open grassland sites, Frost and Edinger (1991) found higher organic carbon levels, greater cation exchange capacity, lower bulk density, and greater concentrations of some nutrients (at a soil depth of 0 to 5 centimeters [cm]) under blue oak canopies than in open grassland. These increases are attributed in part to leaf fall and decomposition (Firestone 1995).

Several factors threaten the integrity of intact, functioning woodland and savanna communities. Blue oak woodlands and savannas are compromised by nonnative species, habitat fragmentation, poor sapling recruitment, and disruption of natural fire and grazing regimes. The lack of regeneration by blue oaks is a long-term issue for maintaining the integrity and wildlife value of this habitat type (Swiecki and Bernhardt 1998). As previously discussed, control of invasive species may be an important aspect of successful oak restoration. In addition, changes in fire frequencies, in particular fire suppression, may impact restoration. McClaren and Bartolome (1989) showed that higher fire frequency might have favored oak regeneration.

3.5.2 Grassland

The grassland natural community is comprised of the following land cover types: grassland, grassland with vernal swale complex, vernal pools, and altered vernal pools. Grassland within the Plan Area typically occurs on relatively level valley basin soils, alluvial fans between the basins and the foothills, and gently sloping terraces along the base of the Sierra Nevada foothills. Some areas of grassland are the result of oak woodland clearing and not natural processes or conditions. Grassland was also used as a land cover type classification for areas dominated by low-growing, herbaceous vegetation (grasses, forbs, and grass-like plants) in disturbed areas such as abandoned agricultural land.

For the purpose of developing the BRCP Conservation Strategy, grassland is divided into two mapped types: “grasslands” and “grasslands with vernal swale complex.” Grasslands are dominated by upland vegetation and support only scattered occurrences of vernal pools and swales. Grasslands with vernal swale complex support high densities of seasonal wetlands defined by their unique, hydrology, soils, and vegetation as vernal pools and swales within a matrix of upland grassland vegetation. More description of vernal pools and swales is provided in this section.

The great majority of valley grassland is dominated by nonnative annual species, but some small areas support high densities of native grasses and forbs and can be considered native grasslands or California Prairie type. This native community was not mapped separately, however, because native grasslands occur as small inclusions in valley grassland that were not discernible on the aerial imagery used. The distribution of the grassland community and its constituent land cover types is shown in Figure 3–14, *Distribution of the Grassland Natural Community in the Plan Area* (see separate file) and the extent of the community and land cover types is presented in Table 3–5.

3.5.2.1 Environmental Conditions

Grassland is generally bordered by oak woodland and savanna to the east (upslope) and by various types of agriculture and urban development to the west. Grassland habitats in California have been significantly modified as a result of nonnative and invasive species, agricultural conversion, and loss and fragmentation from urbanization. Within the Central Valley, grasslands occur primarily around the perimeter of the valley at the interface between woodland habitats and the valley floor. These areas have been and continue to be subject to loss and fragmentation due to expanding urban and rural development and conversion to agriculture, most recently vineyard expansion.

3.5.2.1.1 Land Use

The primary use of grasslands in the Plan Area is livestock grazing with some areas of grassland swale complex and vernal pools set aside for preservation.

3.5.2.1.2 Physical Environment

The grassland natural community occurs between, and sometimes intergrades with, the higher elevation woodland and savanna community along the eastern edge of the Plan Area and lower elevation agricultural lands that dominate the central and western portion of the Plan Area. Grassland occurs on a wide range of soil types within the Plan Area. Grassland with swale complex, vernal pools, and altered vernal pools is restricted based on geology, hydrology, and soil type, which integrates characteristics of geology and hydrology. Soil types that predominantly support grassland cover types are presented in Table 3-7, *Soil Types Supporting Grassland*.

Table 3-7. Soil Types Supporting Grassland

General Soil Unit Soil Complex[1]	Grassland	Grassland with Vernal Swale Complex	Vernal Pools and Altered Vernal Pools
Thermic Soils Formed in Cascade Alluvium on Fan Terraces in the Sacramento Valley			
Redsluff-Redtough-Redswale-Anita-Hamslough-Durixeralfs-typic petraquepts	X	X	X
Thermic Soils on Volcanic Cascade Foothills			
Lucksev-Butteside-Carhart	X	X	X
Doemill-Jokerst	X	X	X
Xerorthents, Shallow-Typic Haploxeralfs-Doemill	X	X	X
Thermic Soils Formed in Sierra Nevada Alluvium on Intermediate and High Fan Terraces in the Sacramento Valley			
Thompsonflat-Oroville-Vistarobles	X	X	X
Thermic Soils on Lovejoy Basalt and Ione Sediments on Sierra Nevada Foothills			
Palexerults-Rock Outcrop, Basalt-Coalcanyon-Elsey-Beatsonhollow-Campbellhills-Thermalrocks	X	X	X

Source: Modified from NRCS (2006).

[1]A description of specific soil complexes is presented in Table 3–2.

3.5.2.1.3 Vegetation

The grassland community in Butte County is species-rich. The majority of upland grassland in all of the grassland land cover types mapped is valley grasslands, which are typically dominated by low-growing nonnative annual grasses interspersed with a diverse assemblage of native perennial grasses, nonnative forbs, and native forbs. Vernal pools and vernal swales found within the grassland matrix contain a unique and diverse vegetation community distinct from valley grasslands; these are discussed below.

Valley grassland throughout California, including in the northeastern Sacramento Valley where the Plan Area is located, has been heavily invaded by nonnative species, especially Mediterranean annual grasses; however, on some unfarmed sites the native component typically includes the majority of plant species diversity. While the percent cover of native species is variable at the landscape scale, a site (e.g., pasture, ridgeline) with as little as 10 percent native species cover can be categorized as distinct native perennial grassland community types (hereafter native grasslands). Native grasslands are typically found in isolated patches, smaller than the mapping unit for this BRCP, but contain higher resource values than valley grassland. Native grassland is considered a rare natural community by CDFW (California Natural Diversity Database [CNDDB] 2006).

In valley grassland, including grassland in the Plan Area, soft chess, ripgut brome, and two species of filaree, *Erodium botrys* (in more mesic sites) or *E. cicutarium* (in drier sites), are typically common and dominant. Slender wild oats, wild oats, and Italian rye-grass can be locally abundant and dominant (Bartolome et al. 2007).

Native grasslands within the valley grassland matrix may be dominated or co-dominated by the same species as valley grassland, but contain higher percent cover of native species. Several unique vegetation community subtypes can be identified within the native grasslands. Subtypes found in Butte County uplands likely include the foothill needlegrass series recognized by the presence of *Nassella lepida* and the purple needlegrass series recognized by presence of *Nassella pulchra* (Sawyer and Keeler-Wolf 1995). Numerous native wildflowers are found within these habitats. Examples of common native wildflowers occurring in valley grassland include butter and eggs, miniature lupine, California poppy, turkey mullein, tarweeds, Itherial's spear, and clovers.

Grassland in upland areas surrounding vernal pools is typically similar to grassland without pools, and may contain patches of native grassland. Vegetation of vernal pools and vernal swales is described below in Section 3.5.2.2, *Vernal Pools and Vernal Swales.*

In all types of valley grasslands occasional oak trees can be present. In the BRCP Land Cover GIS Database, sites supporting occasional oak trees at less than 3 percent cover in a 10-acre unit were classified as valley grassland and not as oak woodland or savanna.

3.5.2.1.4 Wildlife

Grassland provides essential habitat for a variety of wildlife species in the Plan Area. Grassland-associated wildlife species include California ground squirrel, California vole, Botta's pocket gopher, western harvest mouse, coyote, burrowing owl, savannah sparrow, western meadowlark, ring-necked pheasant, western rattlesnake, gopher snake, and western fence lizard. Grassland also provides foraging habitat for turkey vulture and raptors, including Swainson’s hawk, red-tailed hawk, northern harrier, and white-tailed kite (Butte County 2005, DFG 1988). Native grasslands provide habitat for native bees and other economically important pollinators for crops in the agricultural lands of the county (Kremen et al. 2004). Grassland with vernal pools and vernal swales seasonally support crustaceans (e.g., fairy shrimp) and other invertebrates and provide foraging and resting habitat for shorebirds, waterfowl, and other migrant birds. Wildlife species associated with the grassland community are listed in Appendix D.

Although transformed from their native condition, grassland habitats continue to provide essential habitat to many birds and other wildlife species. Many bird species are dependent on grassland habitats for nesting, foraging, and cover. Continuing loss of grassland can result in significant declines in dependent bird populations, however, available information on grassland-dependent bird populations is insufficient (California Partners in Flight 2000) to adequately examine population trends relative to the extent and condition of grassland habitats. Nonetheless, The California Partners in Flight 2000 study examines the status and distribution of seven selected representative focal bird species and provides recommendations and strategies for further assessment, conservation, and enhancement of grassland habitat.

Vernal pools and swales, discussed below, commonly occur in the grassland in the Plan Area. Several special-status invertebrates are known to occur in the vernal pool, vernal swale, and other seasonal wetlands in the Plan Area, including vernal pool tadpole shrimp, vernal pool fairy shrimp, and Conservancy fairy shrimp. As a result of the significant loss of vernal pool and vernal swale habitats in the Central Valley from urbanization and agricultural conversion, populations of these species have declined throughout their range. Collectively, these species occur within a range of specific environmental conditions that include soil type, vegetation characteristics, water depth, water temperature, inundation duration, and water quality.

3.5.2.2 Vernal Pools and Vernal Swales

Vernal pools and vernal swales are found within the grassland in areas with shallow soils on relatively flat areas that are underlain by bedrock, hardpan, and claypan. The geologic formations that support vernal pool and swale terrain are shown in Figure 3–15, *Geologic Formations Supporting Vernal Pools in the Plan Area* (see separate file). Vernal pools are shallow depressions that seasonally fill with rain water during the wet season and are completely dry by late spring or early summer. Vernal swales are similar, except that they generally form individual or a network of drainages that meander through the landscape. Organisms that thrive in this unique, harsh habitat co-evolved with the geologic and climatic conditions that formed vernal pools and vernal swales and, consequently, these features contain a high number of endemic and rare species of plants, animals, and invertebrates. Vernal pools and swales contain a unique assemblage of native herbaceous forbs and grasses including Fremont’s goldfield, valley goldfield, tidy tips, white navarretia, pogogyny, and yellow carpet in the Plan Area.

Several species found in the Plan Area are listed under the federal ESA and CESA, including Hoover's spurge, Butte County meadowfoam, hairy Orcutt grass, slender Orcutt grass, and Greene's tuctoria (USFWS 2005). Numerous native vernal pool plant species are associated with essential pollinators. Examples include specific relationships between certain ground bee species and corresponding vernal pool plants. Protection of upland pollinator habitat is necessary to maintain vernal pool plant populations. Fragmentation of vernal pool habitat can reduce the availability of habitat for pollinator species, resulting in decrease or cessation of seed production in many vernal pool plants (Thorp and Leong 1998).

Three types of vernal pools in the Plan Area are identified in CNDDB as rare natural communities: Northern Basalt Flow Vernal Pools, Northern Hardpan Vernal Pools, and Northern Volcanic Mudflow Vernal Pools. Northern Basalt Flow Vernal Pools occur on flat mesas in the Table Mountain region formed by the Lovejoy Basalt (California Department of Conservation 1992), and are slightly higher in elevation (approximately 1,000 feet) than other vernal pools and vernal swales in the Plan Area. The thin, low-fertility soils are underlain by impervious volcanic basalt rock that results in a perched water table and typically small hydrologically "flashy" vernal pools. These shallow, low-nutrient (especially low-nitrogen) soil conditions are less suitable to nonnative grasses, resulting in improved growth and survival of native grasses and wildflowers. Northern Basalt Flow Vernal Pools are geographically restricted. They are typically small in area (less than 100 square meters [m^2]) and may fill with water and dry multiple times during the rainy season (Keeler-Wolf et al 1998). Because they are underlain by bedrock and found on more uneven terrain, agricultural conversion has had much less of an impact than it has on some other types of vernal pool and vernal swale grasslands.

Northern Hardpan Vernal Pools are the most common type in the Plan Area. They occur on Pleistocene and older valley alluvial plains and terraces with an underlying cemented layer in the soil that restricts percolation. Northern Hardpan Vernal Pools are found on the Modesto, Riverbank, Red Bluff, and Laguna Formations in the Plan Area (California Department of Conservation 1992). The vernal pools and vernal swales can be larger than the other two types in the region (1 acre or more) and tend to remain inundated longer in late spring and summer. Much of this habitat is privately owned land and may be subject to more intensive land use and agriculture (Keeler-Wolf et al. 1998).

Northern Volcanic Mudflow Vernal Pools occur on volcano clastic-derived substrates such as lahars (volcanic mudflows), volcanic conglomerate, and pumiceous tuff of the Cascadian foothills in the Plan Area. Northern Volcanic Mudflow Vernal Pools are found on the Tuscan Formation in the Plan Area (California Department of Conservation 1992). Similar to Northern Basalt Flow Vernal Pools, these vernal pools tend to be small in area, irregularly spaced, and with flashy hydrology. They are characterized by very shallow, low-nutrient soils (less than 30 cm deep) and are underlain by impervious mudflow welded tuff (Keeler-Wolf et al 1998).

3.5.2.3 Environmental Gradients

Naturally occurring grasslands typically occur on the deeper soils of the valley bottoms. Oak trees increase in abundance with elevation, slope, and thinner soil depths. Vegetation transitions upslope at the east side of the Plan Area are therefore typically into blue oak savanna and woodland. The most visible difference between the oak-dominated communities and pure grasslands is the absence of oak trees. Understory species composition and structure changes with increasing canopy cover and shade. Soil nutrient and water cycles under the oak canopy of savanna and woodland are different from grasslands, and the extensive root system in the understory tends to result in soils higher in quality and fertility than in pure grassland stands. Naturally occurring grassland communities in the Plan Area typically grade into oak savannah in the east.

The western boundary of grassland types in the Plan Area is typically agricultural land or urban development. Many grasslands historically intergraded with floodplain dominated by riparian woodland and valley basin dominated by tule marsh, which contain prime soil types for flood-irrigated rice and other agricultural crops. The cities of Chico and Oroville are within and adjacent to grassland communities. As a result of human activities, the transition to agriculture or urban land cover is typically abrupt. In some cases ranchettes or other dispersed development forms a mosaic with grasslands in a transition zone with more contiguous urban development.

3.5.2.4 Invasive Species

California annual grasslands are considered one of the most dramatic examples of plant invasions worldwide (Mooney et al. 1986). Numerous invasive plant species are unpalatable to native and domestic grazers and may also be locally abundant. These species may include grasses such as Medusa-head, barbed goatgrass, cheatgrass, and invasive forbs such as yellow starthistle, as well as several species of mustard (D’Antonio et al. 2007). Medusa-head in particular produces seeds and seedheads that are noxious to livestock; its palatability is low because of high levels of silicon dioxide, and its rate of decomposition is low, resulting in the build-up of thick thatch layers.

As Mediterranean annual grasses dominate most upland grasslands in the Plan Area, they also encroach on shallow vernal pools and vernal swales and threaten native species. In longer duration vernal pools, low mannagrass or waxy mannagrass can become dominant, impacting native plant species and the invertebrate community by altering the physical and chemical characteristics of the vernal pools (Gerlach et al. 2009, Gerlach unpublished data 2011).

3.5.2.5 Ecosystem Functions

In addition to their habitat value for wildlife, diverse, functioning natural communities provide an array of services and benefits to humans. These include provisioning services such as drinking water, irrigation water, and forage for domestic livestock; regulating services such as water filtration, flood abatement, and agricultural crop pollination from wild insects; supporting services such as soil nutrient cycling and soil formation; and an array of cultural benefits including space for recreational activities (Millennium Ecosystem Assessment 2005).

Unique benefits provided by the grasslands and vernal pools and vernal swales for Butte County residents include both aesthetic (rural and open space views) and recreational (hunting, hiking, and wildlife and seasonal wildflower viewing). Grassland and vernal pool and vernal swale habitat in the Plan Area is predominantly found on private lands grazed by domestic livestock; these working landscapes currently provide sufficient livestock forage to maintain a rural livelihood and associated culture. Vernal pools and vernal swales may also link hydrologically via ephemeral and intermittent streams to larger perennial streams and rivers, wetlands, and other bodies of water, which provide additional recreational and cultural values, as well as a water and food supply.

Functioning, intact grasslands, vernal pools, and vernal swales in the Plan Area are important habitat for a host of plant and wildlife species. These include species in all trophic levels, from primary producers (plants, including native grasses and wildflowers), to terrestrial and aquatic invertebrates, to secondary consumers and carnivores including mammals, amphibians, reptiles, and birds. Some species depend entirely on these habitats throughout their lifecycle, others for only a portion of their lifecycle (e.g., breeding habitat or food source). Vernal pools and vernal swales provide important habitat for several species of threatened and endangered crustaceans (e.g., vernal pool fairy shrimp, vernal pool tadpole shrimp, and Conservancy fairy shrimp); these species are able to persist in vernal pools and vernal swales because the seasonal water bodies are disconnected from free-flowing waterways that would otherwise serve as a corridor for invasive predatory fish.

The grassland, vernal pool, and vernal swale ecosystems of Butte County are part of the California Floristic Province, a globally recognized conservation hotspot. These ecoregions are recognized for their exceptional biodiversity, particularly the high degree of endemism; and degree of threat from habitat loss and degradation (Myers et al. 2000). Grasslands, vernal pools, and vernal swales throughout the Central Valley have been heavily impacted by conversion to agriculture and development, as well as invasion of nonnative species, which can have a negative impact on native species, community structure, and wildlife habitat. Invasive species can also affect natural ecosystem functions and/or benefits such as soil nutrient cycling, water infiltration and cycling (leading to erosion or sedimentation), and wildfire (D’Antonio et al. 2007, Reever-Morghan et al. 2007).

Past management strategies for vernal pools and vernal swales have sometimes excluded livestock grazing based on the assumption that trampling, herbivory, and soil churning by livestock negatively impact habitat quality and vernal pool and vernal swale function. Recent research in California vernal pools shows, however, that for some types of vernal pools and under specific local conditions, appropriate grazing may help maintain native species habitat by slowing the encroachment of dense, highly competitive nonnative species, particularly the Mediterranean annual grasses that dominate most upland grasslands (Marty 2005). Livestock grazing practices in valley grasslands and the native grasslands results in variable community responses. These communities are typically more strongly influenced by soil conditions, historical land use practices (heavy grazing, tilling, or other soil disturbance) and annual weather patterns than light to moderate cattle or sheep grazing. Residual dry matter standards recommended by the University of California Cooperative Extension facilitate conservation of existing native species within grasslands while still providing forage for wildlife and livestock and erosion control (Bartolome et al. 2002b). However, grazing animals do not use the landscape uniformly and tend to concentrate on palatable forage and wetland features so stocking rate alone is not an accurate indicator of their impacts on vernal pools (George et al. 2007, Gerlach unpublished data 2011).

Fire has variable and short-lasting effects in grassland relative to environmental variables and historical land use practices. Aboveground biomass removal is the primary effect. An increase in cover of forbs relative to grasses has occurred after fire in some cases. Prescribed fire, sometimes in combination with grazing prescriptions, is sometimes used to control certain invasive species or reduce the chances of larger, uncontrolled wildfires (Bartolome et al. 2007).

3.5.3 Riparian

The riparian natural community is made of the following land cover types: cottonwood-willow riparian forest, valley oak riparian forest, willow scrub, herbaceous riparian and river bar, and dredger tailings with riparian forest/scrub. The distribution of the riparian community and its constituent land cover types are shown in Figure 3–16, *Distribution of the Riparian Natural Community in the Plan Area* (see separate file) and the extent of the community and land cover types is presented in Table 3–5. These cover types are found along streams and rivers throughout the Plan Area. Major creeks (e.g., Rock, Pine, Big Chico, Butte, Dry, Cottonwood, and Honcut creeks) support cottonwood-willow riparian forest or valley oak riparian forest. The Sacramento and Feather Rivers support the largest stands of cottonwood-willow riparian forest, with tributaries and terraces adjacent to the Sacramento River supporting valley oak riparian forest. Willow scrub occurs in smaller creeks or disturbed areas in creeks and rivers that have not had sufficient time to develop a more substantial forest overstory. Herbaceous riparian and river bar occurs within or adjacent to the active channels of the Sacramento and Feather Rivers.

3.5.3.1 Environmental Conditions

The riparian natural community occurs in north-south and northeast-southwest trending long linear patches bisecting other natural communities (oak woodland and savanna, grassland, agriculture, managed wetlands) and urban land within the Plan Area. Riparian ecosystems provide disproportionately higher ecosystem services and wildlife habitat compared to other terrestrial ecosystems (NRC 2002). Existing riparian land cover represents a small proportion of the historical distribution in the Plan Area with losses of riparian vegetation throughout California estimated at between 85 percent and 98 percent removed for agricultural, mining, and urban development (RHJV 2004).

3.5.3.1.1 Land Use

The primary use of the riparian community in the Plan Area is for the provisioning of wildlife habitat for hunting and non-consumptive use.

3.5.3.1.2 Physical Environment

The riparian natural community occurs throughout the Plan Area associated with active rivers and streams (and tributaries), remnant hydrologic features, and other areas of relative topographic lows where local hydrology can support the community through high water table and periodic flooding. Within the foothills, the riparian community occurs as part of hillside swales or drainages that flow from the foothills generally west into the agricultural areas or major hydrologic features. Because the riparian communities are associated with hydrologic features, the associated soils are generally the result of a high water table, recent fluvial events (high or low energy flood events), and dense canopy; however, this community does not require a specific soil type to exist and occurs over all soil types within the Plan Area.

The largest areas of the riparian natural community are associated with the Sacramento and Feather River systems in the Plan Area. Topography and geology of this area are generally dominated by broad, flat areas with the major creeks flowing north to south. The rivers have created wide river channels with steep banks and associated belts of riparian species. The riparian natural community occurs associated with soils on floodplains including Parrott, Gianella, and Farwell series within the Plan Area. A general description of floodplain soils in the Plan Area is provided in Figure 3–8.

3.5.3.1.3 Vegetation

The riparian community is made up of a variety of overstory and understory species. Common overstory species include Fremont cottonwood, red willow, Gooding's willow, valley oak, sycamore, and white alder. Valley oak typically forms a dense, continuous canopy that extends beyond the creek bank. In some locations, particularly in the foothills of the Cascades, valley oak mixes with other riparian trees, such as alder, sycamore, willow and cottonwood. Cottonwood-willow riparian forest is typically dominated by a very dense canopy of cottonwoods and willows. In some circumstances, sycamores and other riparian species are also present. The understory can be made up of immature overstory plants in addition to woody shrubs and vines such as narrow-leafed willow, blackberry brambles, wild rose, wild grape, and herbaceous species.

3.5.3.1.4 Wildlife

Significantly reduced in extent since initial European settlement (Katibah 1984), riparian habitats continue to support the greatest diversity of wildlife species of any wildlife habitat in California. The diverse and complex vegetation and vegetative structure present in riparian communities provides habitat for over 225 birds, mammals, and reptiles in California (RHJV 2004). It is estimated that over 80 percent of all wildlife species in the Sacramento Valley use riparian areas during a part of their life cycle (RHJV 2004). Riparian communities are also considered the most important habitats to land bird species in California (Manly and Davidson 1993, Davidson 1995) and provide habitat for an estimated 83 percent of amphibians and 40 percent of the reptiles in California (Brode and Bury 1984). Loss of riparian habitat is directly linked to population declines and range reduction of many dependent species (RHJV 2004).

Significant riparian resources in the Plan Area occur along the Sacramento River, Feather River, Butte Creek, Big Chico Creek, and several other smaller drainages. These habitats support numerous wildlife species including several special-status species such as Swainson's hawk, Cooper's hawk, western yellow-billed cuckoo, yellow-breasted chat, yellow warbler, and ringtail. High species diversity in riparian habitats is due in part to the multi-stratified vegetative structure present in woody riparian communities. For example, mature cottonwood and valley oak riparian forests, such as along portions of Sacramento and Feather Rivers and Big Chico Creek, provide habitat for nesting common egrets, great blue herons, and several raptor species in the upper canopy; numerous other bird species such as Nuttall's woodpecker, scrub jay, and oak titmouse in the mid-canopy; and many other bird species such as yellow-breasted chat, California towhee, and wrentit in the shrub layer. In addition to nesting birds, riparian systems provide essential habitat for many wintering and neotropical migrant birds that migrate through the Plan Area each year (Humple and Geupel 2002).

Riparian systems also function as important wildlife movement corridors, providing some of the last remaining overstory cover habitat in much of the Central Valley. While today riparian communities generally occur only as narrow corridors of vegetation along watercourses compared with the vast historical riparian forests of the Central Valley, watercourses with generally intact riparian habitat continue to provide linear connectivity that allows for seasonal movements and dispersal corridors for many wildlife species. The Sacramento and Feather rivers and Butte and Big Chico creeks are all important features in this regard, providing for habitat connectively throughout much of the Plan Area.

Where riparian corridors are within open habitats (e.g., grassland and agricultural fields), the structure provided by riparian shrubs and trees provides perches from which flycatchers and other birds forage into open habitats. Riparian vegetation also moderates air temperatures, providing thermal cover for many species of wildlife during hot or cold weather, and shading provided by vegetation overhanging stream channels maintains cooler water temperatures for native fishes. Common riparian-associated wildlife include deer, striped skunk, woodrats, flycatchers, sparrows, swallows, towhees, raptors, sparrows, warblers, garter snakes, lizards, and frogs (Butte County 2005). Wildlife associated with the riparian community are listed in Appendix D.

3.5.3.2 Environmental Gradients

Riparian communities occur along gradients of flood frequency and groundwater depth within floodplains. Different riparian species are tolerant of or require more or less frequent flooding and a shallower or deeper groundwater. In all cases, riparian communities occur where flooding is more frequent and groundwater is higher than adjacent terrestrial communities such as oak woodlands and grasslands.

Cottonwood-willow riparian occurs in most parts of the Plan Area with frequent flooding and shallow groundwater (e.g., the Feather and Sacramento rivers). Streams in the foothills support riparian forest and scrub adjacent to and typically intergrading with oak woodland communities. Where these same streams cross the grasslands the associated riparian forest and scrub presents a sharp transition from the open grassland community. The riparian forest has been removed in much of the grassland landscape. Except on the major rivers, nearly all of the riparian forest has been removed from streams traversing agricultural lands, with the riparian community relegated to mostly riparian scrub within channelized streams and artificial drainages. The gradient from these riparian communities to agricultural fields and orchards is typically abrupt.

As streams and waterways lose elevation, tributaries converge, with concomitant flow increase and, consequently, the riparian corridors typically widen. Hydrologic conditions and climatic differences influence vegetation community species composition as well, so riparian corridor habitat is functionally and structurally different along its length, however, the water linkage between upper and lower reaches of a waterway mean that disturbances to upper reaches of a waterway are also likely to impact downstream structure and function. Likewise, if downstream riparian areas are disturbed, fish and other aquatic and terrestrial wildlife that travel upstream for food or breeding may be restricted or adversely affected. An additional issue that impacts riparian communities is lowered groundwater levels associated with urban and agricultural pumping, as well as incised stream channels. As the groundwater level lowers, it is increasingly difficult for riparian species to establish new recruits, and the age structure of the riparian forest can shift to mature trees only. This is a significant problem for Big Chico Creek west of Chico.

3.5.3.3 Invasive Species

Nonnative invasive species can damage native riparian natural communities. Giant reed, considered the state's most invasive riparian weed, can grow in dense monocultures, crowding out native species and causing changes to hydrologic regimes (Dudley 2000). Salt cedar is another invasive found in the Plan Area. Both of these highly invasive plants can cause channel changes and increases in fire danger. The introduced bullfrog is an important riparian invasive in the Plan Area. This species has been implicated as a primary driver of native Ranid frog declines in Butte County (Hayes and Jennings 1986). In addition, feral cats can impact many native bird species in the Plan Area, for example tricolored blackbird.

3.5.3.4 Ecosystem Functions

Riparian communities provide a variety of ecosystem functions including regulating runoff, reducing erosion, providing important fish and wildlife habitat, and providing corridors of habitat through other cover types that are less suitable for wildlife (e.g., urban and agricultural lands). Riparian areas confer benefits to water quality by processing nutrients from uplands and groundwater, and trapping sediments from uplands that could enter streams. The dense vegetation along riparian corridors can slow flood waters and dissipate the energy of stream flows, reducing the potential for erosion and downstream flash flooding. Shade associated with riparian areas reduces algae growth, which can negatively impact oxygen levels and pH levels. In addition, roots help hold soil in place, which reduces erosion and downstream turbidity that can be detrimental to fish, aquatic invertebrates, and wildlife.

Riparian habitats perform many functions that are necessary to support wildlife species; they provide shade, water, food and forage, and nutrients that form the basis of the food web, in a concentrated area. The dense canopy, coupled with available water, provides crucial habitat for a variety of invertebrates and insects, aquatic and terrestrial. More than 225 species of birds, mammals, amphibians and reptiles depend on riparian habitat in California. Of particular note, numerous species of resident and neotropical migratory birds use riparian habitat during the breeding season; many of these species are declining throughout their range, and maintaining adequate habitat across California is critical to their continued survival (Riparian Habitat Joint Venture [RHJV] 2004).

Riparian vegetation along stream corridors also provides a number of benefits to aquatic biota, including fish. In general, the plants stabilize the banks and provide instream cover through roots, overhanging vegetation (shade and visual cover from terrestrial predators), and fallen woody debris (logs). Logjams and coarse woody debris within riparian corridors also form important habitat and food sources for fish, amphibians, and aquatic insects. Riparian vegetation provides food and nutrients for all trophic levels in the adjacent aquatic community through falling leaves and insects. Large shrubs and trees provide shade that helps to moderate upper daytime temperatures and reduce algal growth in the aquatic community. In addition to stabilizing the banks, the vegetation slows flood waters that overtop the banks and can provide temporary refuge for fish during floods.

3.5.4 Wetlands

Wetlands are common throughout Butte County. Three types of wetlands are mapped in the Plan Area: emergent wetlands (commonly called marshes), managed wetlands, and managed seasonal wetlands. Vernal pools and vernal swales, types of ephemeral spring wetlands, are mapped in association with grasslands and are described in Section 3.5.2, *Grassland*. The distribution of the wetland community and its constituent land cover types are shown in Figure 3–17, *Distribution of the Wetland Natural Community in the Plan Area* (see separate file) and the extent of the community and land cover types is presented in Table 3–5.

3.5.4.1 Environmental Conditions

Emergent wetlands are in scattered locations throughout the Plan Area, generally near creeks, rivers, or areas that receive agricultural runoff. Adjacent communities include all other mapped types. Emergent wetlands can occur in woodlands, grasslands, urban areas, or agriculture. Emergent wetlands not specifically mapped for the BRCP Land Cover GIS Database occur associated with agriculture and ranching practices throughout the valley in irrigation channels, drainages, stock ponds, and other water features. Because these are specific to managed practices and can change from year to year, wetlands associated with agriculture have been subsumed within the mapping of that agricultural community. In some locations, wetlands complexes are actively being restored from historical rice production, to support local species and wetland ecosystem functions.

Managed wetlands occur primarily in the western part of the Plan Area, associated with the Butte Basin and Sacramento River. Managed wetlands in the Plan Area are associated with federal and state wildlife refuges (e.g., Sacramento River National Wildlife Refuge [NWR], Llano Seco NWR, Gray Lodge Wildlife Area), nongovernmental organization lands (e.g., Ducks Unlimited management at Esquon Ranch), and private hunting clubs. These wetlands are supported by water delivery systems that allow for the conveyance of water and regulation of water levels in the wetlands. Managed wetlands include delivery and drainage channels and pond areas that support a mix of open water aquatic, marsh, and riparian scrub and forest habitats. Some areas are perennially flooded to support year-round habitat for nesting and brood rearing of resident waterfowl and other waterbirds (e.g., wood duck, mallard, cinnamon teal, and gadwall, pied-billed grebes, coots, gallinules and American bitterns).

Managed seasonal wetlands mapped in the BRCP Land Cover GIS Database are areas converted from grassland and grassland with vernal swale complex land cover types that have been hydrologically modified by berm construction and soil scraping to provide habitat for winter migratory waterfowl and shorebird foraging and resting habitat. Other areas of managed seasonal wetlands are mapped as part of the irrigated cropland and pasture land cover types, since agriculture is the primary use.

3.5.4.1.1 Land Use

The primary uses of wetlands in the Plan Area are the provisioning of wildlife habitat for hunting and nonconsumptive use.

Emergent wetlands provide primarily nonconsumptive recreational uses year-round, such as bird watching.

Managed wetlands in the Plan Area provide consumptive and nonconsumptive uses such as hunting and bird watching. Recreational activities at several state and federal wildlife and resource management areas and on private lands are predominately waterfowl and upland game bird hunting and wildlife watching. Recreational fishing may also occur pursuant to the purpose and regulations of land management agencies. In addition to controlling water levels and inundation, landowners may plant crops to support wintering waterfowl. The management of private hunting clubs includes grading and vegetation manipulation to create, maintain, or enhance waterfowl habitat, including the management of irrigation and conveyance canals, and the creation of permanent wetlands to provide reproductive habitat for resident wetland species. In addition, controlled flooding of interstitial areas on a seasonal basis contributes to the resource and habitat values. Private rice-producing farmland has been returned to managed wetlands through grading and vegetation management techniques at several locations in Butte County. Many property owners in Butte County lease their rice fields to hunters during the fallow fall and winter months.

Managed seasonal wetlands mapped in the BRCP Land Cover GIS Database are used for hunting. Agricultural lands (e.g. cropland, irrigated pasture) that are secondarily managed as wildlife habitat are seasonally flooded to attract and support waterfowl.

3.5.4.1.2 Physical Environment

Emergent wetlands occur associated with wetland hydrologic and hydric soil features throughout the Plan Area and large complexes of wetlands occur in the southwestern and western section of the Plan Area. Wetlands are supported where soils are ponded or saturated for significant portion of the growing season, creating an anoxic or very low oxygen rooting environment suitable for hydrophytes.

The large, managed wetlands within the Plan Area are associated with the historical natural flood basin of the Sacramento Valley, which dominates the southwestern portion of the Plan Area. Portions of the basin historically flooded frequently for long durations and supported extensive tule and cattail marshes. Today this region is dominated by and managed wetlands and rice farming. Managed wetlands are flooded perennially or seasonally by irrigation conveyance structures.

Managed seasonal wetlands mapped in the BRCP Land Cover GIS Database are areas of grassland and grassland with vernal swale complex that have been modified to increase the frequency and duration of flooding to promote use by waterfowl. Underlying soils are natural seasonal wetland soils (i.e., soils of the vernal pools and swales modified to create the managed seasonal wetland) and terrestrial, non-hydric soils that may develop anoxic characteristics during the period of seasonal inundation.

The primary soil types supporting emergent wetland, managed wetland, and managed seasonal wetland types are presented in Table 3–8, *Soil Types Supporting Wetland Communities*.

Table 3–8. Soil Types Supporting Wetland Communities

Soil Grouping[1] Soil Complex	Emergent Wetland	Managed Wetland	Managed Seasonal Wetlands
Sacramento Flood Plain Thermic			
Parrott-Gianella-Farwell	X	X	
Xerorthents, Tailings-Gianella	X	X	
Sacramento Flood Basin Thermic			
Lofgren-Blavo	X	X	
Esquon-Neerdobe	X	X	
Bosquejo-Galt	X	X	
Gridley Taxadjunct-Subaco Taxadjunct	X	X	
Thermic Soils That Formed in Sierra Nevada Alluvium; on Low Fan Terraces in the Sacramento Valley			
Eastbiggs-Duric Xerarents-Kimball			X

Source*:* Modified from NRCS (2006).
[1]A description of specific soil complexes is presented in Table 3–2.

3.5.4.1.3 Vegetation

Emergent wetlands can be found in low-lying areas adjacent to creeks and rivers, areas receiving runoff from agricultural areas, and areas intentionally dammed to pond water for livestock or agricultural uses. They are characterized by a high water table, and remain ponded or saturated through part or all of the year. Common plants include cattails, sedges, tules, and bulrushes. The margins often support low-growing willows and blackberries. For a list of wetland species that occur in the Plan Area see Appendix D.

Managed wetlands occupy 25,486 acres in the Plan Area. Many of the managed wetlands were previously used for agricultural production. The time period since they were used for agricultural production varies from location to location, resulting in a mosaic of successional stages. The major managed wetland areas are the Gray Lodge Wildlife Area (southwestern section of the Plan Area), Oroville Wildlife Area (encompassing large areas of riparian and wetland habitat along the Feather River), and the Sacramento River National Wildlife Refuge (several areas including Llano Seco Unit and Riparian Sanctuary). Managed wetlands include a mix of many of the common wetland, aquatic, and riparian land cover types: cottonwood and willow forest, willow scrub, ponds, freshwater marsh, and blackberry-dominated areas. Managed wetlands on properties managed by USFWS and CDFW generally include crop establishment to reduce the depredation of neighboring agriculture by waterfowl and other wildlife and to enhance habitat within the managed areas. Managed wetland properties owned by duck clubs do not typically include crops. Other management activities include the flooding of wetlands and farmed fields to enhance foraging habitat for waterfowl, cranes, and other wetland species; and periodic drawdown of wetlands and ponds to control vegetation and perform other habitat maintenance activities. Crops may be planted in managed wetlands to reduce foraging pressure by waterfowl on adjacent lands. Frequent crops include millet, rice, milo, wheat, barley, safflower, sunflower, corn, and suda (Cowan 1999). Irrigation and conveyance infrastructure in managed wetlands support emergent vegetation (usually cattails and bulrushes) and the combination of moist soil plants and emergent vegetation provide an abundance of seeds, aquatic invertebrates, and cover for wintering waterbird species. Although residual grains may also be used by wintering birds, the primary value of managed wetlands is the high nutrients found in moist soil vegetation and invertebrates. The primary factors affecting the composition and abundance of moist soil plants are the timing of the spring drawdown and the successional stage of the wetland (i.e., the time since disturbance through disking or farming), which varies across the Plan Area, thereby creating a mosaic of moist-soil habitats during the time when migratory and wintering species are present.

Managed seasonal wetlands have been created primarily in the southeast part of the Plan Area associated with private lands. Managed seasonal wetlands are created wetlands in which areas of existing seasonal wetlands and grasslands are scraped and sculpted and impounded to establish an area that temporarily ponds during the wet season from natural runoff. Management of these areas employs moist-soil management (to benefit migratory waterfowl and wading birds). Species that benefit from such management are primarily migratory waterfowl and shorebird species that rely heavily on exposed mudflats and shallow areas during drawdown periods, but also migratory raptors that prey on these species (e.g., American peregrine falcon). Seasonal wetlands are generally flood in the fall, with standing water through most or all of the winter until drawdown occurs in the spring. This management supports a variety of annual plants on exposed mudflat that produce seeds, browse, or tubers used by waterfowl.

3.5.4.1.4 Wildlife

More waterfowl come to winter in the upper Sacramento Valley than anywhere else along the Pacific Flyway (Cowan 1999). Both natural and managed wetlands in the Plan Area provide valuable nesting, foraging, cover, and breeding habitat for many bird, reptile, amphibian, and mammal species. Common observed birds at the Gray Lodge Wildlife Area include grebes, several species of geese, dozens of duck species (equating to hundreds of thousands of individuals annually), gadwalls, swans, cranes, herons and egrets, cormorants, raptors, and owls. Other common wildlife includes deer, coyote, rabbits, gray fox, and ground squirrels. Fish are also supported within fringe and backwater wetlands associated with creeks and river systems, providing cover and protection from predators and changes in water temperature, and refuge from flood events. Wildlife associated with the natural and managed wetlands within the Plan Area are listed in Appendix D.

Emergent wetlands are typically used by wildlife year round and seasonally by nesting waterfowl. Reptiles are dependent on the availability of water during most of the year for breeding and foraging. Western pond turtles and giant garter snakes, among other reptile species, use emergent wetlands extensively during their active period for foraging and cover. Managed wetlands fulfill similar functions for covered and other wildlife species as emergent wetlands. Backwaters of the Sacramento and Feather Rivers and Butte Creek support patches of emergent marsh that provide essential wetland habitats for nesting and wintering birds and mammals. Remaining patches of natural wetlands or emergent marsh wetlands that have developed in idle agricultural fields also can support abundant wildlife. These patches of wetland provide habitat for many marsh nesting birds such as red-winged blackbird, tricolored blackbird, marsh wren, and American bittern. Larger patches also support nesting black-crowned night herons and snowy egrets.

Managed wetlands vary in the number and type of species that use them, depending upon depth, size, emergent vegetation, bank substrate, pollutant loads, and other factors. The management of these wetlands determines the conditions and hence the species that are present. Managed wetlands within the Plan Area are associated with areas where agricultural lands (mainly ricelands) have been restored to wetlands. State and federal managed wetlands at Gray Lodge Waterfowl Management Area, Llano Seco Wildlife Refuge, Sacramento River National Wildlife Refuge, and Upper Butte Wildlife Area and others managed wetlands on private lands provide a large area of suitable habitat for both migratory and resident birds along the Pacific Flyway. Millions of birds representing over 225 species, including more than a million ducks and hundreds of thousands of geese, use Gray Lodge Wildlife Area and other wetland features within the Plan Area (DFG 2006).

Species that depend on perennial wetlands are typically absent from managed seasonal wetlands (e.g., western pond turtle, giant garter snake, most amphibians), because seasonal flooding typically does not meet the life history requirements of these species, which require summer flooding. In general, the management practices of managed seasonal wetlands support migratory species, and those that move seasonally from seasonally flooded lands to other wetland habitats in the area (e.g., waterfowl).

3.5.4.2 Environmental Gradients

Emergent wetlands occur as inclusions in all other natural communities in the Plan Area where appropriate hydrologic conditions exist and their locations and boundaries are determined by the presence of frequently ponded water and saturated soils for long duration. They may be filled by rainwater, runoff, or overbank flow or occur with natural or artificial waterways. In natural systems, wetlands are typically transitional between aquatic systems and upland communities. In agricultural and urban areas, wetland boundaries are often abrupt with the adjacent land use.

Managed wetlands in the Plan Area are most commonly bounded by agricultural areas, particularly rice fields. Some managed wetlands, especially larger ones, are bounded by major rivers. The transition zones with adjacent land cover types may be abrupt where narrow berms or levees are used to maintain the wetlands.

Managed seasonal wetlands in the Plan Area are interspersed into the upland grassland and agricultural landscape. Gradients within managed seasonal wetlands are related to the duration of inundation that affects soil moisture and vegetative characteristics.

3.5.4.3 Invasive Species

Nonnative invasive species can damage wetland natural communities, including emergent and managed wetlands. Giant reed, considered the state’s most invasive riparian weed, can grow in dense monocultures, crowding out native species and causing changes to hydrologic regimes (Dudley 2000). Giant reed is found at both Gray Lodge Wildlife Area and at Llano Seco NWR, where removal efforts are ongoing. Bullfrogs and nonnative fishes can be a significant mortality factor for a variety of wetland species, including giant garter snake and western pond turtle. Feral cats are also an important nonnative invasive that can impact many native bird species in wetland communities, such as the tricolored blackbird. A wide variety of common agricultural and ruderal weed species are the prevalent invasive species in managed wetlands and managed seasonal wetland.

3.5.4.4 Ecosystem Functions

Wetlands perform a variety of ecosystem functions including food web support, habitat for insects and other invertebrates, fish and wildlife habitat, filtering of waterborne and dry-deposited anthropogenic pollutants, carbon storage, water flow regulation (e.g., flood abatement), groundwater recharge, and other human and economic benefits.

Wetlands provide habitat for insects and other invertebrates that are critical food sources to a variety of wildlife species, particularly birds. There are species that depend on wetlands during all parts of their lifecycle for food, overwintering, and reproductive habitat. Other species use wetlands for one or two specific functions or parts of the lifecycle, most commonly for food resources. In addition, wetlands produce substantial plant growth that serves as a food source to herbivores (wild and domesticated) and a secondary food source to carnivores.

Wetlands slow the flow of water through the vegetation and soil, and pollutants are often held in the soil. In addition, because the water is slowed, sediments tend to fall out, thus improving water quality and reducing turbidity downstream.

Decomposition of dead plant material in wetlands can be very slow due to anaerobic (non-oxygen) conditions. Thus, the organic material contained in wetlands can remain for many years to decades as peat and muck. The live and dead plant material “holds” the carbon for extended periods, preventing release into the atmosphere. Carbon held in the environment can slow the effects of environmental changes associated with greenhouse gases and global climate change.

Other economic and human benefits of wetlands include stream bank stabilization; nonconsumptive recreation, including wildlife and seasonal wildflower viewing; and consumptive recreation, including hunting and fishing. Wetlands stabilize stream banks by slowing water flow at the edges of major streams and rivers with roots and stems, as described in the riparian section (Section 3.5.3, *Riparian*).

3.5.5 Aquatic

The aquatic natural community is comprised of the perennial, intermittent, and ephemeral streams and channels[5], open water, major canal, agricultural conveyance and drainage canals, and pond land cover types. The distribution of the aquatic community and its constituent land cover types are shown in Figure 3-18, *Distribution of the Aquatic Natural Community in the Plan Area* (see separate file) and Figure 3–9, and the extent of the community and land cover types is presented in Table 3–5.

3.5.5.1 Environmental Conditions

3.5.5.1.1 Land Use

The primary land uses associated with the aquatic community are water storage, conveyance and drainage for agriculture and other uses and recreation, and fish and wildlife habitat. Ponds are primarily used for watering livestock, either directly or as a reservoir for an associated gravity-fed drinker or trough.

3.5.5.1.2 Vegetation

The active high flow portions of rivers and streams, and other perennial open water areas typically have little or no emergent vegetation. Filamentous green algae, however, can be common to abundant where water is clear and shade is moderate to light. Slower moving areas with shallow water can support emergent aquatic vegetation where fine sediments are present. Overall, flow velocity and flow regimes are the driving factors in determining how much and what types of plants will establish within the stream channel. Within perennial streams, sand and gravel bars may be colonized by willows and other species, and aid in anchoring substrate and reducing erosion.

In intermittent streams, vegetation within the channel may include algal communities, which are resistant to repeated drying and wetting. Other plants that are tolerant to intermittent flooding, such as willows, may also establish within the channel of intermittent streams.

In ephemeral streams, vegetation is typically comprised of upland vegetation types that are tolerant of the occasional flooding event, such as grasses and shrubs. Many plant species are adapted to an ephemeral lifestyle, in which they spend most of the year or longer as seeds before conditions are right for a brief period of growth and reproduction.

The presence of vegetation in streams is influenced by the substrate and thus may indicate the level of erosion and depositional activity. Dense, long-lived perennial vegetation (e.g., shrubs or

[5] Note that most streams and channels are mapped as one-dimensional linear features rather than two-dimensional polygons in the BRCP GIS database.

trees) suggests a low energy environment with little deposition, probably occurring over a long period of time. Annual vegetation (e.g., grasses and forbs) may also indicate a low energy environment but stability is generally of a shorter duration. The most active streams often lack vegetation due to scour or repeated frequent burying of vegetation. Vegetation cover, type, and density also influence the surface resistance to erosion of stream banks and bed. Disturbance by high rainfall events is coupled with runoff and sedimentation and stream beds may cut down or bank walls may collapse, leading to a high diversity and mobility of stream bed substrate. The characterization of stream vegetation as an indicator of flow, energy and erosional processes also applies to artificial drainage canals and irrigation conveyances, but maintenance activities may result in less in-channel vegetation than what could be supported under a given flow regime.

3.5.5.1.3 Fish and Wildlife

Fish

The following discussion of fish in the Plan Area focuses on the species inhabiting or seasonally using streams. Because activities potentially affecting the Sacramento River are not included in the BRCP, fish of the Sacramento River are not discussed except where they move into streams within the Plan Area.

Big Chico Creek. A variety of native and nonnative fish inhabit the streams of the Big Chico drainage basin within the Plan Area (Big Chico Creek Watershed Alliance 1999). Native species include Chinook salmon (Central Valley spring-run and fall-/late fall-run ESUs), steelhead and rainbow trout, Sacramento pikeminnow, California roach, Sacramento sucker, hardhead, riffle sculpin, and Pacific lamprey, while nonnative species include smallmouth bass, green sunfish, and brown trout.

Steelhead and Chinook salmon are anadromous and migrate into the Big Chico Creek drainage from the Sacramento River for spawning, egg incubation, and juvenile rearing (Table 3–9 *Spawning Times for Nongame and Anadromous Fish in Big Chico Drainages*). Spring-run Chinook salmon spawn in Rock Creek and Big Chico Creek. The adult spring-run Chinook salmon run in Big Chico Creek was estimated based on snorkel surveys for years 1995–2011 as shown in Table 3–10 *Adult Spring-Run Chinook Salmon Run in Big Chico Creek, 1995–2011*.

Adult salmon die after spawning while steelhead can return to the ocean. The young of both species spend from less than one year to several years in streams before migrating to the ocean. Juvenile Chinook salmon, spawned in the Sacramento River, enter the lower reaches of creeks in the Big Chico Creek watershed for rearing. Rainbow trout and brown trout are resident species. Rainbow trout occur in Big Chico Creek from the east side of Chico upstream into Tehama County, in the foothill and mountain zones of Rock Creek, and in Mud Creek for a short distance above the falls at Richardson Springs. Brown trout occur in Big Chico Creek from Iron Canyon upstream into Tehama County (Big Chico Creek Watershed Alliance 1999). A fish ladder is present in Iron Canyon to allow salmonids access to the upstream reaches.

Table 3–9. Spawning Times for Nongame and Anadromous Fish in Big Chico Drainages

Species	Scientific Name	Spawning Period
Pacific Lamprey	*Lampetra tridentate*	March–May
Rainbow Trout (Steelhead)	*Oncorhynchus mykiss*	February
Central Valley Spring-Run Chinook	*Oncorhynchus tshawytscha*	Mid-September–October
Central Valley Fall-Run Chinook	*Oncorhynchus tshawytscha*	Late October–December
Central Valley Late Fall-Run Chinook	*Oncorhynchus tshawytscha*	January–February
Brown Trout*	*Salmo trutta morpha fario* and *S. trutta morpha lacustris*	October–November
Sacramento Sucker	*Catostomus occidentalis*	January–March
Sacramento Pikeminnow	*Ptychocheilus grandis*	February–April
California Roach	*Hesperoleucus symmetricus*	May–June
Hardhead	*Mylopharodon conocephalus*	April–June
Riffle Sculpin	*Cottus gulosus*	March–April

Source: Existing Conditions Report (Big Chico Creek Watershed Alliance 1999)
* Nonnative species

Table 3–10. Adult Spring-Run Chinook Salmon Run in Big Chico Creek, 1995–2011

Year	Number	Year	Number
1995	200	2004	0
1996	2	2005	37
1997	2	2006	299
1998	369	2007	0
1999	27	2008[1]	0
2000	27	2009[1]	6
2001	39	2010[1]	2
2002	0	2011[1]	124
2003	81		

Source: GrandTab.xls, 4/23/12 update, J. Azat, California Department of Fish and Game
[1] Data were preliminary as of 11/5/12.

The Sacramento sucker, Sacramento pikeminnow, and hardhead are also migratory and move into the Big Chico Creek drainages from the Sacramento River to spawn, primarily in streams that become intermittent during the dry season. Some individuals of these species can also be residents. Riffle sculpins inhabit Big Chico and Rock creeks, and California roach are present in all three streams. Pacific lamprey is another migratory species that is not as limited by natural barriers as are other fish. Smallmouth bass are present in a portion of Mud Creek and in Big Chico Creek below Iron Canyon. This species along with green sunfish prey upon the roach and greatly reduce its population in dry years (when conditions favor smallmouth bass) (Big Chico Creek Watershed Alliance 1999).

Butte Creek. At least 32 species of fish have been reported from Butte Creek and its tributaries with about half of these being nonnative species (CSU Chico 1998). Chinook salmon (fall-run and spring-run) and steelhead migrate into Butte Creek to spawn, moving as far upstream as Centerville Head Dam. Spring-run Chinook salmon spawn between Parrott-Phelan Dam and Centerville Head Dam as do the secondary and late fall-run Chinook. Adult spring-run Chinook enter the creek from March through June, and estimates of the number spawning over the period

1956 through 1997 ranged from 10 to 7,500. The estimated adult spring-run Chinook salmon run in Butte Creek based on snorkel surveys for years 1995–2011 is presented in Table 3–11. *Adult Spring-Run Chinook Salmon Run in Butte Creek, 1995–2011*.

Table 3-11. Adult Spring-Run Chinook Salmon Run in Butte Creek, 1995–2011

Year	Number	Year	Number
1995	7,500	2004	7,390
1996	1,413	2005	10,625
1997	635	2006	4,579
1998	20,259	2007	4,943
1999	3,679	2008[1]	3,935
2000	4,118	2009[1]	2,059
2001	9,605	2010[1]	1,160
2002	8,785	2011[1]	2,130
2003	4,398		

Source: GrandTab.xls, 4/23/12 update, R. Azat, California Department of Fish and Game
[1] Data were preliminary as of 11/5/12.

Using a mark-recapture carcass survey, the estimated number of spring-run Chinook salmon spawners was 18,312 with a pre-spawning mortality of 0 in 2001; 12,897 with a pre-spawning mortality of 3,431 in 2002; and 6,603 with a pre-spawning mortality of 11,231 in 2003 (DFG 2004).

Juveniles emigrate primarily as fry in December through March. The primary fall-run Chinook spawn between Western Canal and Parrott-Phelan Dam. Steelhead enter the creek from August through Marsh and spawn from December through April (CSU Chico 1998).

The other native fish are distributed according to their habitat preferences and interactions with nonnative species. Nonnative species are primarily warm water fish that are found in warmer, slower moving water in the lower reaches of Butte Creek. Many of these species are also present in irrigation canals that are connected to the creek and in stock ponds where they have been introduced for recreational purposes.

Feather River. The Feather River Fish Hatchery is located adjacent to the Thermalito Afterbay (Figure 3–10). This hatchery was built as mitigation for loss of spawning habitat in the Feather River resulting from the construction of Oroville Dam. A portion of the Chinook salmon and steelhead returning to spawn are directed to a fish ladder into the hatchery. This hatchery can accommodate approximately 8,000 spawning fish. Fish reared at this facility are released into the Feather River, Sacramento River, Delta near San Francisco Bay, and Lake Oroville. In addition, salmon are also reared at the Thermalito Facility on the west side of Thermalito Afterbay for planting in the Central Valley river system. The capacity of this facility is 2.5 million fingerlings a year. Approximately 20 percent of the salmon and steelhead returning to spawn use the hatchery and 80 percent use the river below the dam.

Many of the fish species reported for Big Chico Creek are also present in the Feather River along with a number of additional native and nonnative species. Many other species are dependent on aquatic habitats but are generally found only where these habitats occur in association with certain upland habitat types, such as riparian woodlands and emergent wetlands. Kingfishers use aquatic habitats to forage and are found commonly where riparian or other available perching habitat is present. Other birds, such as wood duck, require aquatic habitats for foraging and cover while nesting in adjacent woodlands. Many other waterfowl, grebes, and other water birds require emergent vegetation for cover and breeding. Several mammals, such as river otter, muskrat, and beaver are also dependent on an aquatic habitat and occur where riparian woodlands, riparian scrub, or emergent vegetation provide cover or other needed resources. Many other species are dependent on aquatic habitats but are generally found only where these habitats occur in association with certain upland habitat types, such as riparian woodlands and emergent wetlands. Kingfishers use aquatic habitats to forage and are found commonly where riparian or other available perching habitat is present. Other birds, such as wood duck, require aquatic habitats for foraging and cover while nesting in adjacent woodlands. Many other waterfowl, grebes, and other water birds require emergent vegetation for cover and breeding. Several mammals, such as river otter, muskrat, and beaver are also dependent on an aquatic habitat and occur where riparian woodlands, riparian scrub, or emergent vegetation provide cover or other needed resources.

Table 3–12. *Fish in the Feather River in Butte Count*y. Thermalito Forebay is stocked with catchable-sized rainbow trout.

Several smaller permanent and ephemeral creeks flow through the Plan Area, including Little Chico Creek, Mud Creek, Rock Creek, and Little Dry Creek, that support one or more life stages of a number of native and nonnative fish species (Walther 2009). These smaller waterways can be important nonnatal rearing grounds for salmonids, providing ample food for rapid growth rates of salmonids that improve juvenile survival during their downstream migration towards the ocean (Limm and Marchetti 2009).

Wildlife

Aquatic habitats are essential in maintaining the diversity of wildlife found in the Central Valley and in the Plan Area. Most wildlife species use aquatic habitats at least incidentally for drinking water, some to meet essential life requirements, and others to meet all of their life requirements of nesting, foraging, and cover. In addition to the open water component, most aquatic communities in the Plan Area consist of other adjacent and associated habitats, such as riparian woodlands or scrub, emergent wetlands, or grasslands. These adjacent natural communities greatly enhance the value of the aquatic community by providing habitats that support species that rely on both aquatic and associated habitat types.

Some species are primarily aquatic, although adjacent uplands are also used for some element of their life history. For example, while nesting in adjacent upland sites, western pond turtle requires lakes, large ponds, or perennial watercourses for foraging and cover. This covered species may be found in aquatic habitats along Butte Creek, Big Chico Creek, and other creeks, sloughs, and waterbodies in the Plan Area. Giant garter snake, also a covered species, requires slow-moving streams or channels that support submergent and emergent vegetation and an upland component for hibernaculae. Amphibian species, such as Pacific tree frog, also rely on these habitats. Foothill yellow-legged frogs rely on streams or ponded habitats and are primarily found at higher elevations at the eastern edge of the Plan Area.

Many other species are dependent on aquatic habitats but are generally found only where these habitats occur in association with certain upland habitat types, such as riparian woodlands and emergent wetlands. Kingfishers use aquatic habitats to forage and are found commonly where riparian or other available perching habitat is present. Other birds, such as wood duck, require aquatic habitats for foraging and cover while nesting in adjacent woodlands. Many other waterfowl, grebes, and other water birds require emergent vegetation for cover and breeding. Several mammals, such as river otter, muskrat, and beaver are also dependent on an aquatic habitat and occur where riparian woodlands, riparian scrub, or emergent vegetation provide cover or other needed resources.

Table 3-12. Fish in the Feather River in Butte County

Common Name	Scientific Name	Notes
Green sturgeon	*Acipenser medirostris*	Resident all year downstream of Afterbay Outlet
White sturgeon	*Acipenser transmontanus*	Resident all year downstream of Afterbay Outlet
Central Valley steelhead	*Oncorhynchus mykiss*	Present all year; juveniles primarily Afterbay to Fish Barrier Dam; adults from Afterbay to Honcut Creek in spring and fall
Central Valley Spring-run Chinook salmon	*Oncorhynchus tshawytscha*	Adults March through December primarily at or below Feather River Hatchery
Central Valley fall-/late fall-run Chinook salmon	*Oncorhynchus tshawytscha*	Adults October through February primarily below Feather River Hatchery
Hardhead	*Mylopharodon conocephalus*	Residents all year downstream of Fish Barrier Dam
Sacramento pikeminnow	*Ptychocheilus grandis*	Residents all year downstream of Fish Barrier Dam
Sacramento splittail	*Pogonichthys macrolepidotus*	February through May for spawning downstream of Afterbay Outlet
American shad	*Alosa sapidissima*	May through December for spawning, primarily downstream of Afterbay
Hitch	*Lavinia exilicauda*	Resident all year downstream of Afterbay Outlet
Pacific lamprey	*Lampetra tridentate*	April through July downstream of Fish Barrier Dam
River lamprey	*Lampetra ayresi*	April through July downstream of Fish Barrier Dam
Sacramento sucker	*Catostomus occidentalis*	Resident all year below Fish Barrier Dam
Tule perch	*Hysterocarpus traski*	Resident all year, primarily downstream of Afterbay Outlet
Spotted bass*	*Micropterus punctulatus*	Resident all year, primarily downstream of Afterbay Outlet
Largemouth bass*	*Micropterus salmoides*	Resident all year, primarily downstream of Afterbay Outlet
Smallmouth bass*	*Micropterus dolomieu*	Resident all year, primarily downstream of Afterbay Outlet
Red-eye bass*	*Micropterus coosae*	Resident all year, primarily downstream of Afterbay Outlet
Bluegill*	*Lepomis macrochirus*	Resident all year, primarily downstream of Afterbay Outlet
Green sunfish*	*Lepomis cyanellus*	Resident all year, primarily downstream of Afterbay Outlet
Redear sunfish*	*Lepomus microlophus*	Resident all year, primarily downstream of Afterbay Outlet
Black crappie*	*Pomoxis nigromaculatus*	Resident all year, primarily downstream of Afterbay Outlet
White crappie*	*Pomoxis annularis*	Resident all year, primarily downstream of Afterbay Outlet

Source: SWRI 2003a, Moyle et al. 2004, FERC 2006
* Nonnative species

Larger water bodies, such as Thermalito Afterbay, and other large open water habitats, such as those found at Gray Lodge Wildlife Refuge, are particularly important for roosting and foraging waterfowl and other water birds. These sites are also important foraging habitats for bald eagle and osprey. Many insectivorous birds such as swallows, swifts, and flycatchers forage for insects that congregate over open water habitats.

Ponds are small impoundments mostly created by ranchers or other livestock managers to improve the distribution and availability of water on the landscape. These provide a year-round supply of water and serve as refugia for many native species including California tiger salamander, California red-legged frog, western pond turtle, and foothill yellow-legged frog. They also serve as habitat for nonnative species such as bullfrogs and nonnative fish species (USFWS 2006a).

3.5.5.2 Environmental Gradients

Environmental gradients associated with aquatic communities are primarily dependent on bank slope. If open water is associated with gently sloping banks, the open water typically will grade to emergent vegetation in shallow water and near shore-wetted soils and then to riparian vegetation. The width of these adjacent communities is dependent on bank slope (steeper sloping banks will tend to support narrower bands of wetland and riparian vegetation than gentler sloping banks) and the availability of sufficient surface and subsurface soil moisture relative to the rooting depth of wetland and riparian vegetation.

Floodplains within the Plan Area support an environmental gradient based on small-scale elevation patterns. Floodplains associated with the Sacramento River, Feather River, Big Chico Creek, and Butte Creek have the most pronounced floodplain gradient conditions. Assuming equal access to water, low elevation portions of floodplains inundate more frequently, providing more habitat for aquatic species. Higher elevation portions of floodplains inundated less frequently and support riparian vegetation and wildlife species. Even higher elevation portions inundate so infrequently that they support upland species.

Waterways within the Plan Area contain an environmental gradient that begins upstream with the smallest “first order” streams – most are upslope of the Plan Area. These streams usually occur in steep-sloped areas and move quickly downstream. As waterways move downslope, they combine with others to create larger order streams. Ultimately, all streams in the Plan Area drain to the Sacramento River. Most smaller order streams, such as Little Chico, Mud, and Little Chico Creeks, begin upstream of the Plan Area in the western slopes of the Cascade Range and Sierra Nevada. As these streams move downslope and through the Plan Area, they empty into larger streams such as Big Chico and Butte Creeks, which in turn empty into the larger higher order Sacramento River. Stream order often defines the plants and wildlife supported by the stream because physical characteristics, such as flow speed, flow volume, and sediment load, change along a gradient from lower to higher order streams. These physical characteristics can drive other physical characteristics, such as bank slope, sediment scour, and light levels, that influence the types of aquatic species supported along the gradients.

3.5.5.3 Invasive Species

There are multiple nonnative invasive fish species in the waterways of the Plan Area (Many other species are dependent on aquatic habitats but are generally found only where these habitats occur in association with certain upland habitat types, such as riparian woodlands and emergent wetlands. Kingfishers use aquatic habitats to forage and are found commonly where riparian or other available perching habitat is present. Other birds, such as wood duck, require aquatic habitats for foraging and cover while nesting in adjacent woodlands. Many other waterfowl, grebes, and other water birds require emergent vegetation for cover and breeding. Several mammals, such as river otter, muskrat, and beaver are also dependent on an aquatic habitat and occur where riparian woodlands, riparian scrub, or emergent vegetation provide cover or other needed resources.) Many of these fish were introduced for sportfishing or to provide forage for sport fish. In addition, Thermalito Afterbay is specifically managed for nonnative black bass (largemouth, smallmouth, and spotted) populations to support recreational fishing by the public (Southwest Research Institute [SWRI] 2003b).

The effects of nonnative fish on native fish are generally in the form of predation and competition for food and habitat. For example, many centrarchids (sunfish, crappie, and black basses) are voracious predators and are known to eat a variety of native invertebrate and fish species. Although no introduction of a nonnative fish species has unambiguously caused the extinction of a native species, it is thought that their introduction has contributed to the decline of many native species (Cohen and Carlton 1995). For example, smallmouth bass have been associated with the decline in the native hardhead in the Plan Area. Also, introductions of multiple species of centrarchids have been associated with the extirpation of Sacramento perch from the Sacramento River watershed, including waterways within the Plan Area.

There are also several nonnative invasive species other than fish found in aquatic natural communities that can damage such communities. Giant reed, considered the state's most invasive riparian weed, and salt cedar can grow in dense monocultures along riparian areas, crowding out native species and causing changes to hydrologic regimes in aquatic communities (Dudley 2000). The introduced bullfrog is an important riparian invasive in the Plan Area. This species has been implicated as a primary driver of native Ranid frog declines in Butte County (Hayes and Jennings 1986).

3.5.5.4 Ecosystem Functions

Seasonal high and low flows in streams shape the channel cross-section through scour and deposition of sediments. These processes provide for building and maintaining floodplains and associated communities (i.e., wetland and woody and herbaceous riparian vegetation) as channels meander across the landscape. These processes are muted in locations where channel banks are protected or leveed and in waterways with dams that control releases for power generation, water supply, and flood control. Sediments eroded and transported by streams also create and maintain salmonid spawning habitats. Organic material carried into streams by runoff or by receding overbank flows support foodweb processes by providing nutrients that support plankton, zooplankton, and invertebrate production, both instream as well as in downstream rivers and the Sacramento-San Joaquin River Delta. As described above, open water areas, including reservoirs and canals, also support habitat for fish and wildlife.

3.5.6 Agriculture

The agricultural natural community type is made up of the following land cover types: orchards and vineyards, rice, irrigated cropland, irrigated pasture, and nonnative woodland. Nonnative woodland is included in the agriculture community because this land cover type is comprised of eucalyptus plantations that are planted for commercial purposes (e.g., pulp production). The distribution of the agriculture community and its constituent land cover types are shown in Figure 3–19, *Distribution of Agricultural Lands in the Plan Area* (see separate file) and the extent of the community and land cover types are presented in Table 3–5. The agricultural community dominates the western half of the Plan Area. Adjacent communities are generally riparian-dominated communities associated with the Feather and Sacramento Rivers, urban, or grassland at the eastern limit of primary agricultural development.

3.5.6.1 Environmental Conditions

3.5.6.1.1 Land Use

The primary land use associated with the agriculture community is farming for rice and other crops and maintaining orchards for fruit and nut production.

3.5.6.1.2 Physical Environment

Agriculture within the Plan Area occurs where the soils and topography are most suitable. The western section of the Plan Area is associated with the north Central Valley, where most of the agricultural production occurs. The Valley is flat and generally well-drained, and therefore well-suited for many crops; however, soil function changes from north to south. Rice production dominates the southwestern section of the Plan Area, where the existing hydric soils formed in association with an internally draining flood basin. To the north, rice production ceases and orchards and vineyards become the dominant cover type. Although orchards and vineyards occur in several parts of the Plan Area, specific crops are generally focused by geographic and topographic region (i.e., almonds are grown in the northwestern Plan Area, walnuts dominate the south central Plan Area, and olives occur peppered throughout the southeastern Plan Area in the foothills of the Sierra Nevada). The primary soil types supporting agricultural land cover types are presented in Table 3–13, *Soil Types Supporting Agriculture*.

Table 3–13. Soil Types Supporting Agriculture

Soil Grouping[1] Soil Complex	Orchard/ Vineyard	Rice	Irrigated Cropland	Irrigated Pasture	Nonnative Woodland
Sacramento Flood Plain Thermic					
Parrott-Gianella-Farwell	X	X	X	X	X
Xerorthents, Tailings-Gianella	X	X	X	X	X
Sacramento Flood Basin Thermic					
Lofgren-Blavo	X	X	X	X	X
Esquon-Neerdobe	X	X	X	X	X
Bosquejo-Galt	X	X	X	X	X
Gridley Taxadjunct-Subaco Taxadjunct	X	X	X	X	X
Sacramento Valley Alluvial Fan Thermic					
Olashes	X	X	X	X	X
Conejo-Almendra-Vina	X	X	X	X	X
Haploxerolls-Durixerolls	X	X	X	X	X

Source: Modified from NRCS (2006).
[1]A description of specific soil complexes is presented in Table 3–2.

3.5.6.1.3 Crops and Cropping Patterns

Table 3–14, *Extent of Agricultural Lands by Major Crop Type in Butte County in 2005* presents the extent of agricultural crops reported for Butte County in 2005. Important crops include nonirrigated pasture (i.e., grassland and savanna), rice, almonds, walnuts, and plums (Butte County 2006). Approximately 50 percent of agriculture production within the Plan Area is rice. Table 3–14 lists crops from the Agricultural Commissioner's Report.

Table 3–14. Extent of Agricultural Lands by Major Crop Type in Butte County in 2005[1]

Land Cover and Crop Type	Acreage
Rice	96,400
Irrigated pasture	15,500
Alfalfa	1,885
Wheat	1,600
Other field crops	5,697
Subtotal Field Crops	***121,082***
Almonds	41,478
Olives	2,424
Peaches (all types)	2,987
Dried plums	12,297
Walnuts (English)	32,080
Other orchard/vineyard crops	3,258
Subtotal Orchards and Vineyards	***94,524***
Total	**215,606**

[1] The acreages in this table cannot be directly compared to the agricultural acreages from the land cover mapping, because the numbers in this table are based on reported production and the numbers from the land cover mapping include both producing and non-producing agricultural land. For example, fallow rice fields and abandoned orchards are included in the agricultural land cover mapping.
Source: Values derived from the Agricultural Crop Report (Butte County 2006).

Rice practices consist of ripping or tilling the field. The field is then laser-leveled approximately every seven years. Planting is typically done in April and May, although it can go into June. The field is wetted and the seed is moistened and then applied by air (University of California [UC] Cooperative Extension 2004). Following seeding is an approximately 120-day growing season. Herbicides and pesticides are applied to control weeds, insects, and disease. Following harvest, rice farmers may leave the field fallow or they may burn or flood the field for the winter season. Burning is allowed under regulation to control plant diseases that reduce the value of production of rice. Occasionally, burning is mandated to control a specific pest outbreak. Rice fields can be burned as frequently as every four years, but practically, some farmers burn more frequently by purchasing credits from other farmers who do not burn. Some farmers choose not to burn at all. Flooding is also done to control disease. Many farmers also use flooded fields for duck club use. The timing of flooding is dictated by the rainy season and varies from one year to the next (Price 2006).

Orchards and vineyards are long-term crops that remain relatively constant from year to year. Occasionally, orchards are leveled because of pest problems or crop changes. Typically orchards are replanted as soon as possible, several months, after previous orchards are removed. The largest orchard crop by land area occupied in the Plan Area is almonds. Almonds are most commonly grown in the northwestern part of the Plan Area. Fields used for almonds are typically ripped and leveled prior to planting (UC Cooperative Extension 2006). The site is fumigated prior to planting (Connell pers. comm.). Tree density ranges from 75 to 180 per acre with at least two varieties of almonds with similar blooming periods planted in close proximity, as they require cross-pollination to produce fruit. Weeds are controlled by a variety of methods including disking, spraying with RoundUp, and mowing. Several insecticides are used to control a variety of pests including peach twig borer and mites. Hives of honey bees are used to facilitate pollination. Bait and bait stations are used to control various small mammals including gophers and ground squirrels (UC Cooperative Extension 2006).

Practices for walnut growing are similar to almond growing (Connell pers. comm.). Variations from almond growing practices are described below. Common types of walnuts grown in the region include Chandler, Hartley, Tulare, and Howard and they are grown on Paradox rootstock. Fungicides are used to control walnut blight. Tree density is much lower than for almonds, typically about 56 trees per acre. Insecticides are applied to control mites, codling moth, husk fly, aphids, and scale (UC Cooperative Extension 2002).

Olives were traditionally grown in the foothills south of Oroville. Olive profits have gone down in recent years due to infestation by the olive fly, canned fruit, and a change in the marketability of the particular olive varieties grown in the Plan Area. The olive fly lays eggs on the fruit of the olive and the larvae eat the meat of the olive and proceed toward the stone, making the fruit unmarketable. Most abandoned olive orchards have been left in place and are used for cattle grazing; however, there has been an increased interest in the production of olive oil and the introduction of new olive varieties that are not susceptible to olive fruit fly damage. Olive trees are very long-lived and will persist without watering or maintenance, although they do not produce much fruit (Connell pers. comm.).

3.5.6.1.4 Wildlife

Agricultural lands in the Central Valley represent an extremely altered landscape that retains little resemblance to the historical (pre-European settlement) condition. Formerly consisting of extensive wetlands, open grasslands, broad riparian systems, and oak woodlands, the conversion to agriculture has removed most of these native habitats. However, while generally supporting a less diverse community of wildlife compared with most native habitats, agricultural systems continue to support abundant wildlife and provide essential breeding, foraging, and roosting habitat for many resident and migrant wildlife species.

Ricelands, for example, have become important "surrogate" wetland habitats for over 235 wildlife species in the Central Valley (Jones & Stokes 1995). Approximately 500,000 acres of land in the Central Valley, nearly one-fifth of which occurs in the Plan Area, are planted in rice each year (Jones & Stokes 1995). With the extensive loss of wetland habitats, ricelands provide essential breeding and wintering habitat for waterfowl, shorebirds, wading birds, as well as providing food and cover for some reptiles, amphibians, and mammals (Elphick and Oring 1998). Most significant is the value ricelands provide to waterfowl and other waterbirds using the Pacific Flyway. With less than 300,000 acres of natural wetlands remaining in the Central Valley (*Central Valley Joint Venture Habitat Implementation Plan* 1990), the wetland functions provided by ricelands are an important component of waterfowl management in the Pacific Flyway. Ricelands also play an important role in providing cover, foraging, and roosting habitat for several special-status species, including the state and federally listed giant garter snake and the greater sandhill crane, both covered species in the BRCP. As a result, conversion of rice to orchards may be of significant concern to certain wildlife species, particularly as it pertains to total loss of farmed wetland acres and alternate habitat for many wetland-dependent species.

Agricultural lands also provide essential upland habitat for many wildlife species. Crop patterns that include a variety of hay, grain, and row crops support abundant rodent populations. Field edges, woodlots, and watercourses that support riparian habitat also provide breeding sites and refugia for prey species and other wildlife. Because of this abundance of food, the Central Valley supports one of the largest concentrations of raptors during the winter and breeding seasons. Raptors such as red-tailed hawk, Swainson's hawk, and white-tailed kite nest throughout the Central Valley and forage in a variety of agricultural crop types including hay, grain, row crops and irrigated pastures. Swainson's hawk, a state-listed and covered species in the BRCP, is largely dependent on agricultural foraging habitats in the Central Valley and increasingly throughout its range (Estep 1989, England 1997). Breeding density in the Central Valley between Butte County and Stanislaus County is among the highest within the range of the species and due to highly conducive crop patterns in many areas, likely higher than they were historically (Estep in preparation). As such, conversion of grassland to orchards to grow such crops as olives may also be of concern for grassland-dependent species. Conversion of pastures, row crops, and similar agricultural lands to orchards has been noted as a factor impacting Swainson's hawk.

Native and nonnative vegetation growing along field margins and riparian vegetation growing along permanent agricultural ditches also provides habitat for migrant and resident songbirds, raptors, and small mammals. Filter strips of vegetation planted in agricultural areas to improve water quality also provide wildlife habitat. Marsh wetlands associated with agricultural drainage and irrigation channels provide habitat for a large number of wildlife and fish species (see description of wetland wildlife in Section 3.5.4, *Wetlands*). Wildlife associated with the agriculture community is listed in Appendix D.

3.5.6.2 Environmental Gradients

Transitions from agricultural land cover to other natural communities tend to be very abrupt, as the limit of a given agricultural field is determined by substantial ground surface modification on one or both sides of the transition. These transitions generally result from very different land uses (e.g., from farmed field to development) or changes in soil suitability for supporting crop production. Along the western edge of the community, agricultural lands generally transition to managed wetlands (e.g., Gray Lodge Wildlife Area) or riparian communities associated with the Sacramento River. To the east, agricultural lands generally transition to developed lands (e.g., City of Chico) or grassland communities.

3.5.6.3 Invasive Species

A wide range of invasive plant species are found in the agricultural lands of the Plan Area and many are considered a threat to surrounding natural communities. Examples of agricultural weeds include yellow starthistle (*Centaurea solstitialis*), mustards (*Brassica* spp.), Dallisgrass (*Paspalum dilatatum*), poison hemlock (*Conium maculatum*), and cheeseweed (*Malva parviflora*), to name just a few.

3.5.6.4 Ecosystem Functions

The primary ecological function of agricultural lands is to provide foraging habitat for agriculture-associated species and limited nesting, cover, and other habitat functions associated with habitats provided by riparian and other vegetation growing along ditch and field margins. Ditches and drains associated primarily with rice fields provide functions similar to those described for wetlands under Section 3.5.4, except for carbon-storing functions, which are limited as a result of periodic clearing of vegetation to maintain water flow.

3.5.7 Biological Diversity

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

By most measures of biological diversity, California stands out as unique in North America. For example, California contains more native biological diversity than any other state, including more endemic species than any other state (1,295 species) (Stein 2002). Compared to other states, California is ranked first in the United States in the number of endemic species of vascular plants, amphibians, reptiles, mammals, and freshwater fish (Stein et al. 2000). In terms of total species, California supports approximately one-third of all species of vascular plants and reptiles in the United States, 47 percent of mammal species, and 56 percent of bird species (DFG 2003).

The Plan Area represents less than 0.6 percent of the land area of California but contains a high amount of the state's biological diversity. Some of the elements contributing to this high diversity are the region's diversity of natural communities (including foothill oak woodland, valley grassland, large marsh wetlands, and several types of vernal pool), the elevation range spanned within the Plan Area, and the diversity of geology and topography. In addition, the region is part of the Pacific Flyway, one of the major north-south migratory routes for avifauna in the Americas. Surveys of the California Central Valley document that it is one of the most important regions in western North America for migratory and wintering shorebirds (Shuford et al 1998).

One measure of the degree of biological diversity within the Plan Area is the number of species known to inhabit the Plan Area. Based on information presented in Appendix D, an estimated 1,400 species of vascular plants and vertebrates could occur in natural communities of the Plan Area, representing approximately 17 percent of all the plant and vertebrate species known to occur in California. Table 3–15, *Number of Vertebrate and Vascular Plant Species that Could be Present in the Plan Area* also demonstrates the percentage of species potentially found in the Plan Area compared to the entire state based on taxonomic group. This shows, for example, that close to 70 percent of all of California's bird species use the Plan Area, a testament to its importance as part of the Pacific Flyway. By this measure, the Plan Area also has a high diversity of mammal species (37.4 percent), and reptile species (27.5 percent). It also potentially supports 21 percent and 22.5 percent of California's amphibians and fish species, respectively.

Although species counts and analyses specific to the Plan Area have not been performed, these national and statewide studies strongly suggest that the biological diversity within the Plan Area is high in most plant and animal groups relative to other parts of California and the United States.

Table 3-15. Number of Vertebrate and Vascular Plant Species that Could be Present in the Plan Area

Taxonomic Group	Number of Species in Plan Area	Number of Species in California	Percent of California Species in Plan Area
Mammals[1]	68	182	37.4%
Birds[1,2]	253	368	68.8%
Reptiles[1]	22	80	27.5%
Amphibians[1]	13	62	21.0%
Fish[3]	25	111[4]	22.5%
Total Vertebrates	**381**	**803**	**47.6%**
Vascular Plants[5]	1,018	7,660 (6008)[6]	13.3%
Total Vertebrates and Vascular Plants	**1,400**	**8,463**	**16.5%**

Sources:
[1] From CWHR for species regularly occurring in California (see Appendix D for list of species in Butte County)
[2] Shuford, D. W., G. W. Page, and J. E. Kelmyr. 1998. Patterns and Dynamics of Shorebird Use of California's Central Valley. *The Condor* 100: 227–244.
[3] Moyle, P. B. 2002. *Inland Fishes of California*, Revised and Expanded. Berkeley: University of California Press.
[4] 51 nonnative and 60 native (approximately) (Moyle 2002).
[5] Calflora 2006: http://www.calflora.org/topMission.html. Includes all plant taxa (species and subspecies; native and nonnative) (see Appendix D for list of species in the Plan Area).
[6] Jepson Manual of Higher Plants of California (Hickman 1993). Native plant taxa, only.

3.6 PROPOSED COVERED SPECIES

Species identified for coverage under the BRCP ("covered species") are those for which incidental take authorizations may be required under the ESA and NCCPA to implement the covered activities over the term of the BRCP. An evaluation was conducted starting with a larger list of species that was vetted to identify the proposed covered species.

3.6.1 Species Considered for Coverage

Species considered for coverage in the evaluation were special-status species that could be present in the BRCP Plan Area. Consideration for coverage of nonlisted species was limited to special-status species because, by definition, they are recognized by federal and state wildlife agencies as declining and, therefore, are more likely than other nonlisted species to become listed at some time during implementation of the covered activities. Special-status species are defined as species that meet one of the following criteria:

- Listed as threatened or endangered under ESA;
- Proposed or candidates for listing under ESA;
- Listed as threatened or endangered under the California Endangered Species Act (CESA);
- Candidates for listing under CESA;
- California species of special concern (SSC) as identified by CDFW;[6]

[6] http://www.dfg.ca.gov/wildlife/nongame/ssc/

- Plants listed as rare under the California Native Plant Protection Act; or
- Plants ranked in the California Native Plant Society (CNPS) California Rare Plant Rank as 1A, 1B, or 2.

Sources of information used to identify the special-status species that could be present in the Plan Area were:

- CDFW's CNDDB;[7]
- USFWS' list of endangered and threatened species that occur in or may be affected by projects in Butte County;[8]
- Butte County General Plan Background Report; and
- Recorded observations of special-status species provided by local resource experts.

A total of 108 special-status species (61 animals and 47 plants) were identified as being present or having the potential to be present in the Plan Area based on the sources of information described above (Appendix B, *Evaluation of Species Considered for Coverage*). The special-status animals evaluated for coverage under the BRCP are provided in Table B–1 and the special-status plants evaluated for coverage under the BRCP are provided in Table B–2.

3.6.2 Selection of Proposed Covered Species

Four criteria were used to evaluate the potential covered species identified in Tables B–1 and B-2 (Appendix B). All four of the criteria had to be met for the species to be proposed for coverage under the BRCP.

1. **Occurrence in the Plan Area**. The species is known to occur in the Plan Area or could occur based on presence of habitat in the Plan Area and known occupied habitat near the Plan Area.
2. **Potential for Listing**. The species is listed threatened or endangered under ESA or CESA or is reasonably likely to become listed under these laws during the term of the permit, or is fully protected under the California Fish and Game Code. Nonlisted species are considered likely to become listed in the future if they meet one of the following criteria:
    - They are currently proposed for listing under ESA or are candidates for listing under ESA or CESA, or
    - They are a California species of special concern or CNPS California Rare Plant Rank 1A, 1B, or 2 plant species whose populations or habitats are continuing to decline and

[7] Source: CNDDB RareFind 3 database (2006) and http://imaps.dfg.ca.gov/viewers/cnddb_quickviewer/.
[8] Source: http://www.fws.gov/sacramento/es_species/Lists/es_species_lists-form.cfm.

a substantial proportion of their population is located in the Plan Area that could be substantially affected by covered activities.

3. **Potential to be Affected**. The species or its habitats could be affected by the types of activities anticipated to be covered under the BRCP.
4. **Sufficient Information**. Sufficient scientific information and data are available to determine the likely impacts of the covered activities on the species and to formulate conservation measures that could effectively mitigate and conserve the species.

The evaluation process and results of the process for each of the special-status animal and plant species considered are presented in Table B–1 and Table B–2, respectively. A total of 38 of these species met all four of the selection criteria and are proposed for coverage under the BRCP. The proposed covered species are shown in Table 1–1, *BRCP Covered Species*.

3.6.3 Status of Proposed Covered Species

The ecological requirements, status, threats and stressors, distribution maps, and models of potential habitat for each of the proposed covered species are presented in Appendix A.

3.7 Local Concern Species

In addition to the covered species, there are other species known to occur in the Plan Area that are rare, declining, or potentially threatened by land use changes in the Plan Area. While many of these species have special-status designations, they do not meet one or more of the criteria used in the covered species selection process. The BRCP Stakeholder Committee designated 17 of these species as “Local Concern Species” (see Table 1–2, *Local Concern Species*). While Local Concern Species are not the focus of the BRCP, the conservation measures (see Chapter 5, *Conservation Strategy*) for covered species and natural communities are designed to consider the habitat needs of the Local Concern Species. This section summarizes the status, distribution, and habitat and local concern species. Expected outcomes for these local concern species with full BRCP implementation are described in Appendix N, *Benefits of Conservation Measures for Local Concern Species.*

3.7.1 Greater Roadrunner (*Geococcyx californianus*)

Status. No federal or state status. No other special status.

Description. The greater roadrunner is a medium-sized bird (50–60 cm) with relatively short, broad wings (43–61 cm). The head, neck, back, and wings are dark brown-black and heavily streaked with white, and the breast is mostly white. The legs and beak are blue. The eyes are bright yellow and there is a postocular streak of blue and red skin. Other notable features include the crest of black feathers, which can be raised or lowered, and a long tail that may be carried at an upward angle (Famolaro 2002).

Distribution. The current distribution in California extends the length of the Central Valley and Sierra foothills, Coast Ranges and valleys, and throughout Southern California. Few confirmed breeding locations have been reported in California, all of which are in Southern California (Famolaro 2002). The species is considered rare in northern California and in Butte County (Snowden 2001).

Habitat Associations. Greater roadrunner is found in arid, semi-open scrub habitat, primarily chaparral and coastal scrub communities. In Northern California, it is associated with a mix of open grasslands and chaparral, and occasionally with oak savanna habitats with patches of shrubs and thickets. It is generally found in flat to semi-flat terrain.

Habitat Availability in the Plan Area. The grassland and chaparral communities on the east side of the Plan Area provide suitable habitat conditions for the greater roadrunner. While the species could potentially occur further westward onto the valley floor, the intensive agricultural and increasing development-related fragmentation preclude regular use of this area.

Occurrence/Distribution in the Plan Area. There are no recent records of breeding greater roadrunners in Butte County; however, Snowden (2001) considers it a potentially breeding bird. Reportedly fairly common during the first half of the twentieth century, it is currently considered rare and declining. While there are insufficient records to establish a current distribution of the species in the Plan Area, the grassland and chaparral communities and the oak woodland/grassland communities on the east side of the Plan Area are considered potential habitat.

3.7.2 Northern Harrier (*Circus cyaneus*)

Status. The northern harrier is designated by CDFW as a state species of special concern (Remsen 1978). The northern harrier currently has no special federal status.

Description. The northern harrier is a medium-sized hawk (46–50 cm) with a slight build and relatively long tail and wings (102–118 cm). Adult males are pale gray, while juveniles and females are brown. All plumages show a distinctive white rump patch in flight (Sibley 2003).

Distribution. In California, this species is a permanent resident of the northeastern plateau, coastal areas, and the Central Valley. It is also a widespread winter visitor and migrant in suitable habitat. While declines in the California population have been noted for many years (Grinnell and Miller 1944, Remsen 1978), the species can be locally abundant where suitable habitat remains free of disturbance, especially from intensive agriculture. Breeding populations have declined from destruction of wetland habitats, native grasslands, and moist meadows, and in agricultural areas from burning and plowing of nest sites during early stages of the breeding cycle (MacWhirter and Bildstein 1996).

Habitat Associations. Throughout its range, northern harriers occur primarily in open wetland, grassland, and agricultural habitats. The northern harrier is a ground-nesting raptor, constructing rudimentary nest sites on the ground in marsh, grassland, and some agricultural habitats, particularly grain fields. They forage in seasonal wetland, grassland, and agricultural habitats for voles and other small mammals, birds, frogs, and small reptiles, crustaceans, and insects. They also roost on the ground, using tall grasses and forbs in wetlands, or along wetland/field borders for cover (MacWhirter and Bildstein. 1996).

Habitat Availability in the Plan Area. Nesting and foraging habitat for northern harriers occurs throughout most of the Plan Area. The large wetland habitats in the western and southwestern portions of the Plan Area, such as Llano Seco and wetlands associated with Gray Lodge Wildlife Area, probably represent the most intact, least disturbed, and highest value nesting and foraging habitat. Also, the row- and grain-crop agricultural lands throughout the western and central portions of the Plan Area provide suitable foraging habitat and can provide suitable nesting habitat; however, as noted above agricultural practices in these habitats can result in the destruction of active nests. Finally, the grasslands, grassland/vernal pool complexes, and grassland meadows in the eastern portion of the Plan Area also provide suitable foraging habitat and occasional nesting opportunities.

Occurrence/Distribution in the Plan Area. Nesting records of northern harriers are not well documented, due in part to the difficulty locating and confirming nests. The species likely breeds in all suitable habitat areas noted above, but the largest and most secure nesting areas are those with a marsh component and are relatively undisturbed, such as the Gray Lodge and Llano Seco wetland areas. The species is considered an uncommon breeder (Snowden 2001) and has likely declined in Butte County as a result of agricultural conversion, particularly incompatible crop types such as orchards. Foraging activity occurs throughout all suitable habitats and is particularly important during the winter season when northern migrants are present in the Plan Area (Snowden 2001).

3.7.3 Golden Eagle (*Aquila chrysaetos*)

Status. Currently designated by CDFW as a fully protected species (DFG 2011); the golden eagle is also protected under the federal Bald and Golden Eagle Protection Act and is designated by the USFWS as a federal species of concern.

Description. The golden eagle is a large bird of prey (70–84 cm in height) with very long and broad wings (185–220 cm). They are light brown in color with dark brown eyes and a faintly banded tail. Adults have a golden mantle. Females are somewhat larger, but otherwise the sexes are similar (Kochert et al. 2002).

Distribution. In North America, golden eagles breed from Alaska to Mexico and from the west coast east to Texas. In California, the species breeds throughout the mid- to higher elevation portions of the state and throughout the Southern California deserts (Kochert et al. 2002).

Habitat Associations. In California, golden eagles are generally found in open country, including open woodlands and coniferous forests, grasslands, chaparral habitats, and deserts.

They forage primarily on lagomorphs and ground squirrels (Olendorff 1976). They nest on cliff ledges, large outcrops, and where these habitats are limited they will readily nest in a variety of trees (Bruce et al. 1982).

Habitat Availability in the Plan Area. Available nesting habitat is found in the far eastern portion of the Plan Area. Cliff faces associated with steep canyons provide potential nesting substrates. Large oak trees, foothill pine, and other conifers also provide potential nesting habitat. Suitable foraging habitat includes grassland and chaparral areas in the eastern portion of the Plan Area, and cultivated farmland and pasturelands in the interior and western portions of the Plan Area.

Occurrence/Distribution in the Plan Area. There are no recent records of nesting golden eagles from the Plan Area. A south-facing cliff-site nest has been recorded just west of Table Mountain, but there has been no recently recorded activity at this site. Golden eagles are known to nest on the Sutter Buttes, just south of the Plan Area. Golden eagles are occasionally observed in the Plan Area (http://chicobirding.com).

3.7.4 Prairie Falcon (*Falco mexicanus*)

Status. The prairie falcon is designated by the USFWS as a federal species of concern, and is on the CDFW Watch List.

Description. The prairie falcon is large falcon (37–47 cm) with long, pointed wings (90–113 cm) (Steenhof 1998). It has a pale brown back, whitish chest with brown spots and bars, and brown head and facial markings, including a distinctive dark “mustache” mark on the face. The female is larger than the male but otherwise the sexes are similar.

Distribution. The prairie falcon is distributed throughout the arid west, ranging from southern Canada to northern Mexico and east to Texas. In California, the species is found primarily in the coastal ranges, Great Basin deserts of northeastern California and east of the Sierra Nevada, and the Southern California deserts. Prairie falcons are also found, although rarely, along the western slope of the Sierra Nevada and is considered a rare breeding bird in Butte County (Snowden 2001).

Habitat Associations. The Prairie falcon nests almost exclusively on cliff ledges and protected large rock outcrops. They forage in grasslands, prairies, and in cultivated fields and pasture habitats.

Habitat Availability in the Plan Area. Available nesting habitat is restricted to the cliff faces associated with steep canyons on the eastern edge of the Plan Area. Available foraging habitat includes the grassland and open chaparral and woodland habitats on the east side and to a lesser extent cultivated habitats in the interior and western portions of the Plan Area.

Occurrence/Distribution in the Plan Area. There are no recent records of nesting prairie falcons in the Plan Area. Snowden (2001) considers the species a rare breeder along the eastern edge of the Plan Area. The species is more frequently observed during the winter, when it can be found hunting in agricultural, grassland, and scrub habitats throughout the Plan Area.

3.7.5 Merlin (*Falco columbarius*)

Status. The merlin was previously designated as a state species of special concern by CDFW (Remsen 1978); however, the species is not included on the recently published revision of CDFW’s Bird Species of Special Concern (Shuford and Gardali 2008). Currently, it is on CDFW’s Watch List. The merlin currently has no special federal status.

Description. The merlin is a small falcon (24–30 cm) with long, pointed wings (53–68 cm) and a long, banded tail. It is the least distinctively marked falcon in North America with a faint mustache mark, brown streaking on the chest and belly, and with an unmarked gray or brown back (Sodhi et al. 1993). The sexes are similar, but the male is smaller and with a gray back; the female has a brown back.

Distribution. The merlin’s breeding range extends across Alaska and Canada and southward to the most northern United States. The species also occurs across northern Eurasia. The merlin does not breed in California. Merlins winter from southern Canada to northern South America (Sodhi et al. 1993). In California, it is an uncommon winter migrant from September to May, occurring throughout most of the western half of the state below 1,500 meters (Zeiner et al. 1990).

Habitat Associations. In California, merlins winter in open woodland, grasslands, open cultivated fields, marshes, estuaries, and along the coast. In the Central Valley, merlins are generally associated with agricultural and open grassland or savannah habitats, particularly when associated with seasonal or permanent marsh habitats (Sodhi et al. 1993). They are generally not found in heavily wooded areas (Garrett and Dunn 1981). They prey primarily on birds, but also take small mammals, reptiles, and insects.

Habitat Availability in the Plan Area. Within the Plan Area, available habitat includes non-orchard agricultural fields, grasslands and vernal pool grasslands, and seasonal and permanent marshes and wetlands. Merlins may benefit from rice fields because these areas concentrate shorebirds and other avian prey (Jones & Stokes 2005).

Occurrence/Distribution in the Plan Area. Merlins are occasionally reported in Butte County during the nonbreeding season. The species occurs uncommonly throughout the non-orchard agricultural, grassland, vernal pool grassland, and wetland communities.

3.7.6 Long-Eared Owl (*Asio otus*)

Status. The long-eared owl is designated by CDFW as a state species of special concern. Currently, it has no special federal status.

Description. The long-eared owl is a medium-sized owl (35–40 cm) with long, rounded wings (90–100 cm). It is mostly brown, but is cryptically marked with brown and black, streaking and barring on the breast and belly, which makes it difficult to detect in dense vegetation. It has large conspicuous "ear" tufts and an orange facial disk and distinctive white markings on the face that form and "x" between the eyes. It has fully feathered legs and feet. The sexes are similar; however, males are somewhat smaller and often slightly paler than females (Marks et al. 1994).

Distribution. The breeding distribution extends throughout most of southern Canada, northern and eastern United States, the Great Lakes region, and throughout much of the northern prairie and western United States. In California, the species occurs throughout much of the state with reported historic concentrations in the Sacramento Valley, San Joaquin Valley, and in the San Diego area, where it is now rare, and more current concentration areas at various locations on the east side of the Sierra, such as the Susan River, and in desert oases in Southern California deserts (Marks et al. 1994). While thought to be extirpated in many locations, including the Sacramento Valley, the species is very secretive and potentially more common than recorded observations would suggest.

Habitat Associations. The long-eared owl requires dense wooded areas for daytime roosting and nesting with adjacent open areas where they hunt for small rodents and occasionally small birds. Long-eared owls are often associated with coniferous forest edges or patches of conifers, riparian woodland, and oak woodland habitats where sufficient cover is available. Snowden (2001) reports a preference for riparian vegetation dominated by box elder or willow. They do not construct their own nest, instead, they use stick nests built by other species, including American crows and various hawk species. Adjacent foraging habitats include grasslands, shrublands, open woodlands, cultivated farmland, and other open habitats. Habitat requirements are similar during breeding and wintering seasons (Marks et al. 1994).

Habitat Availability in the Plan Area. Available nesting and roosting habitat includes dense riparian woodlands along the Sacramento River, Feather River, Big Chico Creek, and Butte Creek, willow and box elder thickets along smaller drainages, and woodlands along the edges of grassland and chaparral habitats in the eastern portion of the Plan Area.

Occurrence/Distribution in the Plan Area. Considered rare by Snowden (2001) and an uncertain breeder, there are no recent reported breeding occurrences of long-eared owls from the Plan Area. Historical breeding sites include a Sacramento River oxbow near the former M&T Ranch west of Chico and near Hamlin Canyon, south of Butte Creek on the east side of the Plan Area (Snowden pers. comm.). Occurrences reported by Altacal Audubon and others are winter occurrences.

3.7.7 Short-Eared Owl (*Asio flammeus*)

Status. The short-eared owl is designated by CDFW as a state species of special concern. Currently, it has no special federal status.

Description. The short-eared owl is a medium-sized owl (34–43 cm) with relatively long (85–103 cm) rounded wings. Its ear tufts are small and appear as ridges that begin above the bill and curve up and over the forehead and crest. It has a large, round off-white facial disk with fine brown tinges and black around the eyes. Underparts are white to buffy with dark brown streaks and the back is dark brown with white mottling (www.owling.com). The female is slightly larger than the male but otherwise the sexes are similar (Holt and Leasure 1993).

Distribution. The breeding range extends from Alaska to Central California in the west and Northern Quebec and Newfoundland to Northern Virginia in the east. The winter ranges includes all of southern United States to southern Mexico (Holt and Leasure 1993). In California, the historic breeding range included most of the lowland portions of the state. The current breeding distribution includes remaining open wetland, marsh, and prairie habitats in the Central Valley and coastal areas. The species winters primarily in the Central Valley, Sierra Nevada foothills, and Southern California.

Habitat Associations. Short-eared owls are usually found in open areas with few trees, including annual and perennial grasslands, prairies, meadows, freshwater emergent marshes, dunes, and irrigated pasturelands where it nests and roosts on the ground in dense vegetation and forages on small rodents and birds.

Habitat Availability in the Plan Area. Potential nesting habitat for short-eared owls in the Plan Area is similar to the northern harrier. Probably the highest value potential nesting habitat occurs in the wetland habitats of Llano Seco and the Butte Creek watershed in and around Gray Lodge Wildlife Area. Irrigated cropland and the grassland and grassland/vernal complexes in the eastern portion of the Plan Area also provide suitable wintering habitat.

Occurrence/Distribution in the Plan Area. Few breeding records for Butte County are available. Snowden (2001) reports the short-eared owl as a rare breeder in Butte County. Potential breeding habitat includes the Llano Seco and Butte Creek watershed area in and around Gray Lodge Wildlife Area. Wintering birds could potentially use this area and grassland habitats in the eastern portion of the Plan Area.

3.7.8 Willow Flycatcher (*Empidonax traillii*)

Status. State Endangered. Of the three subspecies present in California, *E. t. brewsteri* is the most likely to occur in the Plan Area. All subspecies are state-threatened, but *E. t. brewsteri* has no federal status. It is designated by the USFWS as a federal species of concern.

Description. The willow flycatcher is a small flycatcher (13–17 cm) similar in appearance to other *Empidonax* flycatchers. Its upper parts are drab olive to brownish gray and underparts are light gray washed with yellow on the belly during spring. It has two whitish wingbars, and a white throat contrasting with a dull brownish breast band. It has a short, wide bill and a medium-long tail. The sexes are similar (Craig and Williams 1998).

Distribution. The breeding range extends across southern Canada and throughout most of the United States with the exception of the southeast United States. It winters in Central and South America (Sedgewick 2000). In California, Grinnell and Miller (1944) reported nesting willow flycatchers throughout the state wherever deciduous shrubs, mainly thickets of willows, occurred. Currently, the species is considered a rare to locally uncommon summer resident in wet meadows and montane riparian habitats from 600 to 2,440 meters and a common spring and fall migrant at lower elevations (Craig and Williams 1998). *E.t. brewsteri* is currently found primarily in isolated Sierra Nevada and Cascade meadows, but has more recently been detected in several new locales such as along the Klamath River (Craig and Williams 1998).

Habitat Associations. Breeding habitat is typically moist meadows with perennial streams; lowland riparian woodlands dominated by willows (*Salix* spp.), primarily in tree form, and cottonwoods (*Populus* spp.); or smaller spring-fed or boggy areas with willow or alders (*Alnus* spp.) (Serena 1982, Harris et al. 1988 [in Craig and Williams 1998]). Riparian deciduous shrubs or trees, such as willow or alder, are essential elements on willow flycatcher territories (Sanders and Flett 1989, Harris et al. 1988 [in Craig and Williams 1998]). During migration, the species can be observed along riparian corridors at lower elevations.

Habitat Availability in the Plan Area. There is no extensive wet meadow-riparian breeding habitat within the Plan Area. Riparian habitat along the Sacramento and Feather Rivers, Butte Creek and Big Chico Creek, and other smaller drainages, provides suitable cover and roosting habitat during the fall and spring migratory periods.

Occurrence/Distribution in the Plan Area. There are no recent breeding occurrences of willow flycatcher from the Plan Area. Snowden (2001) reports breeding activity at a few wet meadow-riparian areas in northern Butte County, but outside of the Plan Area. Dawn Garcia of CSU Chico reports several migratory occurrences along Butte Creek in 2006. Other occurrences during the spring and fall migratory periods are periodically reported by local birders.

3.7.9 Loggerhead Shrike (*Lanius ludovicianus*)

Status. The loggerhead shrike is designated by the USFWS as a federal species of concern and by CDFW as a state species of special concern.

Description. The loggerhead shrike is a medium-sized (20–23 cm), stout, short-winged passerine that is often seen perched on barbed wire fences. The underparts and back are grey and the throat and upper breast is white, which distinctly contrasts with the black tail, wings and facemask (Sibley 2000).

Distribution. The breeding range extends from central prairie provinces and the Canadian border southward to Florida, west to California, and southern Mexico (Yosef 1996). In California, the loggerhead shrike is a permanent resident and winter visitor in foothills and lowlands throughout California, where it is considered a fairly common resident (Small 1994).

Habitat Associations. Shrikes prefer open habitats with scattered trees, shrubs, posts, fences, utility lines, or other perches. It nests in small trees and shrubs and forages for small rodents and insects in pastures and agricultural lands.

Habitat Availability in the Plan Area. Most of the Plan Area is considered potential habitat for loggerhead shrike, particularly the lower elevation pasture and non-orchard agricultural lands with small trees and shrubs for nesting. Highest value lands may occur in the open pastures and irrigation croplands in the southwestern portion of the Plan Area, and in the open grassland habitats on the eastern side of the Plan Area.

Occurrence/Distribution in the Plan Area. Nest sites are infrequently reported and documented, likely due to the difficulty locating nests; however, occurrences of individual birds are regularly, although infrequently, reported by local birders. Snowden (2001) considers the species uncommon in Butte County and notes that populations may be declining as a result of the loss of potential nest sites (small trees and shrubs).

3.7.10 Yellow-Billed Magpie (*Pica nuttalli*)

Status. The yellow-billed magpie is designated by the USFWS as a federal species of concern. It currently has no special state status. The species is included here due to its sensitivity to the effects of the West Nile virus. Recent information regarding the susceptibility of magpies to the virus and the low survivability of infected magpies has led to concern regarding the future status of yellow-billed magpie populations.

Description. The yellow-billed magpie is a medium-sized corvid (43–50 cm) with a black head and chest, white shoulders and belly, iridescent blue wings, and a long tapered black tail. The bill is bright yellow. Males are slightly larger than females; otherwise, the sexes are alike.

Distribution. The species is endemic to California west of the Sierra Nevada. Its range includes Sacramento and San Joaquin valley floors and foothills, and valleys of the Coast Ranges from San Francisco Bay south to Santa Barbara County (Reynolds 1995).

Habitat Associations. Yellow-billed magpie inhabits open country with tall trees for nesting and roosting. It usually forages on the ground in agricultural fields, grasslands, pastures, and around farmyards and other disturbed sites. It nests high in trees, usually in valley oak, black walnut, and other tall trees. Yellow-billed magpies are highly social, foraging and roosting together often in large numbers. They nest individually or in loose colonies (Reynolds 1995).

Habitat Availability in the Plan Area. Suitable habitat is found throughout the lower elevation portions of the Plan Area. All agricultural types are used, including orchards. Pasturelands and grasslands also provide suitable habitat for magpies. Magpie nests are commonly found along all of the major watercourses, including the Sacramento and Feather Rivers, along roadside trees, and in isolated oak trees.

Occurrence/Distribution in the Plan Area. Yellow-billed magpie is widely distributed throughout the mid- and lower-elevation portions of the Plan Area. Populations have reportedly declined during the last two years (Altacal Audubon Society records) presumably as a result of West Nile Virus infestation.

3.7.11 California Lark (*Eremophila alpestris*)

Status. The California horned lark is currently on CDFW's Watch List. It currently has no special federal status. Of the numerous subspecies of horned lark, *E.a. rubea* is the locally breeding race within the Plan Area (Snowden 2001); however, other subspecies likely occur in the Plan Area during the migratory and wintering periods.

Description. Horned larks are small, sparrow-sized ground-dwelling birds. They are pale sandy-brown, with a yellowish chin and throat, black mask and breast band, and two small black tufts ("horns") on the head.

Distribution. Horned larks breed widely throughout North America, from northern Alaska to southern Mexico. They winter from southern Canada southward across the United States and Mexico (Beason 1995).

Habitat Associations. Throughout their range, horned larks are associated with open desert scrub, grasslands, montane meadows, and similar open habitats (Beason 1995). Grinnell and Miller (1944) describe horned lark breeding habitat as level or gently sloping shortgrass prairie, montane meadows, "bald" hills, open coastal plains, fallow grain fields, and alkali flats. More recently in California, they are commonly found in open grasslands and rangelands in the Sierra Nevada foothills, Coast Ranges, and Southern California. Horned larks are also considered an agricultural pest as they increasingly find available foraging habitat in newly planted fields, particularly those near open grassland breeding habitat (Internet Center for Wildlife Damage Management 2011).

Habitat Availability in the Plan Area. Breeding habitat for horned larks occurs throughout the foothill grassland and valley grassland/vernal pool habitats. Irrigated croplands also provide available foraging habitat; however, Snowden (2001) reports migratory subspecies likely use the valley floor habitats while *E.a. rubea* apparently remains within its foothill grassland breeding habitat.

Occurrence/Distribution in the Plan Area. Snowden (2001) reports horned larks are a common breeding and wintering species in the Plan Area. Distribution includes all foothill grassland and lower elevation grassland and non-orchard irrigated cropland; however, the breeding distribution is limited largely to the non-cultivated grassland habitats in the eastern portion of the Plan Area.

3.7.12 Purple Martin (*Progne subis*)

Status. The purple martin is designated by CDFW as a state species of special concern. It currently has no special federal status. Three subspecies of purple martin are currently recognized with *P. s. arboricola*, the only one found in California.

Description. Purple martin is the largest (15 cm) North American swallow. They are bluish-blackish above in all plumages, with females having paler underparts (Sibley 2003).

Distribution. The purple martin breeding range extends from central Alberta to the Gulf of Mexico east of the dry western section of the Great Plains. Disjunct populations are found in the southern Rocky Mountain region, Baja California, northern and central Mexico, and along the Pacific coast from Vancouver, British Columbia to central California. Smaller populations are found on the Modoc Plateau, Sacramento area, northern Sierra Nevada, and in the mountains of Southern California. The winter range is primarily in central South America (Brown 1997).

Habitat Associations. Purple martins develop colonial nests in cavities of large trees in oak or riparian woodlands and low-elevation coniferous forests. Nests are in old woodpecker cavities in dead snags and are often in residual snags in burned or logged forests (Brown 1997). With the extensive loss of mature riparian trees throughout much of their range in California, purple martins have begun using man-made structures such as buildings, bridges and highway overpasses for nesting (Airola and Grantham 2003).

Habitat Availability in the Plan Area. Potential breeding habitat is available in oak woodland and savanna habitats along the eastern edge of the Plan Area. Currently, potential man-made nesting habitat is unavailable at most freeway overcrossings or bridges where vertical "weep" holes could be present (Airola and Grantham 2003). Future construction, however, could create these nesting opportunities.

Occurrence/Distribution in the Plan Area. Snowden (2001) reports the possible extirpation of purple martins from Butte County. Available and otherwise suitable nesting habitat is unoccupied likely as a result of nest cavity competition from European starlings (*Sturnus vulgaris*).

3.7.13 California Thrasher (*Toxostoma redivivum*)

Status. The California thrasher has no federal or state status and no other special status; however, the species is of local concern and thought to be declining (Snowden 2001).

Description. The California thrasher is a large thrasher (28–33 cm) with a long, deeply curved bill. It is dark brown above with lighter gray-brown breast and buff-brown to orange undertail coverts. It has dark brown eyes, indistinct light brown eyebrow and dark "mustache." The sexes are alike (Cody 1998).

Distribution. Endemic to California and northern Baja California, the species is found in chaparral and coastal scrub communities along the coast and Coast Ranges, western Sierra Nevada, and Southern California and Baja California deserts (Sibley 2003).

Habitat Associations. The California thrasher is found primarily in chaparral and other shrub communities from sea level to montane chaparral. It will also breed in adjacent oak woodlands, pine-juniper scrub, and occasionally in parks and gardens, but only if dense cover is available (Cody 1998).

Habitat Availability in the Plan Area. Chaparral habitats on the eastern edge of the Plan Area provide suitable habitat for thrashers.

Occurrence/Distribution in the Plan Area. There are few nesting records of California thrasher in Butte County; however, it has been regularly (although infrequently) reported during the breeding season. Snowden (2001) reports the species as possibly declining in Butte County as a result of rural urbanization and predation by house cats. The distribution likely is directly associated with the distribution of chaparral vegetation in the Plan Area.

3.7.14 Yellow Warbler (*Dendroica petechia*)

Status. The yellow warbler is designated by CDFW as a species of special concern and is designated by the USFWS as a federal species of concern.

Description. The yellow warbler is a small (12–13 cm), plain yellow wood-warbler with few distinguishing marks. It is the only bright yellow wood-warbler with yellow spots on the tail. The fresh-plumaged adult males have distinctive small red streaks on the underparts (Sibley 2003).

Distribution. The breeding distribution extends from northern Alaska and Canada southward to the central United States and west into Mexico. The species winters in Mexico and Central and South America. Throughout California, yellow warbler is summer resident and transient in suitable riparian habitats (Small 1994, Lowther et al. 1999).

Habitat Associations. In California, yellow warblers nest primarily in riparian habitats (Grinnell and Miller 1944), but in some montane areas they also nest in a variety of shrub habitats (e.g., manzanita, ceanothus) far removed from water (Grinnell et al. 1930, Beedy and Granholm 1985). Migrants prefer edges to the interior of forests and broad-leaf trees to conifers. They can be found in a variety of habitats, including riparian, oak woodland, and suburban parks and gardens (Dunn and Garrett 1997).

Habitat Availability in the Plan Area. Available breeding habitat includes riparian woodlands association with the Sacramento River, Feather River, Butte Creek, Big Chico Creek, and other small drainages with suitable riparian vegetation.

Occurrence/Distribution in the Plan Area. Snowden (2001) notes that yellow warblers nest in riparian and chaparral habitats in the montane zone, presumably outside of the Plan Area, and are a rare breeding bird in valley riparian habitats within the Plan Area. Heath (1998) reports breeding occurrences in the Plan Area along the Sacramento River. Dawn Garcia of CSU Chico reports several migratory occurrences along Butte Creek and several possible breeding occurrences along Butte Creek and Big Chico Creek from 2006 and 2007.

3.7.15 Hitch (*Lavinia exilicauda*)

Status. Hitch have no federal or state status and no other special status. Moyle (2002) identifies them as a 1D “watch list” species.

Description. Hitch are native cyprinids (minnows) with laterally compressed, moderately deep bodies, moderately large scales, and a small head. The body tapers to a narrow caudal peduncle. They have a large forked tail and long anal fin, which distinguishes this species from most other California cyprinids. Individuals can reach up to 35 cm (standard length).

Distribution. Hitch are native to the Sacramento-San Joaquin River Delta and upstream tributaries, Clear Lake and associated lakes, the Russian River, and Pajaro-Salinas Rivers and major upstream tributaries. They have been introduced into upstream reservoirs within their native range and are found in the San Luis Reservoir in Merced County and in Los Angeles County, presumably by introduction via the California Aqueduct.

Habitat Associations. Hitch are found in warm, low elevation lakes, sloughs, and slow-moving portions of rivers and clear, low-gradient streams. Individuals are generally found in streams with sandy bottoms but can live in urbanized channels with high turbidity and silt loads.

Habitat Availability in the Plan Area. Most creeks and rivers in the Plan Area have stretches of slow-moving water that are potential habitat for hitch.

Occurrence/Distribution in the Plan Area. The Central Valley subspecies of hitch (*L. e. exilicauda*) is found most commonly in undisturbed reaches in the Plan Area (M. Marchetti pers. comm.). Hitch are found occasionally in the Feather River and in other waterways in Butte County (McReynolds pers. comm.). It is likely that hitch are found in other waterways with appropriate habitat throughout the Plan Area.

3.7.16 Hardhead (*Mylopharodon conocephalus*)

Status. Hardhead have no federal status, but are identified as a California species of special concern by CDFW. Moyle (2002) identifies them as a 1D “watch list” species.

Description. Hardhead are large, native cyprinids (60 cm or greater standard length) that have an elongate body, forked tail, and a shape similar to pikeminnow. Juveniles are silver colored, turning brown to dark bronze with maturity.

Distribution. Hardhead are widely distributed in undisturbed stretches of low- to mid-elevation streams in the Sacramento-San Joaquin River watershed. In the Sacramento drainage, hardhead are typically found in larger tributary streams as well as the mainstem Sacramento River.

Habitat Associations. Hardhead prefer clean, deep pools and runs with well-oxygenated water, substrate with a mix of sand, gravel, and boulders, and slow flows.

Habitat Availability in the Plan Area. There are several moderately large creeks and rivers in the Plan Area that support or could support hardhead populations.

Occurrence/Distribution in the Plan Area. Hardhead are found in scattered populations in waterways throughout the Plan Area. They have been seen in high numbers in Big Chico Creek (T. McReynolds pers. comm.) and the Feather River (A. Seesholtz pers. comm.). Hardhead are considered “plentiful” upstream of Lake Oroville (Oroville Facilities FERC Relicensing Project 2004). It is likely that hardhead are found in other waterways with appropriate habitat throughout the Plan Area.

3.7.17 Tule Perch (*Hysterocarpus traski*)

Status. Tule perch have no federal or state status and no other special status. Moyle (2002) identifies them as a 1D “watch list” species.

Description. Tule perch are medium-sized (less than 15 cm total length), deep-bodied embiotocids (surfperch). Their color is highly variable, but is generally dark blue or purple on their backs and white or yellow on their undersides. There are three color variants of side barring: unbarred, broad-barred, and narrow-barred. Only unbarred and narrow-barred individuals are found in the Plan Area. Adults often have a hump on their back between their head and dorsal fin. Both dorsal fin rays and anal fin rays extend to the caudal peduncle.

Distribution. The Sacramento-San Joaquin subspecies of tule perch (*H. t. traski*) is found in Central Valley rivers up to major canyons or waterfalls. It also occurs in the Delta, Suisun Marsh, the Napa River, and other creeks in the San Francisco Bay Area. The Russian River subspecies is found throughout the Russian River and lower reaches of its tributaries. The Clear Lake subspecies is found in Clear Lake and nearby lakes. Tule Perch have established in Silver and Pyramid reservoirs, presumably carried there from the Delta via the California Aqueduct.

Habitat Associations. Tule perch are typically found in lowland lakes, estuarine sloughs, and clear rivers and streams. They require cool, well-oxygenated water and have a high salinity tolerance. As their name suggests, they are commonly associated with tules (*Schoenoplectus* spp. and *Scirpus* spp.)

Habitat Availability in the Plan Area. There are a number of creeks and rivers in the Plan Area that support or could support tule perch populations.

Occurrence/Distribution in the Plan Area. The Sacramento-San Joaquin River subspecies of tule perch is found in Big Chico Creek and tributaries (T. McReynolds pers. comm.) and the Feather River (A. Seesholtz pers. comm.). It is likely that tule perch are found in other waterways with appropriate habitat conditions throughout the Plan Area.

3.8 MIGRATORY DEER HERDS IN THE PLAN AREA

Descriptions of deer herds in Butte County were developed primarily from the Butte County General Plan (Butte County 2005). A deer herd is defined as a breeding population of deer that occupies a range common to that population. Many covered natural communities, including oak woodland and savanna, grassland, and riparian communities provide important winter range for migratory and resident deer herds in Butte County. Herds of black-tailed deer are common in Butte County (Figure 3–20, *Deer Herds and Habitat Ranges in the Plan Area* [see separate file]).

Migratory deer use different areas for summer and winter activities and migrate between these areas to meet their year-round needs. Deer that remain in a restricted area on a year-round basis are considered resident populations. Migratory and resident deer that use the Plan Area are primarily associated with oak woodland and savanna and riparian communities. Three separate migratory deer herds, the East Tehama, Bucks Mountain, and Mooretown herds, occupy the eastern foothills and mountains in Butte County and depend on these areas for all or part of their habitat requirements. Resident deer herds in Butte County are the Camp Beale and Sacramento Valley herds.

Migratory Deer Herds. Migratory deer populations are less tolerant of humans and their pets, requiring a greater distance from areas of human habitation and use. They migrate mainly to take advantage of the availability of food. Migratory deer can occupy areas that will not support resident deer on a year-round basis. The majority of migratory deer habitat in Butte County is winter range. Winter range is considerably less abundant than summer range and is considered the limiting portion of the deer habitat because of its small size relative to summer range and its location in areas where land is in demand for other uses. The black-tailed deer winter range within Butte County extends from the valley floor to nearly 4,000 feet in elevation. The critical winter range generally extends from 1,000 to 3,000 feet in elevation.

The main factors limiting populations of migratory deer in Butte County are the quantity and quality of habitat. Habitat values include food-producing areas in summer and winter, water, thermal cover, fawning areas (protection from predation during critical periods), and areas that allow for freedom of movement. Availability of food and water for deer varies seasonally and the amount of food available in winter may be the most limiting factor to deer populations, as they must meet their minimum energy requirements during the winter to survive. The necessary winter range components preferred by deer include a good interspersion of vegetative cover, abundant browse and herbaceous forage, limited residential development, and southerly aspect.

Eastern Tehama Deer Herd. The Eastern Tehama deer herd is the largest migratory deer herd in the county and occupies a range considered to be the most extensive in the state. The range of the herd includes portions of Tehama, Plumas, Lassen, Shasta, and Butte counties. Winter range is approximately 520,000 acres; migratory and summer ranges total approximately 920,500 acres and migration routes to and from seasonal ranges are the longest in the state, covering a distance of 50 to 100 miles. Approximately 40 percent of the critical winter range in Butte County has been severely impacted due to residential encroachment since the mid-1960s (Butte County 2005).

Bucks Mountain Deer Herd. The Bucks Mountain deer herd range extends from eastern Butte County to western Plumas County. Winter range is approximately 200,600 acres; migratory and summer ranges total approximately 265,600 acres. Approximately 28 percent of the critical winter range in Butte County has been lost to residential encroachment since the mid-1960s (Butte County 2005).

Mooretown Deer Herd. Mooretown deer herds occupy a range extending from the southern boundary of the Bucks Mountain deer herd into northwestern Sierra and northeastern Yuba counties. Winter range is approximately 232,000 acres; migratory and summer ranges total approximately 217,950 acres. Approximately 50 percent of the critical winter range in Butte County has been lost to residential encroachment since the mid-1960s (Butte County 2005).

3.8.1 Land Use Conflicts with Migratory Deer

Residential development in the foothills of the western Sierra Nevada Mountains has increased substantially since the early 1960s and has been a major factor in the loss of winter range habitat for migratory deer. This habitat loss has seriously threatened the welfare of migratory deer. Most of the deer winter range in California is on private land. Subdivision and development of parcels allow land use changes, which result in a permanent loss of deer habitat. Habitat losses are due to the elimination of forage and cover plants; disturbance from noise, traffic, and domestic dogs; and public use as a result of improved road access and subdivisions. One of the direct effects of residential development in deer winter range is development of barriers that interfere with deer movement in and out of winter range and separate food and water source areas from shelter sites. Barriers to deer movement include areas with high housing densities, deer-proof or deer-resistant fencing, reservoirs, major streams or rivers, and major roads and highways.

Houses arranged in linear corridors through migratory pathways and rows of houses on small lots along roadways and streams present the greatest barriers to migratory deer. In addition, predation and harassment of deer by domestic dogs accompanies increased residential development in rural areas. Deer generally do not come within 1,000 or more feet of an occupied dwelling with dogs. Migratory deer appear to be far less tolerant of the presence of dogs than are resident deer.

Construction of large reservoirs and canals can block migratory deer movement and result in loss of habitat. Due to its size and location, Oroville Reservoir is a major obstacle to movement of migratory deer. Certain fence designs are barriers to deer movement, particularly to does and fawns. Landowners occasionally construct unusually high fences around large acreages to purposefully exclude deer and prevent damage to their horticultural plantings or crops. Deer-proof or deer-resistant fences around large acreages in winter range and across critical deer migration corridors adversely affect deer populations. Highways and roads are a source of deer mortality.

3.9 Extent of Potential Jurisdictional Wetlands and Other Waters in the Plan Area

The extents of wetlands and other waters of the United States in the Plan Area were estimated using the methods described in Section 3.4.5, *Potential Jurisdictional Wetlands and Other Waters*. Table 3–16, *Potential Jurisdictional Wetlands and Other Waters in the Plan Area* (see separate file) provides a summary of the extent of jurisdictional wetlands and other waters in the Plan Area and a summary of the methods used for estimation. Table 3–17, *Existing Extent of Potential Jurisdictional Wetlands and Other Waters in the Plan Area by Watershed Unit* (see separate file) presents a calculation of the potential extent of jurisdictional wetlands and other waters by HUC 10 watersheds in the Plan Area. Table 3–18, *Estimated Extent of Potential Jurisdictional Wetlands and Other Waters in the Plan Area by CAZ* and UPA (see separate file) presents a calculation of the potential extent of jurisdictional wetlands and other waters by CAZ. Table 3–19, *Acreage of Vernal pools and Other Seasonal Wetlands within CAZs and UPAs* (see separate file) presents a calculation of the potential existing acreage of vernal pools and other seasonal wetlands in the Plan Area. Ecological characteristics of the different types of wetlands and aquatic habitats in the Plan Area are described in Section 3.5.2, 3.5.3, 3.5.4, and 3.5.5, *Aquatic*.