

3.2.3.2 Zone 1

Much of Zone 1 is underlain by the Rocklin Pluton, an igneous formation intruded during the Lower Cretaceous period¹. The Rocklin Pluton is composed of quartz-diorite (Olmsted 1961, Swanson 1978, Wagner et al. 1987). In southwestern Zone 1, the sedimentary Mehrten Formation overlies the Rocklin Pluton. The Mehrten is a groundwater-bearing formation composed of moderately to well-indurated andesitic sand to sandstone interbedded with conglomerate, tuffaceous siltstone, and claystone. It was deposited in the mid-Cenozoic era² (DWR 2006).

The minerals composing the parent material for soils throughout the Zone 1 service area include quartz, plagioclase feldspar, alkali feldspar, biotite, and hornblende. Common chemical constituents in these minerals include aluminum, oxygen, and silica. Additional chemical constituents, depending on the parent material, may include calcium, iron, magnesium, potassium, and sodium.

Upper Zone 1 is characterized by silt loams, while lower Zone 1 is dominated by the coarser Andregg and other sandy loams. Gravelly, cobbly, and stony loams are found in western Zone 1, along with small areas of Alamo clay soil. Xerofluvents with variable textures are located along unlined canals, drainages, and along Auburn, Secret and Miners ravines. Xerorthents, also with variable textures, are present in cut and fill areas in western Zone 1. Soils in Zone 1 are listed by texture and classification in the order of their prevalence in **Table 3-10**. Zone 1 soils are mapped by texture in **Figures 3-96** and **3-97**.

TABLE 3-10
ZONE 1 SOILS BY GENERALIZED TEXTURE AND CLASSIFICATION

Soil Texture ¹	Soil Classifications ²
Sandy loam and coarse sandy loam	Andregg, Sierra, Cometa-Ramona, Caperton-Andregg, Boomer
Gravelly, cobbly, and stony loam	Exchequer, Inks, Inks-Exchequer,
Loam	Fiddyment-Kaseberg, Boomer, Cometa-Fiddyment
Silt loam	Auburn, Auburn-Sobrante
Clay	Alamo
Variable	Xerorthents, Xerofluvents

Source: Soil Survey Staff, *Natural Resources Conservation Service (USDA-NRCS). 2008.*

Notes:

¹ Soil textures provided in order of prevalence

² The soil classifications listed in this table account for 85 percent of the total area of Zone 1. The remaining 15 percent of the area is covered by 18 additional classes.

Soil permeability is moderate to high (26 to 480 inches per day) within much of lower Zone 1. Soils of moderately low permeability (9 inches per day) to low permeability (1 to 3 inches per day) lie along the center of lower Zone 1, from the northeast head of the system to the head of Dry Creek in the southwest (PCWA 2005).

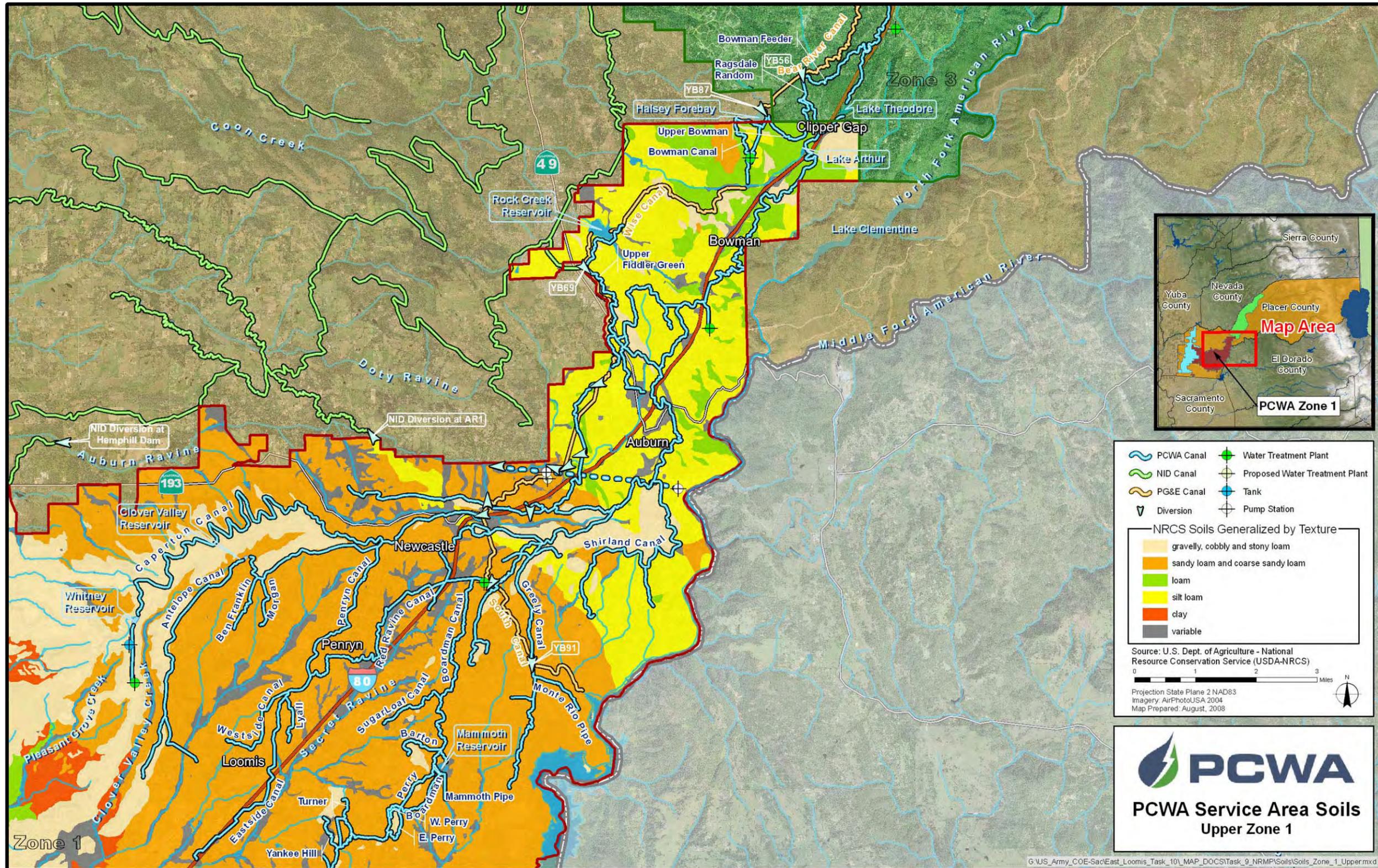
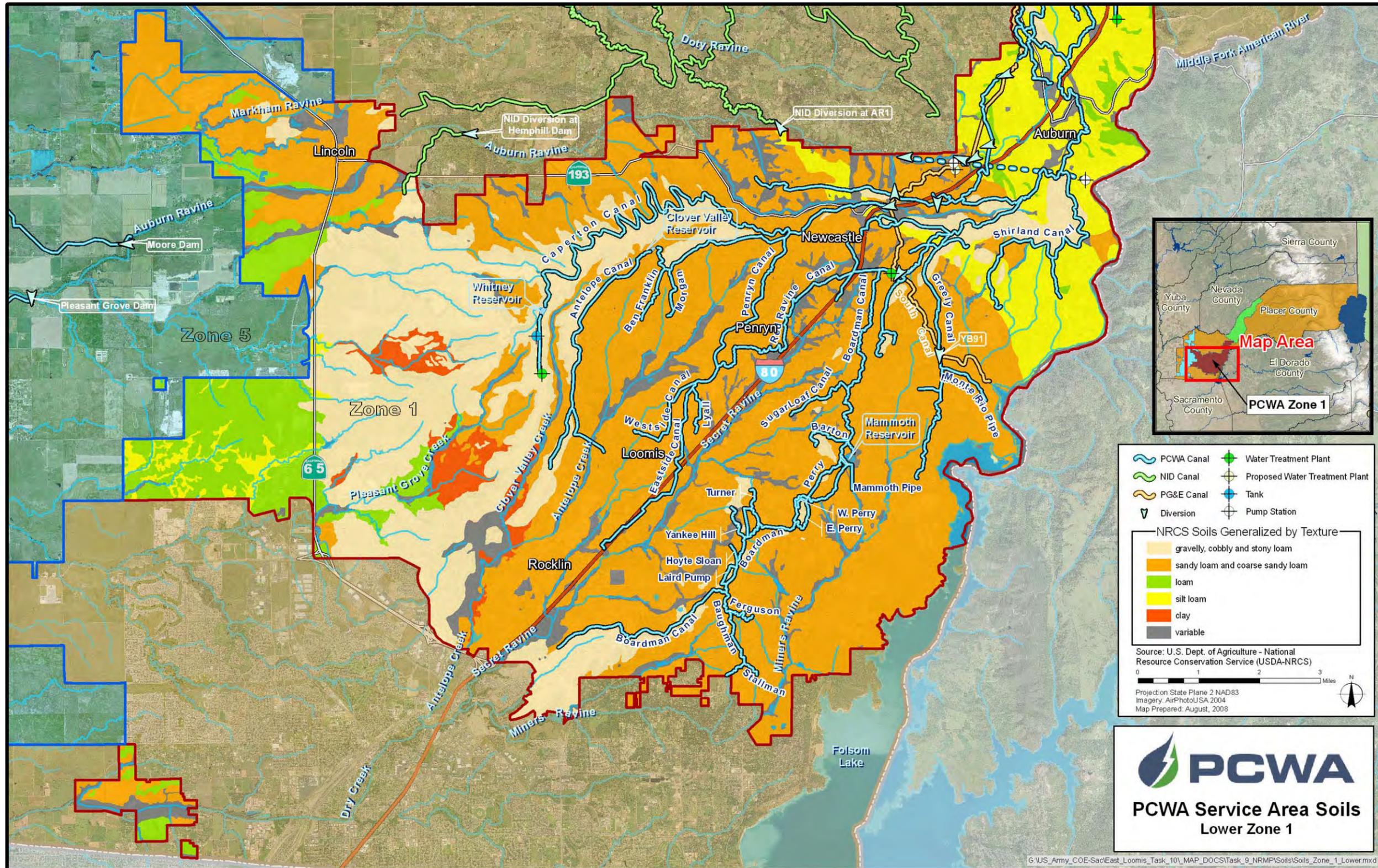


FIGURE 3-96
UPPER ZONE 1 SOILS MAP



**FIGURE 3-97
 LOWER ZONE 1 SOILS MAP**

3.2.3.3 Zone 5

Zone 5 is dominated by Cometa-Fiddymment, Kilaga, and Fiddymment loams, which are found in the southern part of the zone. Sandy loam and coarse sandy loams are present in central Zone 5, and gravelly, cobbly, and stony loams make up the majority of soils in the northern part of the zone. Xerofluvents with variable textures are found at the bottoms of the major drainages, including Auburn and Doty ravines and Pleasant Grove Creek. Soils in Zone 5 are listed by texture and classification in the order of their prevalence in **Table 3-11**. Zone 5 soils are mapped by texture in **Figure 3-98**.

**TABLE 3-11
ZONE 5 SOILS BY GENERALIZED TEXTURE AND CLASSIFICATION**

Soil Texture ¹	Soil Classifications ²
Loam	Cometa-Fiddymment, Kilaga, Fiddymment
Sandy loam and coarse sandy loam	San Joaquin-Cometa, Cometa-Ramona
Gravelly, cobbly, and stony loam	Redding-Corning
Silt loam	Alamo-Fiddymment
Variable	Xerofluvents

Source: Soil Survey Staff, Natural Resources Conservation Service (USDA-NRCS). 2008.

Note:

¹ Soil textures provided in order of prevalence

²The soil classifications listed in this table account for 95 percent of the total area of Zone 5. The remaining 5 percent of the area is covered by eight additional classes.

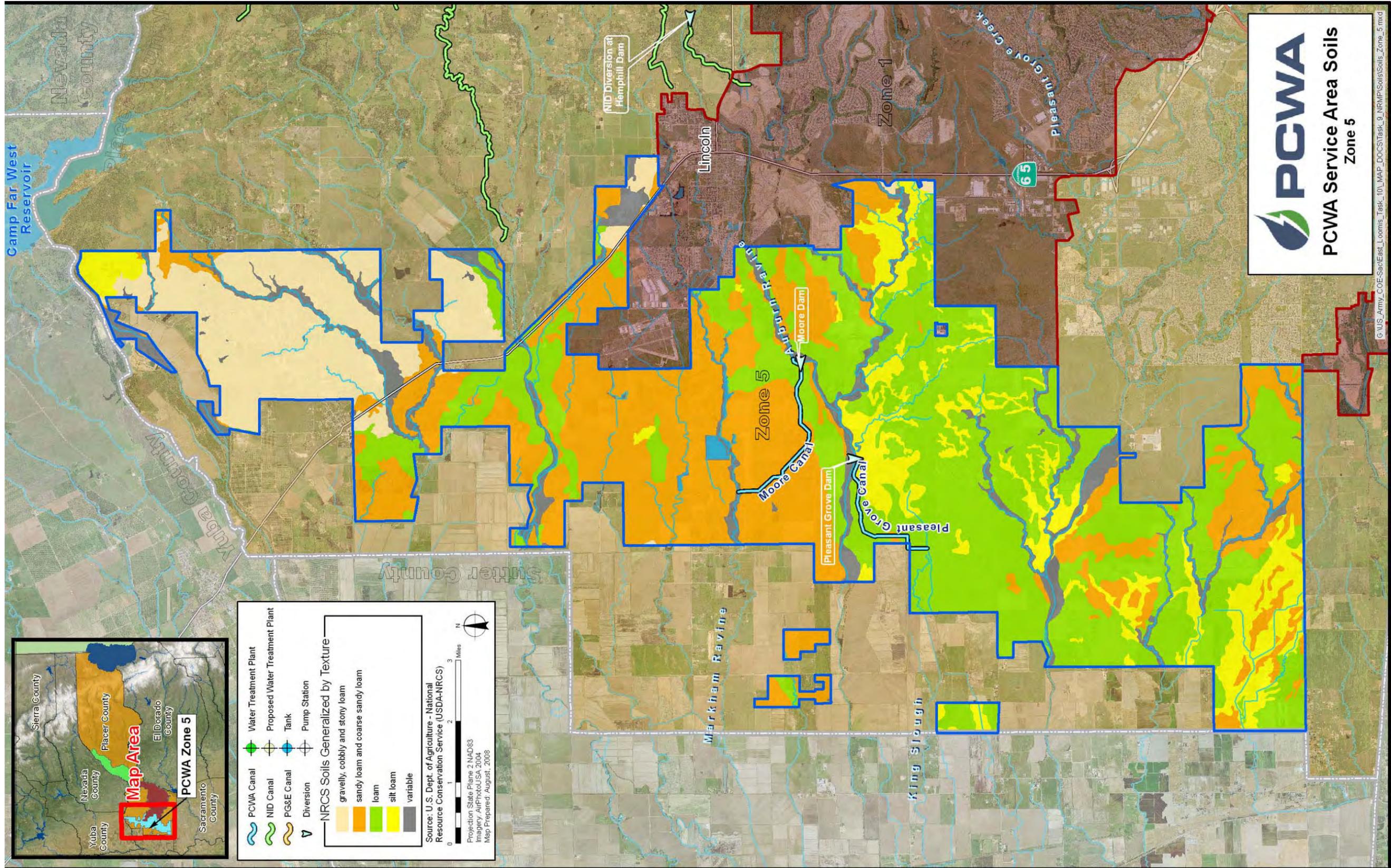


FIGURE 3-98
ZONE 5 SOILS MAP

3.3 BIOLOGICAL RESOURCES SETTING

The following sections describe terrestrial and aquatic habitat and species within the PCWA raw water distribution system area during routine canal operations.

3.3.1 Terrestrial Habitat and Species

Habitat types in the study area vary in structure and composition throughout the study area. The study area ranges from Lake Alta in the Sierra Nevada foothills at an elevation greater than 3,000 feet msl down to nearly sea level at the western boundary of Zone 3, approximately 50 miles to the southwest. In general, forested habitat types are more common in the higher elevations in the eastern portions of Zone 3. Moving west through Zones 1 and 5, agricultural, urban (including rural residential), and herbaceous habitat types become more common. The following sections describe habitats in the areas that may be directly or indirectly affected by O&M activities. Refer to **Section 3.1** for a description of habitat types, including discussions of associated species.

3.3.1.1 Zone 3

Habitat types along canals in Zone 3 (primarily Boardman Canal) are generally forested, with montane hardwood being the most common (**Figure 3-99**). Douglas-fir and ponderosa pine habitats also frequently occur. Less common habitats include urban (forested and rural residential) and annual grassland.

Reservoirs in Zone 3 that could be directly affected by O&M activities include Lake Alta, Lake Theodore, and Lake Arthur. Lake Alta is located within Sierra Nevada montane forest habitat dominated by Douglas-fir. Oaks and incense cedar also occur in the canopy. Habitat surrounding Lake Theodore is mapped as an urban, oak woodland, and annual grassland. The area around Lake Arthur is mapped as oak woodland, montane hardwood, and montane hardwood conifer.

Canyon Creek traverses a variety of habitats, predominately montane hardwood, montane hardwood conifer, ponderosa pine, urban, and barren.

3.3.1.2 Zone 1

Zone 1 contains the largest number and extent of canals in the study area. Canals traverse a number of different habitat types (**Figures 3-100** and **3-101**). Urban habitats are the most common along canals, specifically rural residential, suburban, and forested urban areas. Forested habitat types are also very common and are largely dominated by oaks. Other less common habitat types include wetlands, agricultural areas, and chaparral.

Five reservoirs have been identified in Zone 1 that may be directly impacted by O&M activities. McCrary Reservoir occurs in a rural residential area. Mammoth Reservoir is surrounded by several habitat types including rural residential, rural residential forested, annual grassland, and agricultural. Clover Valley Reservoir occurs in an oak woodland area, with valley foothill riparian forests bordering the Antelope Canal, which drains into and out of the reservoir. Caperton Reservoir is bordered by rural residential, oak woodland, and annual grassland habitat types. Whitney Reservoir is bordered by oak savannah and oak woodland habitats.

Auburn Ravine in Zone 1 lies within the City of Lincoln. In this area, Auburn Ravine is predominately forested, composed of mature trees with canopy cover generally more than 50 percent. Tree species include Fremont cottonwood, Oregon ash, and willow (Placer County Planning Department 2002).

3.3.1.3 Zone 5

Two canals that could be affected by O&M activities fall within Zone 5: Pleasant Grove Canal and Moore Canal. Habitat types along these canals are primarily disturbed, agricultural lands, generally grasslands and croplands, including rice fields (**Figure 3-102**). Some grassland areas adjacent to these canals have been identified as containing vernal pool complexes.

Auburn Ravine in Zone 5 is predominately forested and supports Fremont cottonwood, Oregon ash, and willow. The eastern portion of Auburn Ravine in Zone 5 is more densely forested, with canopy cover generally greater than 50 percent. Canopy cover decreases to less than 50 percent in the western portion of Zone 5 (Placer County Planning Department 2002).

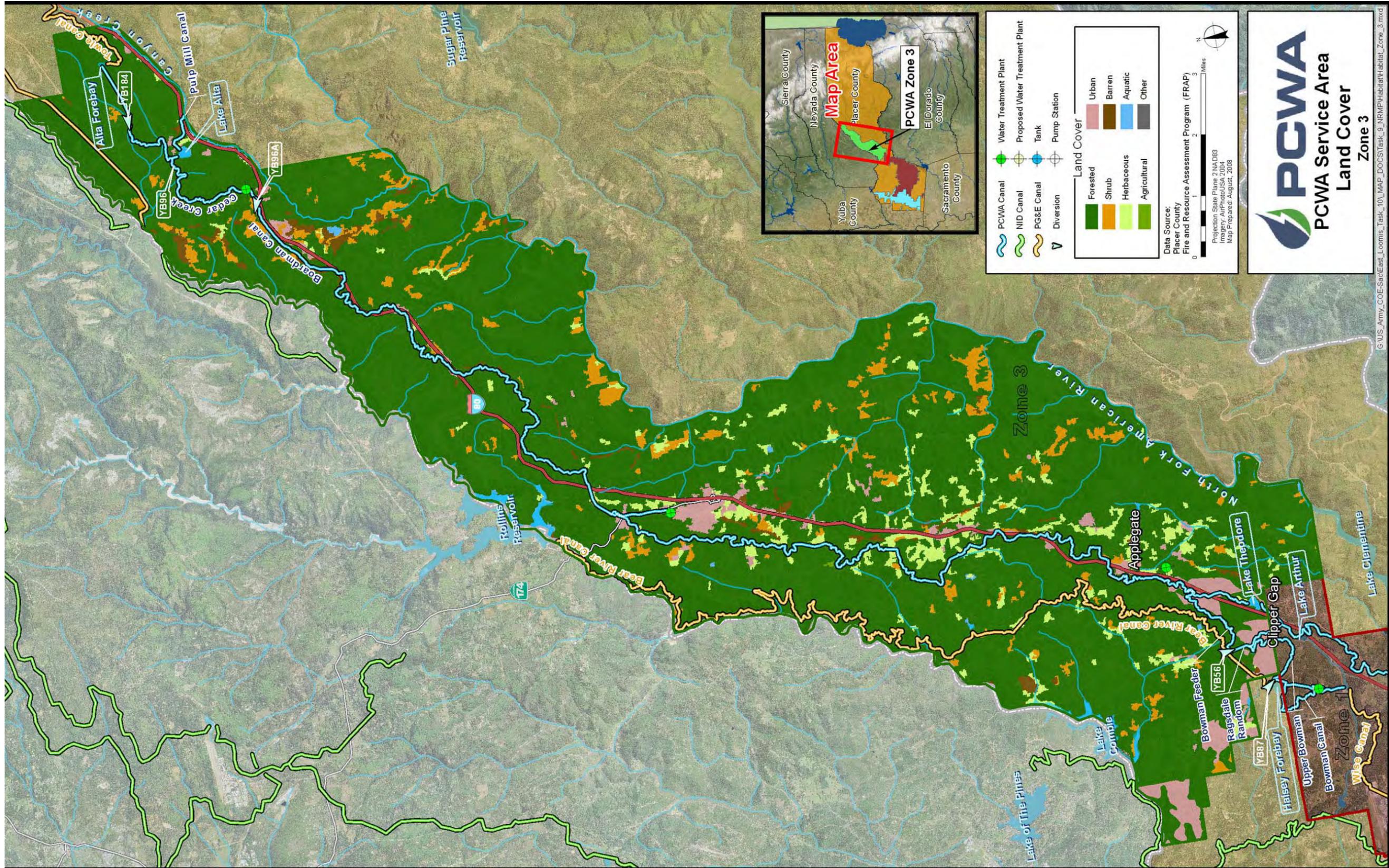


FIGURE 3-99
 ZONE 3 LAND COVER TYPES

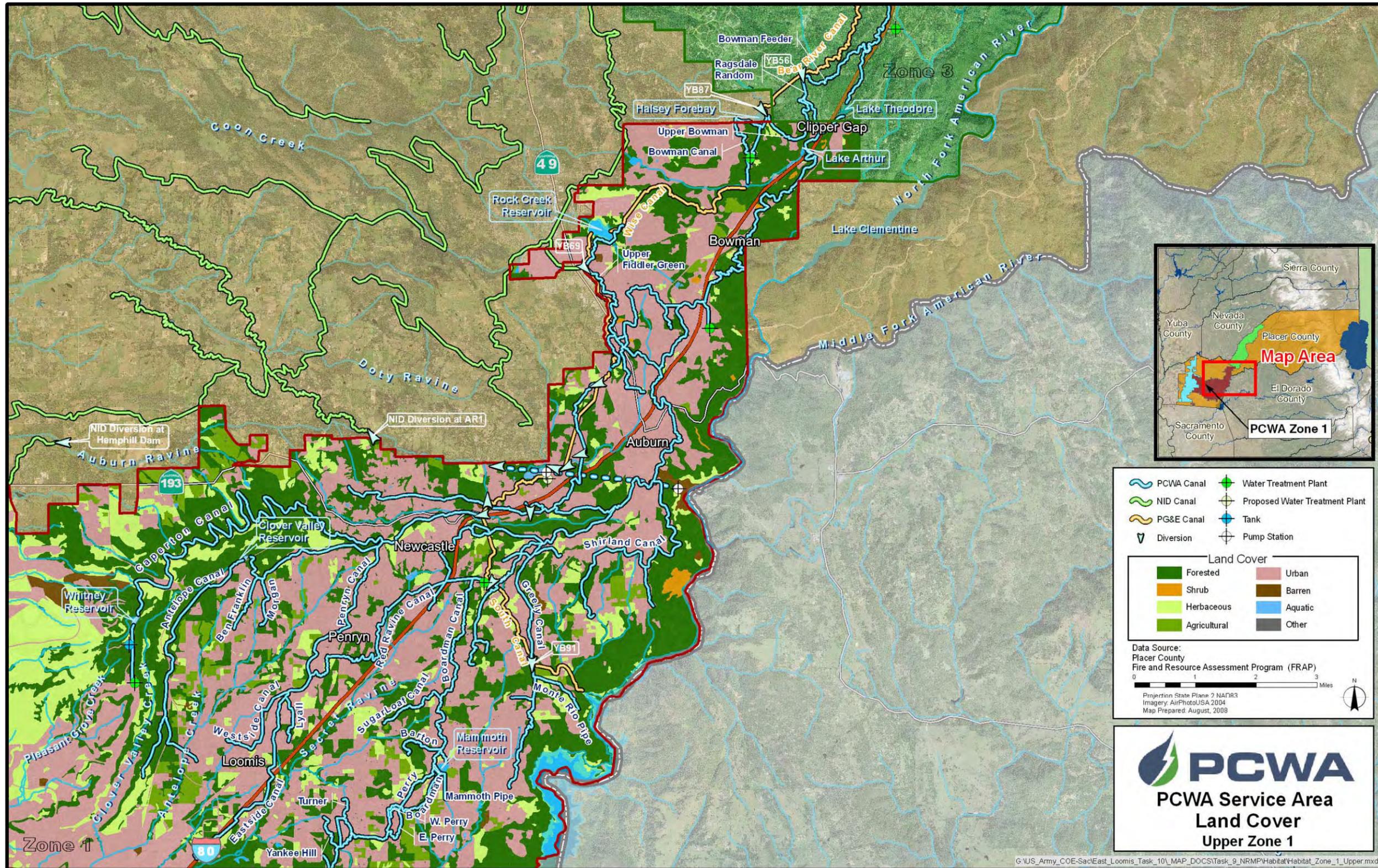


FIGURE 3-100
 UPPER ZONE 1 LAND COVER TYPES

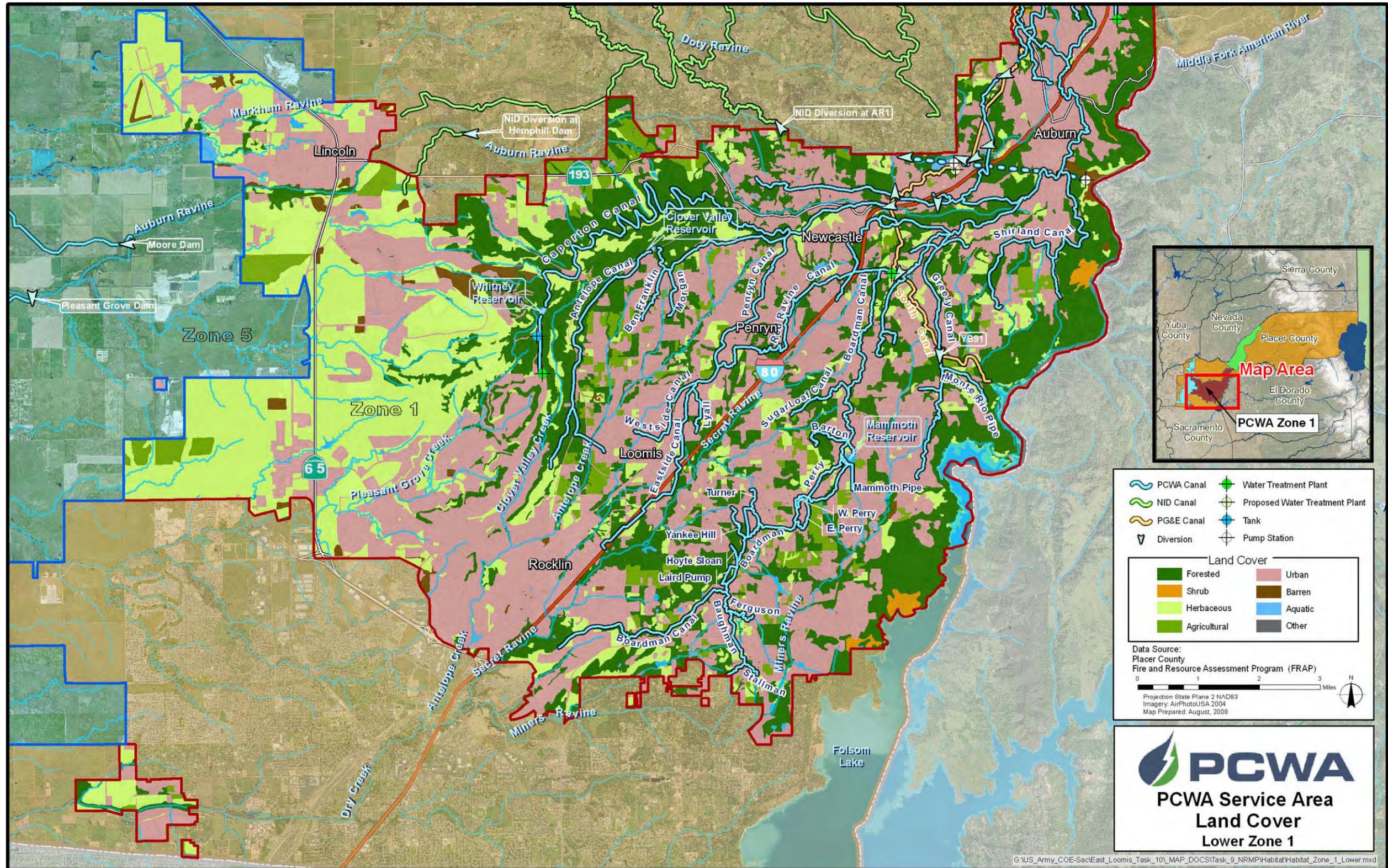


FIGURE 3-101
LOWER ZONE 1 LAND COVER TYPES

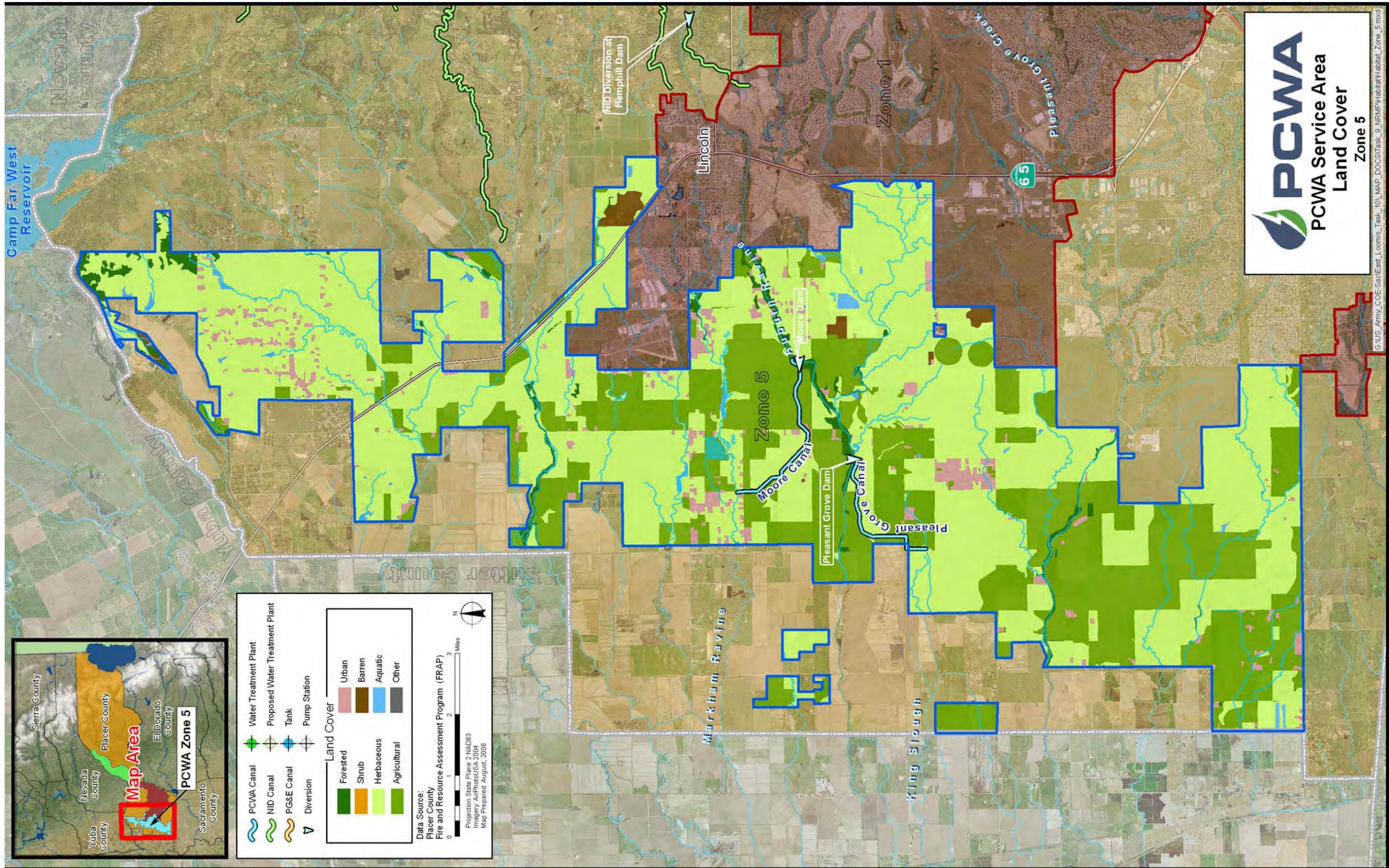


FIGURE 3-102
 ZONE 5 LAND COVER TYPES

3.3.2 Aquatic Habitat and Species

Studies in Zones 1, 3, and 5 of the PCWA regarding aquatic habitat conditions and species evaluations have primarily focused on fish communities, including anadromous fall-run Chinook salmon and Central Valley steelhead. Fish observed in the canal system by PCWA enter the canals from the PG&E reservoirs and canals that supply PCWA, and include brown trout (*Salmo trutta*), rainbow trout (*Oncorhynchus mykiss*), catfish (*Ictalurus* or *Ameiurus* sp.), Sacramento sucker (*Catostomus occidentalis*), and Sacramento pikeminnow (*Ptychocheilus grandis*) (PCWA 2004). The canals within PCWA's raw water distribution system, however, are not believed to provide consistent suitable habitat for these species.

3.3.2.1 Zone 3

Although no substantial data was found on aquatic habitat and species conditions specific to Canyon Creek, the creek may include aquatic habit and species common to Sierra Nevada montane hardwood streams. Canyon Creek is at approximately 3,543 feet msl in a relatively rural area composed of hiking trails and campgrounds. Several large dams located downstream (Nimbus and Folsom dams on the Lower American River) prohibit potential access to Canyon Creek by Chinook salmon or steelhead. Fish observed in the North Fork American River would likely be found in Canyon Creek, such as the rainbow trout, riffle sculpin, Sacramento sucker, and speckled dace. Nonnative brown trout may also be found in Canyon Creek. The elevation of the creek is too high for fish such as pikeminnow to be present.

3.3.2.2 Zone 1

Unregulated outlet releases and seepage along the canal system may contribute to flows in natural watercourses in the basin. Secret Ravine and Miners Ravine are recognized by DFG as the primary production areas in the Dry Creek drainage for fall-run Chinook salmon and Central Valley steelhead (DFG 2001). In the Dry Creek watershed, these ravines appear to be especially important for spawning and rearing of these anadromous fishes (DFG 2001).

Auburn Ravine Watershed

The artificially high flows in Auburn Ravine during summer months due to water supply conveyances from PCWA, PG&E, and NID support more aquatic habitat than would be maintained under natural hydrologic conditions (Placer County Planning Department 2002). Portions of Auburn Ravine are designated as Critical Habitat for Central Valley steelhead (70 Code of Federal Regulations (CFR) 52488, September 2, 2005). Efforts are currently underway to improve habitat conditions in Auburn Ravine for salmonids and other native fishes.

Auburn Ravine's characteristics dramatically vary between its headwaters and the East Side Canal. Fall-run Chinook salmon and Central Valley steelhead spawn and rear in upstream reaches (between its headwaters at the City of Auburn to the City of Lincoln), but the quality of migration habitat for salmonids has been substantially reduced by beaver dams, numerous water diversions, and their associated diversion structures (Placer County Planning Department 2002). On behalf of PCWA, South Sutter District installs two seasonal diversion dams in Auburn

Ravine, Moore Dam and Pleasant Grove Dam, where flows are diverted to the Moore and Pleasant Grove canals, respectively. NID Auburn Ravine 1 Dam is a year-round barrier to migration. Also, NID Hemphill Dam (a seasonal diversion dam) and NID gaging station impair migration of salmonids during most flow conditions. Since water deliveries to agricultural water users are curtailed during the fall, generally before fall-run Chinook salmon attempt to migrate upstream to spawn, the depth of water in the stream channel below some flow-control structures is often insufficient to facilitate adult fish passage.

Table 3-12 lists fish species reported to be present in Auburn Ravine. American River and Feather River hatchery-raised juvenile fall- and spring-run Chinook salmon have been released to Auburn Ravine infrequently since the 1980s. Typically, about 100,000 fall-run Chinook salmon from Nimbus Fish Hatchery were released to Auburn Ravine (Placer County Planning Department 2002, Barngrover pers. comm.), with 140,000 fall-run Chinook salmon released in Auburn Ravine during March 1998 (Placer County Planning Department 2002).

TABLE 3-12
FISH SPECIES PRESENT IN AUBURN RAVINE

Native		Introduced	
Common Name	Scientific Name	Common Name	Scientific Name
Chinook salmon	<i>Oncorhynchus tshawytscha</i>	Black bullhead	<i>Ameiurus melas</i>
Sacramento pikeminnow	<i>Ptychocheilus grandis</i>	Common carp	<i>Cyprinus carpio</i>
Steelhead	<i>Oncorhynchus mykiss</i>	Green sunfish	<i>Lepomis cyanellus</i>
Bluegill	<i>Lepomis macrochirus</i>	Largemouth bass	<i>Micropterus</i> spp.
Spreckled dace	<i>Rhinichthys osculus</i>	Pumpkin seed	<i>Lepomis gibbosus</i>
Sacramento sucker	<i>Catostomus occidentalis</i>	Redear sunfish	<i>Lepomis microlophus</i>
California roach	<i>Hesperoleucus symmetricus</i> ,	Golden shiner	<i>Notemigonus crysoleucas</i>
Lamprey spp	<i>Lamperta</i> spp.	Mosquitofish	<i>Gambusia affinis</i>
Prickly Sculpin	<i>Cottus asper</i>	Brown trout	<i>Salmo trutta</i>
Hardhead	<i>Mylopharodon conocephalus</i>		

Source: Placer County Planning Department 2003, 2005b

Fish communities and associated aquatic habitat were assessed in the Auburn Ravine by DFG in fall 2004 and spring 2005. Fish community IBI scores for Auburn Ravine were approximately 80 out of 100 (Titus et al. 2005). The gross ecological health of Auburn Ravine was rated “good to very good” based on its IBI score (Titus et al. 2005).

Summary results of BMI population analyses and B-IBI results, along with physical habitat characteristics during BMI analyses, are shown in **Tables 3-13** and **3-14** respectively. Detailed results of BMI population and B-IBI analyses at Auburn Ravine below Auburn Ravine Tunnel Outlet are provided in **Appendix A**. **Figure 3-103** compares B-IBI results for Auburn Ravine to other stream sites evaluated by DCC in the PCWA service area for this NRMP in 2007, and sites previously evaluated by DCC from 2000 through 2006.

Based on BMI and B-IBI analyses described in **Appendix A**, aquatic habitat quality at Auburn Ravine below Auburn Ravine Tunnel Outlet appeared to better than Miners Ravine below Sierra