4.0 EXISTING ENVIRONMENT AND RESOURCE IMPACTS

This Section is divided into 13 sub-sections: Section 4.1 provides a general description of the Project setting and Sections 4.2 through 4.13 provide existing, relevant, and reasonably available information (i.e., baseline conditions) regarding the resources potentially affected by the Project; as well as known or potential Project impacts on these resources. Source documents are cited throughout this Section and listed in detail in Section 8.0. The resource areas include:

- Air Quality and Noise (Section 4.2)
- Geology and Soils (Section 4.3)
- Water Resources (Section 4.4)
- Fish and Other Aquatic Resources (Section 4.5)
- Wildlife and Botanical Resources (Section 4.6)
- Wetlands, Riparian, and Littoral Habitats (Section 4.7)
- Endangered Species Act-Listed and Candidate Species (Section 4.8)
- Recreation and Land Use (Section 4.9)
- Aesthetic Resources (Section 4.10)
- Cultural Resources (Section 4.11)
- Socioeconomic Resources (Section 4.12)
- Tribal Resources (Section 4.13)

The amount of detail included in the description of each existing resource and potential impact is commensurate with the available information and relative importance of the resource in this relicensing.

4.1 GENERAL DESCRIPTION OF PROJECT SETTING

4.1.1 <u>River Basins</u>

The Project is located in and around the Sierra Pelona Mountains between the Tehachapi and San Emigdo Mountains, part of the Transverse Ranges in southern California. The Project uses water passing through the SWP to generate power.

As shown in Figure 4.1-1, two drainage basins are incidentally intercepted by the Project: (1) Piru Creek, including its tributary Gorman Creek; and (2) Castaic Creek. A general description of each of these basins is provided below. Quail Lake, the other Project impoundment, is an engineered water body and does not collect surface water flows or discharge into State surface waters.

4.1.1.1 Piru Creek

Piru Creek's headwaters collect water from about a dozen named tributaries and are located approximately 40 river miles upstream of Pyramid Dam, which is located approximately 29 miles upstream of the confluence of Piru Creek and the Santa Clara River. Piru Creek and its tributaries above Pyramid Lake flow relatively unimpaired; there are no diversions or dams located on any of the drainages. Pyramid Lake also incidentally intercepts water from Gorman Creek, West Fork Liebre Gulch, and Liebre Gulch to the north. The sub-basin drainage area upstream of Pyramid Dam is 295 square miles of steep mountainous terrain, with elevations that range from 2,600 feet to 8,900 feet (see Figure 4.1-1).

Stream releases from Pyramid Dam are routed into Piru Creek (Pyramid reach) and flow downstream 18 miles to the NMWSE of Lake Piru, which is formed by Santa Felicia Dam, located 5.9 miles upstream of the confluence of Piru Creek and the Santa Clara River. Santa Felicia Dam was constructed in 1955 by the UWCD for flood storage and seasonal groundwater recharge. Pyramid reach collects flows from three named tributaries before reaching Lake Piru: (1) Fish Creek, which enters Pyramid reach 8.0 miles downstream of Pyramid Dam; (2) Michael Creek, which enters 15.7 miles below the dam; and (3) Agua Blanca Creek, which enters 16.4 miles below Pyramid Dam.

From Santa Felicia Dam, Piru Creek flows 5.9 miles downstream into the Santa Clara River. The sub-basin drainage area of Pyramid reach is 142 square miles of steep mountainous terrain and rolling foothills with elevations that range from 650 feet to 6,800 feet. Figure 4.1-2 shows the gradient in Piru Creek in the vicinity of the Project, with notable features identified.

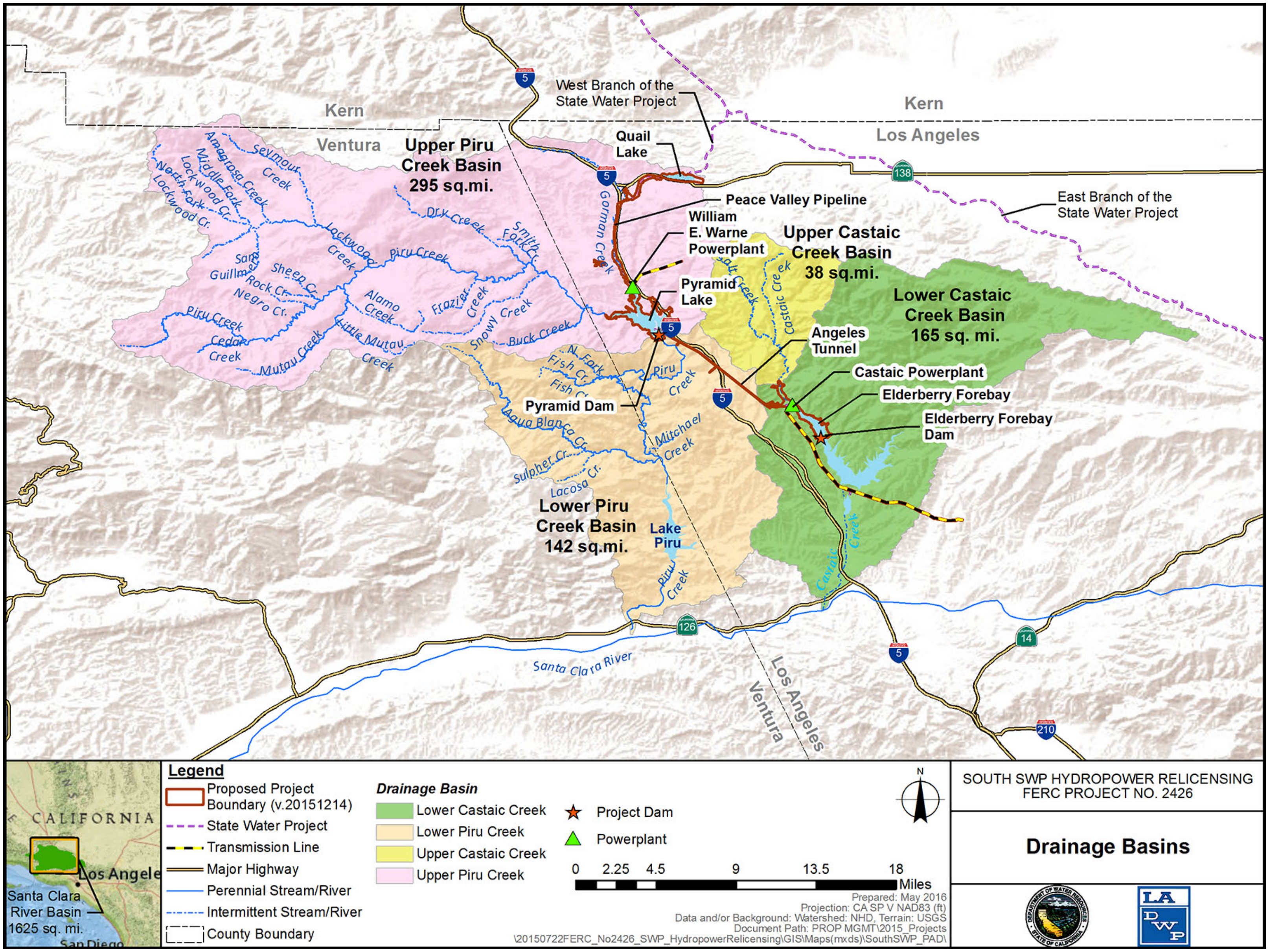
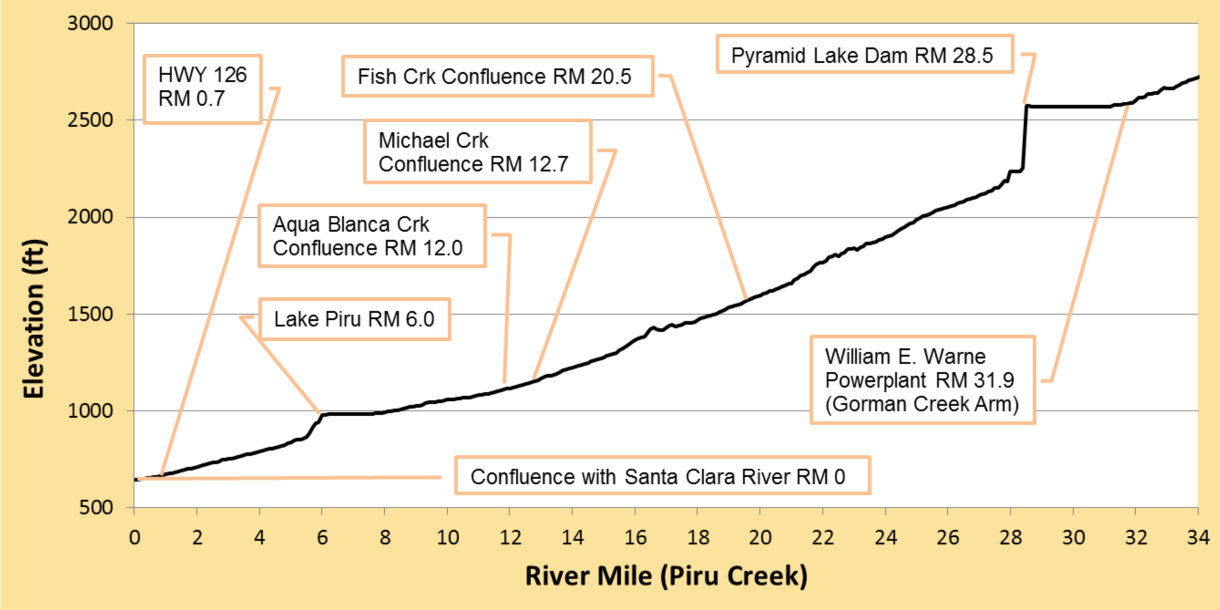


Figure 4.1-1. Drainage Basins in the Vicinity of the Project Facilities



Key:
ft = feet
RM = river mile

Figure 4.1-2. Piru Creek Profile

Pyramid Lake is filled with water from the SWP but it also receives small volumes of water from Piru Creek, Gorman Creek, Canada de los Alamos, West Fork of Liebre Gulch and Liebre Gulch. Inflows from Piru Creek to Pyramid Lake contribute on average 28,666 AF per year. Gorman Creek is not gaged. Releases from Pyramid Lake to Pyramid reach include both streamflow releases and release for delivery to UWCD. The release into Pyramid reach for natural streamflow below Pyramid Dam averages 25,081 AF per year and the release for delivery to UWCD averages 2,018 AF per year. Figure 3.2-6 summarizes the average monthly inflow to Pyramid Lake from Piru Creek and the releases to the Pyramid reach.

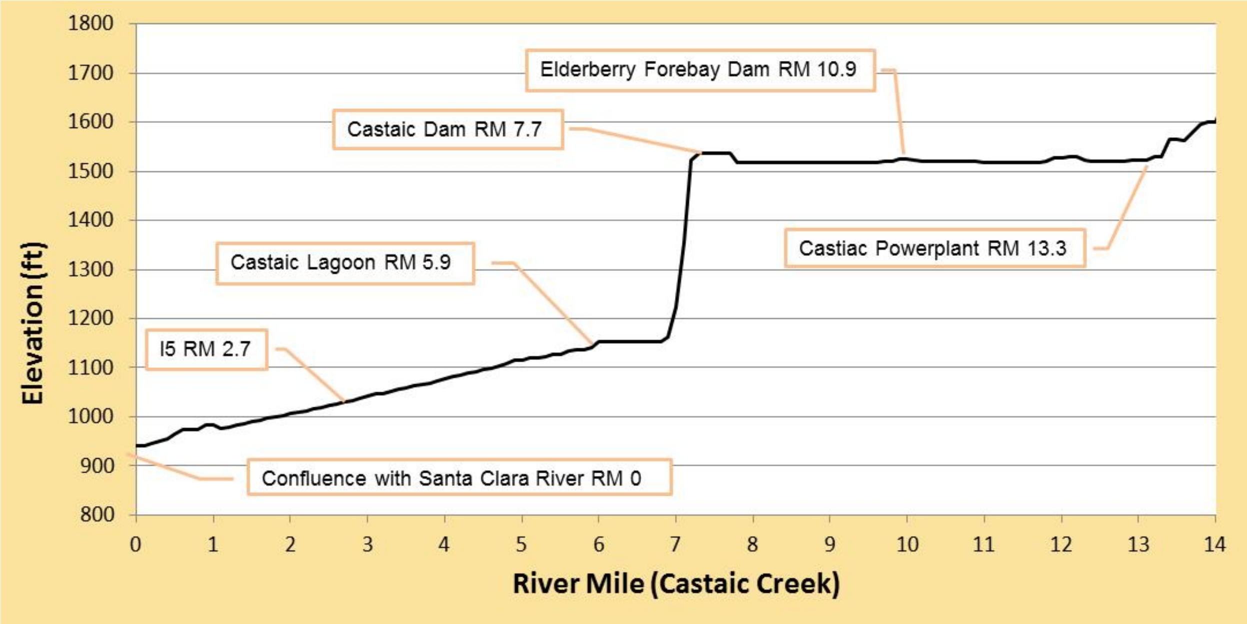
4.1.1.2 Castaic Creek

Castaic Creek headwaters are located 11 river miles upstream of Elderberry Forebay, and collect water from Salt Creek before flowing into Elderberry Forebay. Castaic Creek flows along a natural channel until just above Elderberry Forebay, where it enters a series of three check-dam basins that drain into Elderberry Forebay, just downstream of the Castaic Powerplant tailrace.

Castaic Creek flows are passed through Elderberry Forebay Dam, which is 10.9 river miles upstream of the confluence of Castaic Creek and the Santa Clara River near Valencia, California. The flows continue through Castaic Lake (non-Project facility) impounded by Castaic Dam, which is located 7.7 miles upstream of the Santa Clara River. Castaic Creek re-emerges after passing south through Castaic Lagoon and into the Santa Clara River. The sub-basin formed by Elderberry Forebay Dam is 38 square miles of steep mountainous terrain with elevations that range from 1,500 feet to 5,700 feet. The remaining area of the Castaic Creek basin is 165 square miles of steep mountainous terrain and rolling foothills with elevations that range from 950 feet to 5,400 feet.

Castaic Creek joins the Santa Clara River 40 river miles below the Santa Clara River headwaters in the San Gabriel Mountains, located east of the confluence. The Piru Creek confluence with the Santa Clara River is 10.4 river miles west of the Castaic Creek confluence. From the Piru Creek confluence, the Santa Clara River continues west 32 river miles to the Pacific Ocean. The Santa Clara River basin is 1,626 square miles.

Figure 4.1-3 shows the gradient in Castaic Creek in the vicinity of the Project, with notable features identified.



Key:
RM = river mile
ft = feet

Figure 4.1-3. Castaic Creek Profile

4.1.2 Climate

The climate in the Project area is Mediterranean. It is generally hot in summer and mild and dry through most of the year. Air temperatures range from approximately 70 to 100 degrees Fahrenheit (°F) during the summer, and 40° to 65°F during the winter. Monthly precipitation ranges from 0 to 5 inches, depending on the month, with the wettest months occurring between December and March, and very little rain falling from April through August. Refer to Section 4.2 for a detailed description of air quality in the Project area.

4.1.3 Major Land Uses

The topography around the three Project reservoirs is generally hilly and mountainous with lower terrain surrounded by arid chaparral scrub vegetation. Quail Lake is at an elevation of approximately 3,300 feet. Slopes in the vicinity of the lake range from 2 to 20 percent. Pyramid Lake is at an elevation of approximately 3,000 feet, with nearby slopes that range from 2 to 100 percent. Elderberry Forebay is at an elevation of 2,400 feet, with nearby slopes similar to the slopes near Pyramid Lake.

The areas immediately adjacent to Elderberry Forebay are not accessible to the public for safety purposes. The majority of the areas immediately adjacent to Pyramid Lake are NFS lands managed by the ANF. The Lower Quail Canal is located on DWR-owned land that extends to Pyramid Lake. Water from the Lower Quail Canal passes into the Peace Valley Pipeline, and terminates at the Warne Powerplant, located on DWR-owned land. The Angeles Tunnel, which connects Pyramid Lake to Elderberry Forebay, passes mostly under public multiple-use lands managed by the ANF, except where it connects to the Castaic Powerplant, which is on DWR-owned land.

Prior to the construction of Pyramid Lake and Dam, land uses were more in grazing, transportation, and open space. The area has always been part of an important north-south transportation corridor. Settlement and commercial development were limited prior to the 1970s. Similarly, Quail Lake was constructed in an area mostly used in grazing and transportation uses associated with nearby Highway 138.

All three reservoirs are within Los Angeles County, with land use policies for the region guided by Los Angeles County and the ANF. The ANF Land and Resource Management Plan (LRMP) was adopted in 2006 and is intended to provide guidance for management of the NFS lands for a period of 10 to 15 years.

Land use policies for private lands in the Project area are provided by Los Angeles County's General Plan. The existing General Plan was adopted in 1980, and several sections have been updated through 2014. The General Plan is currently undergoing a comprehensive revision. Refer to Section 4.9 for a detailed description of land use in the Project area.

4.1.4 Major Water Uses

Water passing through the hydropower generating plants serves as a major source of water for the greater Los Angeles communities. The northern part (i.e., Quail Lake) of the Project is within the Lahontan RWQCB's planning territory, and the southern part is within the Los Angeles RWQCB's territory. Both agencies have issued basin plans, but only the Los Angeles Basin Plan identifies designated beneficial uses for specific surface waters potentially affected by the Project. Refer to Section 4.4 for a detailed description of water uses in the Project area.

4.2 AIR QUALITY AND NOISE

This Section provides information regarding existing air quality and noise conditions. Besides this general introductory information, this Section includes four main sub-sections: Section 4.2.1 describes air quality management plans and regulations that pertain to the Project region; Section 4.2.2 describes air quality conditions in the Project area; Section 4.2.3 describes noise management plans and regulations that pertain to the Project region; and Section 4.2.4 describes noise conditions at Project facilities.

4.2.1 Pertinent Air Quality Management Plans and Regulations

The California Air Resource Board (CARB), as part of the California Environmental Protection Agency (CAL-EPA), is responsible for protecting public health and the environment from the harmful effects of air pollution. Pollutants associated with air emissions, such as ozone (O_3), particulate matter and nitrogen dioxide (NO_2), are associated with respiratory illness. Carbon monoxide (CO), another air pollutant, can be absorbed through the lungs into the bloodstream and reduce the ability of blood to carry oxygen. Sources of air emissions include commercial facility operations, fugitive dust, vehicles and trucks, aircraft, boats, trains, and natural sources such as biogenic and geogenic hydrocarbons and wildfires.

To reduce harmful exposure to air pollutants, the federal Clean Air Act requires the EPA to set outdoor air quality standards for the nation with the option for states to adopt additional, or more protective standards, if needed. CARB has adopted ambient (outdoor) air quality standards (AAQS) that are more protective than federal standards and has implemented standards for some pollutants not addressed by federal standards. An AAQS establishes the concentration above which the pollutant is known to cause adverse health effects to sensitive groups within the greater population, such as children and the elderly. The goal is for localized effects not to cause or contribute to an exceedance of the standards. Criteria pollutants for which AAQS have been established include O_3, particulate matter, CO, NO_2, sulfur dioxide (SO_2) and lead. California and federal AAQS for criteria pollutants are presented in Table 4.2-1.

This page intentionally left blank.

Table 4.2-1. California and Federal Ambient Air Quality Standards

Pollutant	Averaging Time	California Standards[1]		Federal Standards[2]		
		Concentration[3]	Method[4]	Primary[3,5]	Secondary[3,6]	Method[7]
Ozone (O_3)[8]	1 Hour	0.09 ppm (180 $\mu g/m^3$)	Ultraviolet Photometry	--	Same as Primary Standard	Ultraviolet Photometry
	8 Hour	0.070 ppm (137 $\mu g/m^3$)		0.070 ppm (137 $\mu g/m^3$)		
Respirable Particulate Matter (PM10)[9]	24 Hour	50 $\mu g/m^3$	Gravimetric or Beta Attenuation	150 $\mu g/m^3$	Same as Primary Standard	Inertial Separation and Gravimetric Analysis
	Annual Arithmetic Mean	20 $\mu g/m^3$		--		
Fine Particulate Matter (PM2.5)[9]	24 Hour	--	--	35 $\mu g/m^3$	Same as Primary Standard	Inertial Separation and Gravimetric Analysis
	Annual Arithmetic Mean	12 $\mu g/m^3$	Gravimetric or Beta Attenuation	12.0 $\mu g/m^3$	15 $\mu g/m^3$	
Carbon Monoxide (CO)	1 Hour	20.0 ppm (23 mg/m^3)	Non-Dispersive Infrared Photometry	35 ppm (40 mg/m^3)	--	Non-Dispersive Infrared Photometry
	8 Hour	9.0 ppm (10 mg/m^3)		9 ppm (10 mg/m^3)		
	8 Hour (Lake Tahoe)	6 ppm (7 mg/m^3)		--	--	
Nitrogen Dioxide (NO_2)[10]	1 Hour	0.18 ppm (339 $\mu g/m^3$)	Gas Phase Chemiluminescence	100 ppb (188 $\mu g/m^3$)	--	Gas Phase Chemiluminescence
	Annual Arithmetic Mean	0.030 ppm (57 $\mu g/m^3$)		0.053 ppm (100 $\mu g/m^3$)	Same as Primary Standard	
Sulfur Dioxide (SO_2)[11]	1 Hour	0.25 ppm (655 $\mu g/m^3$)	Ultraviolet Fluorescence	75 ppb (196 $\mu g/m^3$)[9]	--	Ultraviolet Fluorescence; Spectrophotometry (Pararosaniline Method)
	3 Hour	--		--	0.5 ppm (1,300 $\mu g/m^3$)	
	24 Hour	0.04 ppm (105 $\mu g/m^3$)		0.14 ppm (for certain areas)[10]	--	
	Annual Arithmetic Mean	--		0.030 ppm (for certain areas)[10]	--	
Lead[12, 13]	30 Day Average	1.5 $\mu g/m^3$	Atomic Absorption	---	--	High Volume Sampler and Atomic Absorption
	Calendar Quarter	--		1.5 $\mu g/m^3$ (for certain areas)[12]	Same as Primary Standard	
	Rolling 3-Month Average	--		0.15 $\mu g/m^3$		
Visibility Reducing Particles[14]	8 Hour	See footnote 13	Beta Attenuation and Transmittance through Filter Tape	No National Standards		
Sulfates	24 Hour	25 $\mu g/m^3$	Ion Chromatography			
Hydrogen Sulfide	1 Hour	0.03 ppm (42 $\mu g/m^3$)	Ultraviolet Fluorescence			
Vinyl Chloride[12]	24 Hour	0.01 ppm (26 $\mu g/m^3$)	Gas Chromatography			

Source: CARB 10/1/2015

Key:

µg = microgram *ppb = part per billion*
m^3 = cubic meter *ppm = part per million*
mg = milligram

[1]California standards for ozone, carbon monoxide (except 8-hour Lake Tahoe), sulfur dioxide (1 and 24 hour), nitrogen dioxide, and particulate matter (PM10, PM2.5, and visibility reducing particles), are values that are not to be exceeded. All others are not to be equaled or exceeded. California ambient air quality standards are listed in the Table of Standards in Section 70200 of Title 17 of the California Code of Regulations.

[2]National standards (other than ozone, particulate matter, and those based on annual arithmetic mean) are not to be exceeded more than once a year. The ozone standard is attained when the fourth highest 8-hour concentration measured at each site in a year, averaged over three years, is equal to or less than the standard. For PM10, the 24 hour standard is attained when the expected number of days per calendar year with a 24 hour average concentration above 150 $\mu g/m^3$ is equal to or less than one. For PM2.5, the 24 hour standard is attained when 98 percent of the daily concentrations, averaged over three years, are equal to or less than the standard. Contact the U.S. EPA for further clarification and current national policies.

[3]Concentration expressed first in units in which it was promulgated. Equivalent units given in parentheses are based upon a reference temperature of 25°C and a reference pressure of 760 torr. Most measurements of air quality are to be corrected to a reference temperature of 25°C and a reference pressure of 760 torr; ppm in this table refers to ppm by volume, or micromoles of pollutant per mole of gas.

[4]Any equivalent measurement method which can be shown to the satisfaction of the CARB to give equivalent results at or near the level of the air quality standard may be used.

[5]National Primary Standards: The levels of air quality necessary, with an adequate margin of safety to protect the public health.

[6]National Secondary Standards: The levels of air quality necessary to protect the public welfare from any known or anticipated adverse effects of a pollutant.

[7]Reference method as described by the U.S. EPA. An "equivalent method" of measurement may be used but must have a "consistent relationship to the reference method" and must be approved by the U.S. EPA.

[8]On October 1, 2015, the national 8-hour ozone primary and secondary standards were lowered from 0.075 to 0.070 ppm.

[9]On December 14, 2012, the national annual PM2.5 primary standard was lowered from 15 $\mu g/m^3$ to 12.0 $\mu g/m^3$. The existing national 24 hour PM2.5 standards (primary and secondary) were retained at 35 $\mu g/m^3$, as was the annual secondary standard of 15 $\mu g/m^3$. The existing 24-hour PM10 standards (primary and secondary) of 150 $\mu g/m^3$ also were retained. The form of the annual primary and secondary standards is the annual mean, averaged over 3 years.

[10]To attain the 1-hour national standard, the 3-year average of the annual 98th percentile of the 1-hour daily maximum concentrations at each site must not exceed 100 ppb. Note that the national 1-hour standard is in units of parts per billion (ppb). California standards are in units of parts per million (ppm). To directly compare the national 1-hour standard to the California standards, the units can be converted from ppb to ppm.

[11]On June 2, 2010, a new 1-hour SO_2 standard was established and the existing 24-hour and annual primary standards were revoked. To attain the 1-hour national standard, the 3-year average of the annual 99th percentile of the 1-hour daily maximum concentrations at each site must not exceed 75 ppb. The 1971 SO_2 national standards (24-hour and annual) remain in effect until one year after an area is designated for the 2010 standard, except that in areas designated nonattainment for the 1971 standards, the 1971 standards remain in effect until implementation plans to attain or maintain the 2010 standards are approved.

Note that the 1-hour national standard is in units of parts per billion (ppb). California standards are in units of parts per million (ppm). To directly compare the 1-hour national standard to the California standard, the units can be converted to ppm. In this case, the national standard of 75 ppb is identical to 0.075 ppm.

[12]The CARB has identified lead and vinyl chloride as 'toxic air contaminants' with no threshold level of exposure for adverse health effects determined. These actions allow for the implementation of control measures at levels below the ambient concentrations specified for these pollutants.

[13]The national standard for lead was revised on October 15, 2008 to a rolling 3-month average. The 1978 lead standard (1.5 $\mu g/m^3$ as a quarterly average) remains in effect until one year after an area is designated for the 2008 standard, except that in areas designated nonattainment for the 1978 standard, the 1978 standard remains in effect until implementation plans to attain or maintain the 2008 standard are approved.

[14]n 1989, the CARB converted both the general statewide 10-mile visibility standard and the Lake Tahoe 30-mile visibility standard to instrumental equivalents, which are "extinction of 0.23 per kilometer" and "extinction of 0.07 per kilometer" for the statewide and Lake Tahoe Air Basin standards, respectively.

This page intentionally left blank.

Both the California and federal governments use ambient air monitoring data to classify areas according to their attainment status with respect to criteria pollutants. These designations are used to identify areas with air quality problems. The three basic designation categories are:

- Attainment – Ambient air quality is not in violation of the established standard for the specific criteria pollutant.
- Nonattainment – Ambient air quality violates the established standard for the specific criteria pollutant.
- Unclassified – There is currently insufficient data for determining attainment or nonattainment.

In addition to the above designations, the State includes a sub-category of the nonattainment designation:

- Nonattainment-transitional – Nonattainment areas that are making progress and nearing attainment.

4.2.2 Air Quality in Project Area

To manage air quality problems, the State is divided into 15 air basins, each of which is associated with one or more Air Quality Management Districts. The area of Los Angeles County in which the Project is located is within the South Coast Air Quality Management District (CAL-EPA 2014). Table 4.2-2 shows the current federal and State attainment status for each pollutant in Los Angeles County.

Table 4.2-2. Attainment Status for Air Quality Pollutants in Los Angeles County[1]

Pollutant	State Attainment Status	National Attainment Status
Ozone (8 hr)	Nonattainment	Nonattainment
Carbon Monoxide	Attainment	Attainment
Nitrogen Dioxide	Attainment	Nonattainment[2]
Fine Particulate Matter	Nonattainment	Nonattainment
Respirable Particulate Matter	Nonattainment	Attainment
Sulfur Dioxide	Attainment	Attainment
Lead	Attainment	Nonattainment
Sulfates	Attainment	No Federal Standards
Hydrogen Sulfide	Unclassified	
Visibility Reducing Particles	Unclassified	

Sources: CAL-EPA 2014b; Environmental Protection Agency Green Book 2015
Note:
[1]*The federal 1-hour ozone rule was vacated on June 15, 2005.*
[2]*Areas outside of attainment are now known as 'Maintenance' areas.*

The Project is situated within geographic areas that are currently designated as nonattainment for 8-hour O_3, NO_2 (federal only), Fine Particulate Matter (PM2.5), Respirable Particulate Matter (PM10, State only) and lead (federal only).

Greenhouse gas (GHG) emissions associated with development of hydroelectric systems has been a topic of study by the International Hydropower Association since 2006. In July 2008, a Working Group established to initiate such studies published "Scoping Paper - Assessment of Greenhouse Gas Status of Freshwater Reservoirs," in which it was observed that reservoirs 5 years or less in age emitted higher levels of GHG, principally methane, than reservoirs 10 years and older. Although there is a wide range of variables associated with reservoir conditions, GHG emissions from the older reservoirs were comparable to natural lakes (United Nations 2008). This observation was verified in a study performed by Pelletier et al. (2009) for the Hydro-Quebec Eastmain 1 Project. Notably, the Project reservoirs have been in existence for over 40 years (Quail, Elderberry, and Pyramid Lakes since 1967, 1972 and 1973, respectively). GHG emissions are not expected to be an issue 40 years after construction.

Meteorological data are currently being collected at four weather stations within the Project vicinity as shown in Figure 4.2-1. Of the four stations, three are Remote Automatic Weather Stations with data management by the Western Regional Climate Center, and the fourth station with data management by the National Weather Service. Meteorological data are also collected within the Project boundary at two weather stations owned and operated by DWR: the Lower Quail Canal Weather Station, located at the upper end of Lower Quail Canal; and the Pyramid Weather Station, located about 600 feet north of Warne Powerplant (pers. comm., Goebl 2015). The types of meteorological data collected and period of operation for each weather station are summarized in Table 4.2-3.

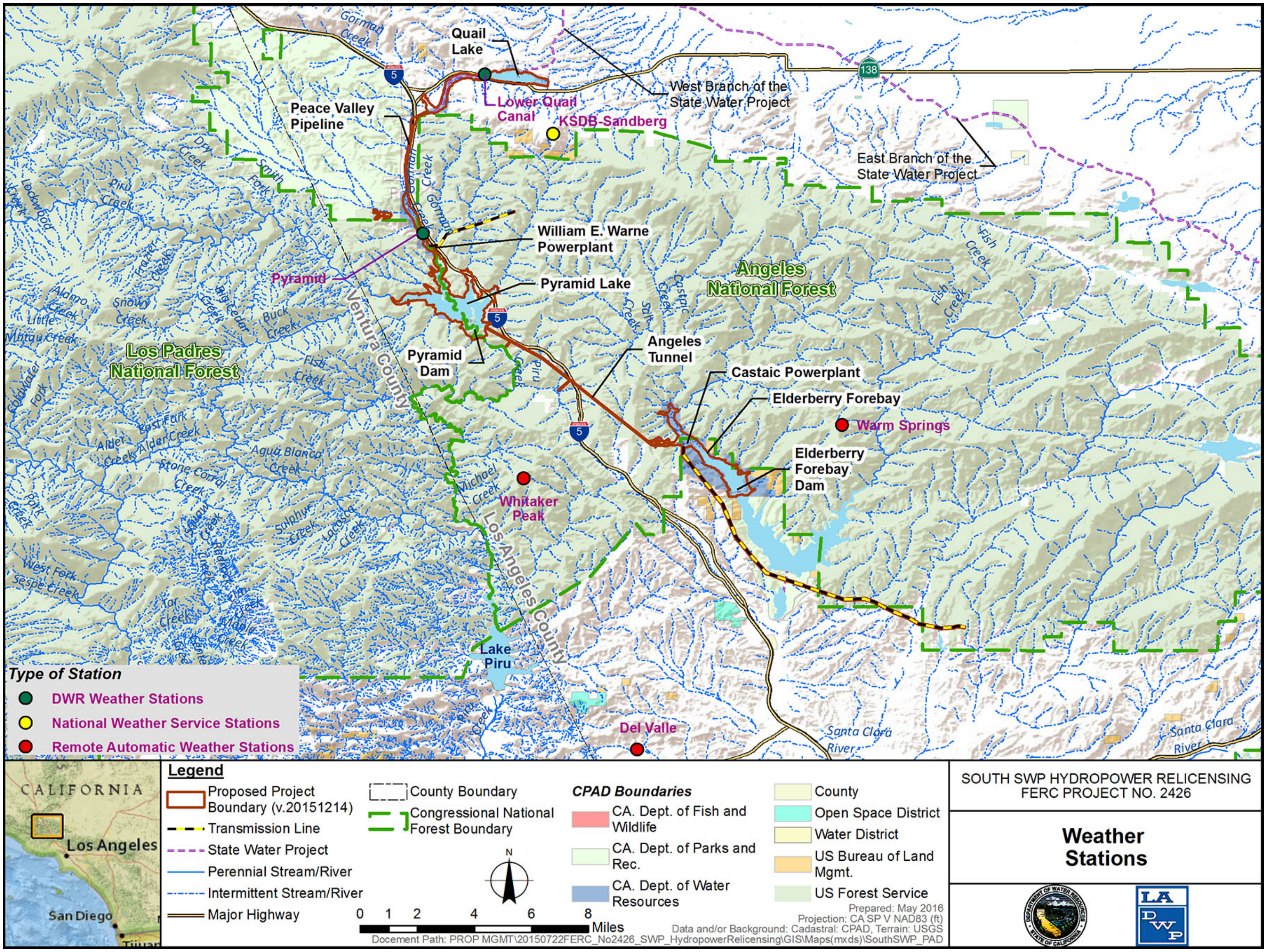


Figure 4.2-1. Weather Stations Located in the Project Vicinity

Table 4.2-3. Weather Station Information

Weather Station	Data Managed By	Latitude	Longitude	Elev	Period of Operation	Data Types
Whitaker Peak[1] (Project vicinity)	Western Region Climate Center	34°34'07"	-118°44'25"	4,120	10/1/1999 – present	Hourly: solar radiation, wind speed, wind direction, air temperature, fuel temperature, fuel moisture, humidity, dew point, barometric pressure, precipitation
Warm Springs[2] (Project vicinity)	Western Region Climate Center	34°35'45"	-118°34'43"	4,930	4/1/1986 - present	Hourly: solar radiation, wind speed, wind direction, air temperature, fuel temperature, fuel moisture, humidity, dew point, precipitation
Del Valle[3] (Project vicinity)	Western Region Climate Center	34°25'52"	-118°40'58"	1,278	11/1/1998 - present	Hourly: solar radiation, wind speed, wind direction, air temperature, fuel temperature, fuel moisture, humidity, dew point, barometric pressure, precipitation
KDSB-Sandberg[4] (Project vicinity)	National Weather Service	34°44'36"	-118°43'31"	4,524	1/1/1948 - present	Hourly: wind speed, wind direction, air temperature, visibility, clouds, air temperature, fuel temperature, fuel moisture, humidity, dew point, barometric pressure, precipitation
Lower Quail Canal[5] (existing Project boundary)	DWR	--	--	--	1988 - present	Daily: high and low temperatures, precipitation
Pyramid[5] (existing Project boundary)	DWR	--	--	--	1988 - present	Daily: high and low temperatures, precipitation, evaporation rate

Sources: [1]*Western Region Climate Center (http://www.raws.dri.edu/cgi-bin/rawMAIN.pl?caCWPK)*
[2]*Western Region Climate Center (http://www.raws.dri.edu/cgi-bin/rawMAIN.pl?caCWAR)*
[3]*Western Region Climate Center (http://www.raws.dri.edu/cgi-bin/rawMAIN.pl?caCDVA)*
[4]*National Weather Service (http://www.wrh.noaa.gov/mesowest/getobext.php?wfo=lox&sid=KSDB&num=48)*
[5]*Pers. comm., Goebl 2015*

4.2.3 Pertinent Noise Considerations

Noise is defined as unwanted sound. It is emitted from many sources, including airplanes, factories, railroads, power generation plants and highway vehicles. The magnitude of noise is described by its sound pressure. Since the range of sound pressure varies greatly, a logarithmic scale is used to relate sound pressures to a common reference level, the decibel. Sound pressures described in decibels are called sound levels.

Sound levels, measured using an "A-weighted decibel scale" are expressed as decibels (dBA). This scale is frequency adjusted to represent the way the human ear responds to sounds. Throughout this discussion, all noise levels are expressed in dBA. The degree of disturbance or annoyance of unwanted sound depends essentially on three factors:

- The amount and nature of the intruding noise
- The relationship between the background noise and the intruding noise
- The type of activity occurring where the noise is heard

With regard to the first factor, it is important to note that individuals have different sensitivity to noise. Loud noises bother some people more than others. In addition, people react differently to various patterns of noise, often depending on whether such noise is viewed as uncomfortable or offensive.

With regard to the second factor, individuals tend to judge the annoyance of an unwanted noise in terms of its relationship to noise from other sources (i.e., background noise). The blowing of a car horn at night when background noise levels are approximately 45 dBA generally would be more objectionable than the blowing of a car horn in the afternoon when background noises might be 55 dBA.

The third factor is related to the interference of noise with activities of individuals. In a 60-dBA environment, normal work activities requiring high levels of concentration may be interrupted by loud noises, while activities requiring manual effort may not be interrupted to the same degree. Time-averaged descriptors are utilized to provide a better assessment of time-varying sound levels. The three most common noise descriptors used in community noise surveys are the equivalent sound level (Leq), percentile distributions of sound levels (L%), and the day-night average sound level (Ldn).

The Leq is an energy-averaged sound level that includes both steady background sounds and transient short-term sounds. The Leq is equivalent in energy to the fluctuating sound level over the measurement period. The Leq is commonly used to describe traffic noise levels, which tend to be characterized by fluctuating sound levels.

The L% indicates the sound level exceeded for a percentage of the measurement period. For example, the L_{90} is the sound level exceeded for 90 percent of the measurement period and is commonly used to represent background sound levels. The

L_{10} is the sound level exceeded for 10 percent of the measurement period and represents the peak sound levels present in the environment.

The Ldn is another descriptor used to evaluate community noise levels. The Ldn is a 24-hour average sound level, which includes a 10 dBA penalty added to nighttime sound levels (i.e., 10 p.m. to 7 a.m.) because people tend to be more sensitive to noise during the nighttime. The Ldn sound level is commonly used to describe aircraft and train noise levels.

For the State, noise intensity is also discussed in terms of Community Noise Equivalent Level, which presents a weighted average noise level that increases the relative significance of evening and nighttime noise. The Community Noise Equivalent Level descriptor is used to evaluate community noise levels, which includes a 5 and 10 dBA penalty added to evening (i.e., 7 p.m. to 10 p.m.) and nighttime sound levels, respectively, in consideration of people's increased sensitivity to noise during the evening and nighttime periods.

County noise standards are generally established based on land use and zoning designations. This is done to ensure that acceptable noise levels are consistent with community development goals and policies. As such, there can be variability between various counties' noise standards. Table 4.2-4 summarizes Los Angeles County's proposed noise standards.

Table 4.2-4. Los Angeles County's Noise Standards for the Project

On-site Sound Level Descriptor	Day (7 a.m. through 10 a.m.)	Night (10 p.m. through 7 a.m.)
Hourly Leq	50 dBA	45 dBA
Maximum	70 dBA	65 dBA

Source: Los Angeles County 2015
Key:
dBA = decibel

4.2.4 Noise in Project Area

Generally, noise from the Project powerhouses, which are the only main sources of ongoing Project generated-noise, occur at very low levels and are mostly emanated from underground chambers in relatively remote areas; no residences or commercial properties are near the powerhouses. Periodic sources of Project-related noise include activities such as vegetation management and road maintenance. Also, recreation activities generate a seasonal source of noise (e.g., jet skis and motorized boats).

4.3 GEOLOGY AND SOILS

This Section provides information regarding existing geology and soil resources. Besides this general introductory information, this Section is divided into 13 main sub-sections: Section 4.3.1 describes the existing environmental conditions and regional geologic setting; Sections 4.3.1.1 through 4.3.1.3 focus on the geomorphology, tectonic history, and seismicity; Section 4.3.2 summarizes the Project-specific geologic conditions; Section 4.3.3 describes general soil types known to occur within the Project area; Sections 4.3.4 through 4.3.11 provide summaries of the geology and soils resources associated with the Project including bedrock, surface deposits and soils, faulting and seismic considerations, and erosion potential and sedimentation; Section 4.3.12 describes the geology and soils resources associated with Pyramid reach; Section 4.3.13 provides information regarding mineral resources in proximity to the Project.

4.3.1 Regional Geologic Setting

4.3.1.1 Geomorphology

The majority of the Project is located in the Sierra Pelona Mountains in the Ridge Basin. However, the northern most portion of the Project lies in the Antelope Valley on the Mojave crustal block (Mojave Desert Province, Figure 4.3-1). The Ridge Basin is a geologic structure within the north-central portion of the Transverse Ranges Geomorphic Province (Figure 4.3-1). To the north of the Transverse Ranges is the Mojave Desert Province, including Antelope and Summit valleys. To the north and west of the Project are the Coast Ranges Province and to the south is the Peninsular Ranges Province that includes the Los Angeles Basin.

The Transverse Ranges Province is a geologically complex region of southern California characterized by east-west oriented mountain ranges (e.g., the Sierra Pelona, San Gabriel, and San Bernardino mountains) and valleys, in contrast to the northwest trending mountains and valleys of the Coast Ranges and Peninsular Ranges Provinces, and much of the rest of the State. Ongoing intense north-south compressional tectonic forces are causing relatively fast uplift of the Transverse Ranges' mountain blocks, and as a result these mountain blocks have developed the characteristically steep terrain. (CGS 2002a as cited in DWR 2009).

The Mojave Desert Province is bounded by the Tehachapi Mountains on the northwest, together with the Transverse Ranges Province on the southwest. These western boundaries are distinct, forming the dominant pie-slice shaped Antelope Valley. The boundaries of this valley are caused by the two largest faults in California: the San Andreas fault and the Garlock fault. The Mojave Desert extends eastward into the state of Nevada occupying approximately 25,000 square miles in total (Figure 4.3-1).

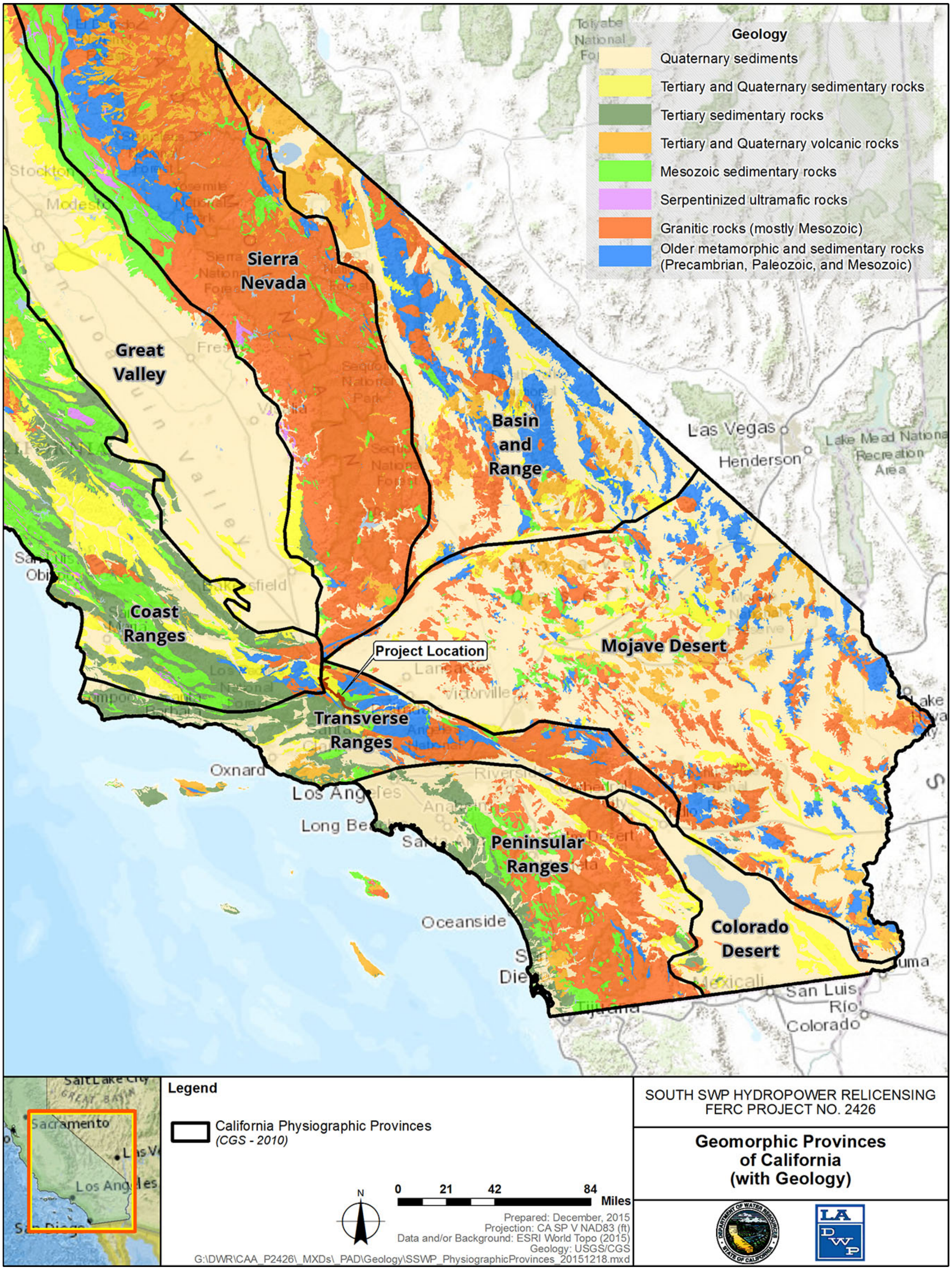


Figure 4.3-1. Geomorphic Provinces of Southern California (with Geology)

4.3.1.2 Tectonic History

A myriad of forces - including the accretion of seafloor crust and oceanic sediments along the western margin of the North American continent, their subsequent uplift, intrusion by granitic batholiths, periods of volcanism during subduction, horizontal translational displacement and concurrent erosion - have resulted in the formation of the California's broad geologic features and present-day landscape observed in the Project vicinity. (DWR 2009).

Approximately 700 million years ago (mya), the North American continent rifted away from the Rodinia supercontinent, exposing the west coast of the North American continent to the world's oceans. Southern California's current geologic features are a product of long-term tectonic activity associated with episodic subduction, which lasted from about 438 to 144 mya (Paleozoic to the Mesozoic Eras). (Atwater 2000)

During the Mesozoic Era, about 250 to 65 mya, the ancestral southern California coast lay over a subduction zone. Much of the basement rock of California formed during that period. Through late Cretaceous and Eocene time (about 70 to 35 mya), continental and marine sediments were deposited on the continental shelf. (Atwater 2000).

As sea levels fell or the continental margin rose, during the late Eocene and Oligocene Epochs, about 35 to 23 mya, the continental margin was exposed and a lowland of meandering rivers and floodplains developed. By early Miocene Epoch approximately 16 to 23 mya, the sea again covered the continental margin and marine sediments were deposited. The region's geologic features were then further altered by transform movement between the Pacific and North American Plates, along the San Andreas fault (Figure 4.3-2). Starting about 20 mya, the subduction system between the Pacific and North American Plates was gradually replaced by the transform motion of the San Andreas fault separating the generally westward-drifting continental North American Plate from the northwest-drifting oceanic Pacific Plate. (Atwater 2000).

The Pacific Plate detached slices of the continental rim and transported them northwestward. One slice of a mountain block became trapped in the shear between the North American and Pacific Plates. This slice of mountain block rotated clockwise forming a rift valley on its east. Subsequently, volcanic intrusions followed fractures in the block and sediments filled the deep rift valley. The rotated block, today's Transverse Ranges Province, continues to rotate, causing the ongoing tilting, folding and uplift of the growing mountain range. Thrust faults also border the northern and southern mountain block margins (Atwater 2000), further separating its geology from the surrounding geology.

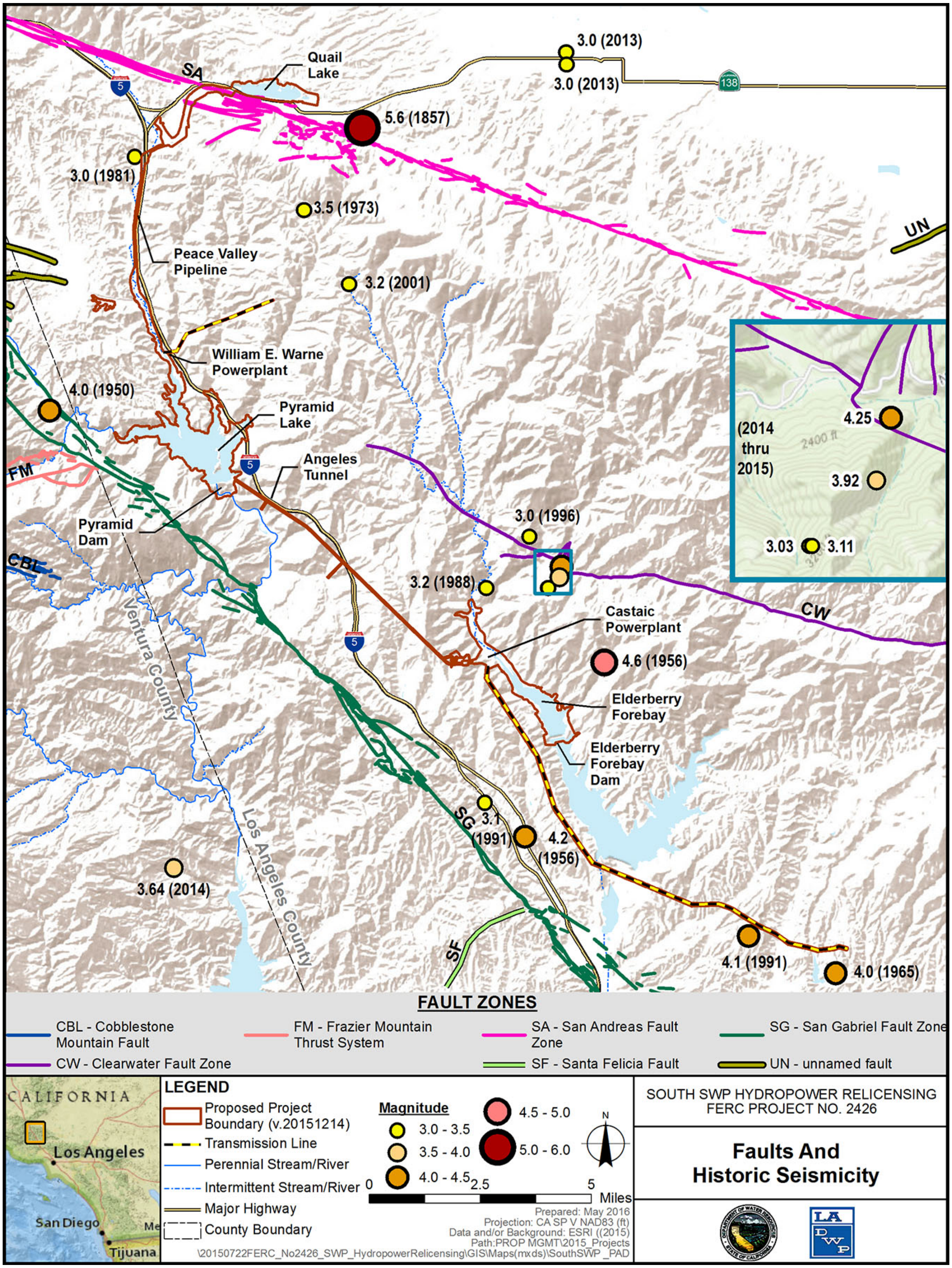


Figure 4.3-2. Fault Zones and Historic Seismicity in the Project Vicinity

4.3.1.3 Seismicity

Southern California is a region of high seismic activity. Numerous active, potentially active, and inactive faults are scattered across the region. The criteria for these major groups are based on criteria developed by the California Geological Survey (CGS, formerly known as California Division of Mines and Geology [CDMG]) for the Alquist-Priolo Earthquake Fault Zone Program (Bryant and Hart, 2007). By definition, an active fault is one that has had surface displacement within Holocene Epoch time (approximately 11,500 years through the present). A potentially active fault has demonstrated surface displacement during Quaternary time (approximately the last 1.6 million years), but has had no known Holocene movement. Faults that have not moved in the last 1.6 million years are considered inactive. Many active, potentially active and historically active (last 200 years) faults are located throughout the region and traverse portions of the Project. Within the Project vicinity, significant earthquakes (magnitude [M] 6 or greater on the Richter magnitude scale) have historically occurred along four faults; the San Andreas fault, the Garlock fault, the San Gabriel fault, and the White Wolf fault. (Figure 4.3-2)

The northernmost portion of the Project (Quail Lake and a portion of Lower Quail Canal) lies on the Mojave crustal block (Mojave Desert Province, Figure 4.3-1), with main traces of the San Andreas fault passing within 500 feet of the southern bank of Quail Lake and crossing the initial 0.75-mile of Lower Quail Canal. The rest of the Project lies in a crustal slice of rock known as the Ridge Basin (Transverse Range Provence Figure 4.3-2) that is wedged between the San Andreas fault to the north and the San Gabriel fault to the south. The San Gabriel fault merges with the San Andreas fault about 10 miles to the west, near Frazier Park and about 80 miles to the east-southeast, near Cajon Pass. The two faults form a crustal block that reaches a maximum width of about 20 miles. The crustal block containing the Project is cut by numerous regional and local active, potentially-active and inactive faults. Other minor faults in the area lie to the east of the Project and several low angle thrust faults lie to the west.

4.3.1.4 Faulting

The most prominent tectonic feature associated with the Project is the San Andreas Fault Zone (Figure 4.3-2). The fault is a right-lateral strike-slip feature that trends roughly northwest extending about 600 miles from the Imperial Valley in southern California to Point Arena on the northern California coast, where it continues offshore to the west. The southern segment of the San Andreas fault was responsible for the estimated M 7.9 Fort Tejon earthquake of 1857, the largest historic earthquake to affect southern California. The Fort Tejon earthquake caused a 225-mile long surface rupture of the San Andreas fault from the likely epicentral area northwest of Parkfield, Monterey County to at least Cajon Pass northwest of San Bernardino, traversing the Project's Quail Lake located in the fault rift zone. (SCEDC 2015a) An estimated 20 feet of horizontal displacement of the land surface occurred near the city of Gorman, approximately 4 miles from the Project. The 1857 earthquake, along with the 1906 San Francisco earthquake of northern California, represent the two largest fault ruptures in California history. (Gomez 2000).

The Garlock fault is an east-northeast striking fault that separates the Tehachapi and Sierra Nevada mountains from the Mojave Desert (Figure 4.3-2). Although no significant historic earthquakes have been recorded on the Garlock fault, the last rupture of the fault has been estimated at occurring between 1460 and 1900. The Garlock fault is considered an active fault that is capable of producing a significant seismic event. (DWR 2009).

The San Gabriel fault is approximately 87 miles in length, extending southeastward from the San Andreas fault about 10 miles west of the Project to the Cajon Pass area, where it merges once again with the San Andreas fault (Figure 4.3-2). This primarily right-lateral strike-slip fault extends through the Project area, passing approximately 0.5 miles southwest of Pyramid Dam and nearly 3 miles from Elderberry Dam. Most of its displacement likely occurred during the middle Miocene to early Pliocene time approximately 14 mya to 3 mya, and may have functioned as an ancestral branch of the San Andreas fault during some portion of this time. (DWR 2012a).

More recently, the Kern County or Tehachapi earthquake of 1952 was estimated at M 7.5, and was generated on the White Wolf fault (not shown in Figure 4.3-2) located approximately 30 miles north of the Project. This earthquake caused significant damage locally and was felt as far away as San Diego and San Francisco. This earthquake reportedly caused landslides around the future Pyramid Dam site area. (SCEDC 2015b).

The 1971, M 6.6 Sylmar or San Fernando earthquake, was centered about 29 miles south of the Project. There were no known reports of slope failure resulting from this earthquake around the Project facilities.

The 1994, M 6.7 Northridge earthquake was centered in Reseda, about 22 miles south of the Project. Licensees did not find evidence of damage to the Project facilities.

Other prominent active faults in and near the Project are the Liebre and Clearwater faults in the northern portion of Ridge Basin, and the Bee Canyon and San Francisquito faults to the east (GSA 2003 as cited in DWR 2014c) (not shown in Figure 4.3-2).

4.3.2 Project Geologic Setting

The Project facilities extend from the southern edge of the Antelope Valley on the western edge of the Mojave crustal block to the southern edge of the Ridge Basin, a deep structural trough that contains a thick stratigraphic section of Pliocene Epoch, approximately 5.3 to 2.6 mya, sedimentary rocks (the QPc unit shown in Figure 4.3-3) bounded on the north by the San Andreas fault and on the west and southwest by the San Gabriel fault. During the late Miocene and early Pliocene epochs, approximately 11.6 to 3.6 mya, this region to the north of Los Angeles and San Bernardino began to rise due to the collision of the Pacific and North American Plates. Rock eroding from the hills was deposited as alluvial sediments in the adjacent, subsiding basin. The combination of rapid erosion and subsidence led to the formation of very thick Pliocene

Epoch sedimentary deposits, which are as much as 1,500 feet thick (Figure 4.3-3). (DWR 2014c).

The northern portion of the Project stretches from the Antelope Valley south to the north-trending Peace Valley. Bedrock in this area consists of the Oso and Quail Lake Formations (near Quail Lake) and the Hungry Valley Formation (around Lower Quail Canal and the western extent of the Project), of the Ridge Basin Group of formations. The Oso and Quail Lake Formations were deposited during the late Miocene Epoch, around 5.3 mya. The Oso Formation consists of sandstone, claystone, and conglomerate. The Quail Lake Formation consists of sandstone and silty shale. The Hungry Valley Formation was deposited in the Plio-Pleistocene Epoch, approximately 3.6 to 1.8 mya, and consists of coarse-grained arkosic sandstone with interbedded clayey siltstone. The central portion of the Peace Valley consists of the Peace Valley Formation, which was deposited between the late Miocene and Early Pliocene Epochs and consists of claystone and siltstone. The southern portion of the Peach Valley and most of Pyramid Lake consists of the Peace Valley Formation and the Ridge Route Formation. The Ridge Route Formation was deposited between the late Miocene and Early Pliocene Epochs and consists of sandstone, claystone, and interbedded breccia. The Peace Valley floor is underlain by as much as 100 feet of alluvial deposits consisting primarily of silts, but also includes some clays, fine-grained sands and gravels. The geologic structure of the area is dominated by the effects of the San Andreas Fault Zone. The Ridge Basin Group, including the Hungry Valley, Peace Valley and Ridge Route Formations, has a regional dip to the northwest, except near the San Andreas fault where the rocks are tightly folded (Figure 4.3-3). (DWR 2014c, Dibblee et. al. 2002, and Dibblee et. al. 2006).

The southern portion of the Project lies within the Cretaceous Period (66 to 145 mya) to Paleocene Epoch (56 to 66 mya) San Francisquito Formation overlain by the Miocene Epoch (approximately 23 to 5.3 mya) marine Castaic Formation. These bedrock units consist of clay shale, siltstone, shaley siltstone, sandy siltstone and sandstone conglomerate that are cut by numerous regional and local east-west trending faults that cross between the San Andreas and San Gabriel faults. These units are all inclined to the west at dips of approximately 10 to 30 degrees and are covered by relatively thin deposits of soil, slopewash, creep materials, and talus which form apron-like masses that occupy portions of gullies and drainage channels (Figure 4.3-3). (DWR 2005 and Dibblee and Ehrenspeck 1997).

4.3.2.1 General Bedrock

The oldest sedimentary formation in Ridge Basin is the San Francisquito Formation, which is composed of conglomerate, sandstones and shales (Crowell and Link 1982). Overlying the San Francisquito is the late Miocene Epoch, approximately 11.6 to 5.3 mya, Castaic Formation that consists primarily of shale with interbedded siltstone, sandstone, and conglomerate. (Foster 2003).

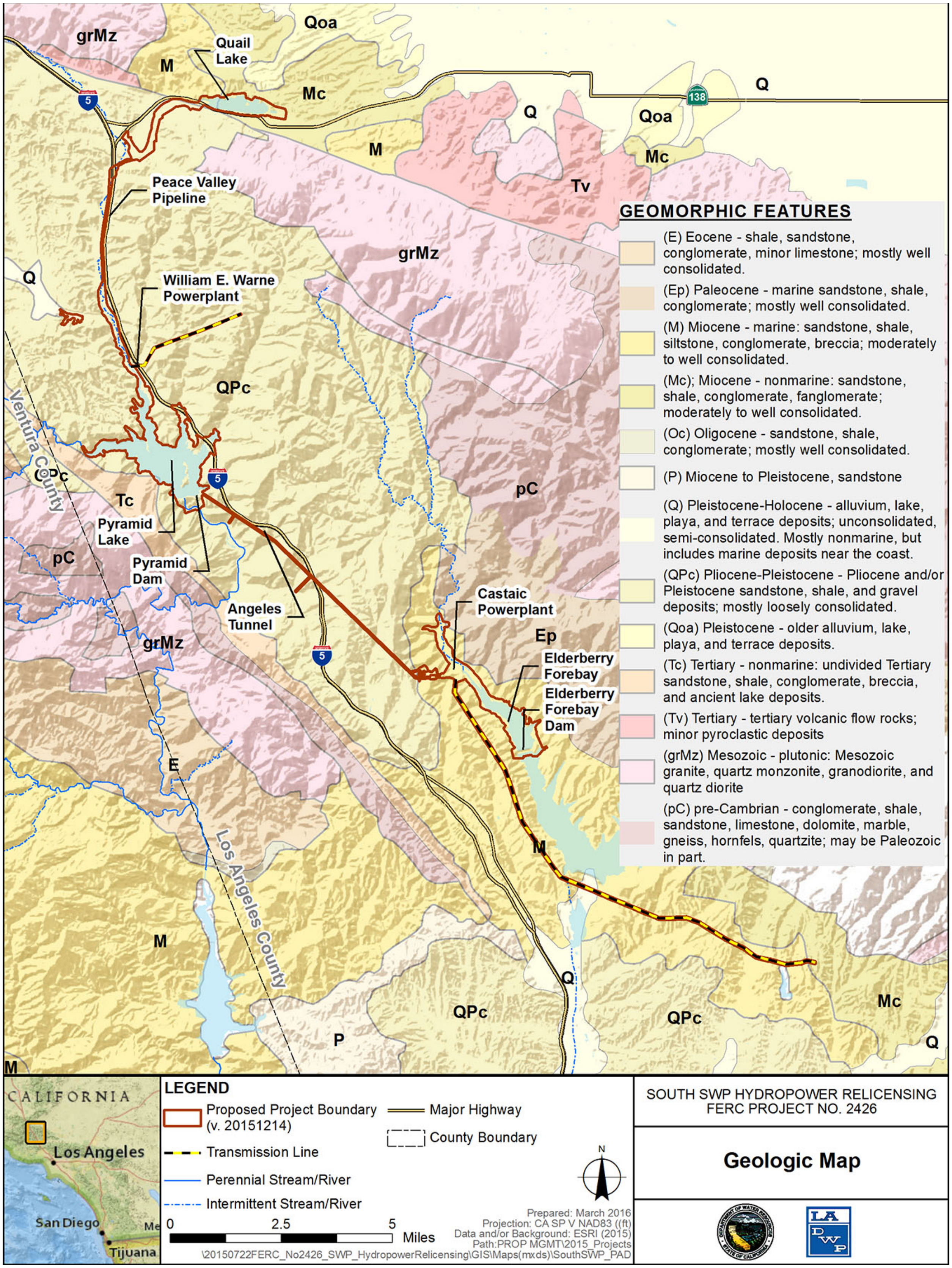


Figure 4.3-3. Geologic Map of the Project Area

Above the Castaic Formation are the Oso and Quail Lake Formations and the Ridge Basin Group that consists of the Violin Breccia, Ridge Route, Peace Valley and Hungry Valley Formations (Foster 2003 and Dibblee et. al. 2006). With the exception of the Oso and Quail Lake Formations, these formations have been folded into a series of westerly- to northwesterly-trending folds. Erosional processes have sculpted these rocks into steep-walled canyons and sharp ridges. (Federal Power Commission 1976).

4.3.2.2 Surface Deposits

Surficial geologic units include Quaternary Period 2.6 mya to present alluvial, younger terrace, older terrace and landslide deposits. Holocene alluvium, approximately 11,500 years to present, typically consists of loose to slightly consolidated stream deposits of silt, sand and gravel that may be up to 100 feet thick overlying the Hungry Valley Formation. Younger terrace materials are alluvial fan deposits consisting of slightly consolidated silt, clay, sand, and gravel. Older stream terrace deposits consist of fine sand, silt, and clay, with a few beds of coarse sand and sandy gravel. (DWR 2005c).

Some bedrock units are more susceptible to landsliding than others. In the Project area, poorly indurated portions of the Peace Valley Formation are particularly prone to landsliding when bedding dip slopes coincide with natural ground surface slopes (Foster 2003).

Sections 4.3.4 through 4.3.11 provide details regarding surficial deposits adjacent to Project features.

4.3.3 Soil Types

Soil types in the Project area are variable and reflect the diversity of parent materials and slope conditions that make up the Project. The Project traverses a number of different terrains from the relatively flat Antelope Valley in which Quail Lake is located through the Sierra Pelona Mountains, in which Elderberry Forebay is located. Figure 4.3-4 shows the soil series within the Project vicinity.

In the Antelope Valley, the Project is underlain almost exclusively by Holocene alluvium, alluvial fan, and saline sand deposits. Soils developed here are well-drained, fine sandy loams that exhibit moderately rapid to moderately slow subsoil permeability. As the Project enters Peace Valley, it is underlain by thick, recently deposited alluvial silts and sands. Soils that have developed on these deposits are well-drained, sandy, heavy sandy to gravelly loams. Further south in the Peace Valley, mountainous soils characterized by well-drained sandy loams and silty clay loams, are present.

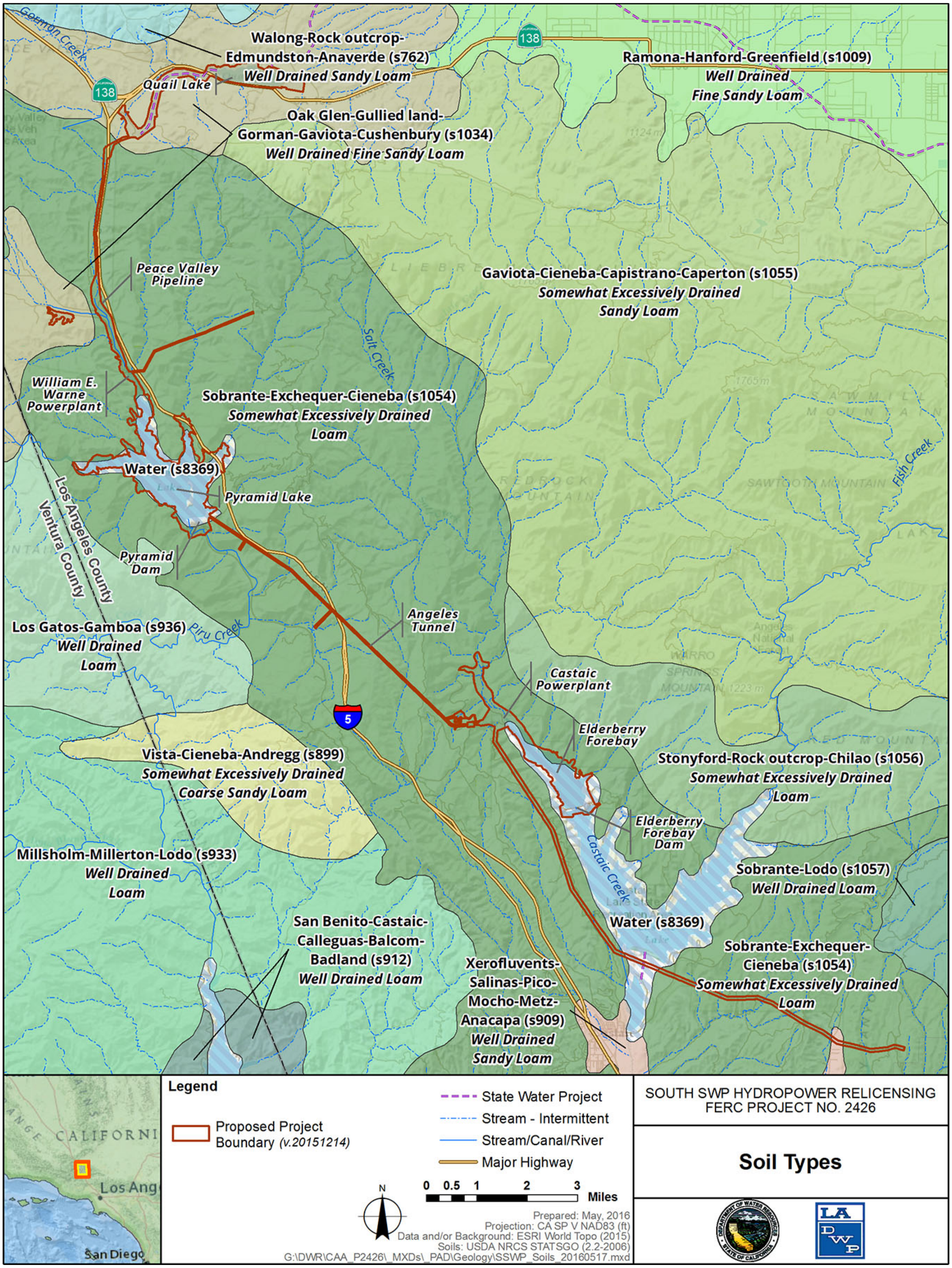


Figure 4.3-4. Soils Map of the Project Vicinity

A pattern of alluvial valley soils and stony mountainous soils exist, with some variation, through the Pyramid Lake area. Along the western lobe of Elderberry Forebay, including the Castaic Powerplant, soils consist of well-drained to excessively well-drained, loams, clay loams and sandy loams of less than 20 inches of depth over hard sandstone or shattered sandstone and shale. Soil, slopewash, creep materials, and talus form apron-like masses that occupy the lower portions of gullies, drainage channels, and the base of bluffs along Castaic Creek and Elderberry Forebay.

4.3.3.1 Paleontology

Marine molluscan and echinoid fossils from the upper Miocene have been noted in the Quail Lake Formation (Dibblee 1967). Beds of the Peace Valley Formation contain lower Miocene fossils of horse, camel, antelope, cat, elephant and reptiles, including pond turtle. The Hungry Valley Formation reportedly contains lower Miocene fossils of horse teeth, tapir, rhinoceros, camel and antelope. (Miller and Downs 1974). The Castaic Formation contains megafauna of about 100 species, most of which are pelecypods, and gastropods. Minor elements of the fauna are scaphopods, brachiopods, echinoderms, barnacles, bryozoans, and vertebrates. (Stanton 1966). The San Francisquito Formation ranges in age from the late Maastrichtian (66 mya to 72.1 mya) to late Paleocene and contains turritellas, ammonites, mytilids, thick shelled oysters, and bivalve molluscs (Squires and Saul 2006).

4.3.4 <u>Quail Lake, Lower Quail Canal, and Quail Detention Embankment</u>

4.3.4.1 Bedrock, Surface Deposits and Soils

Quail Lake is underlain almost exclusively by Holocene alluvium, alluvial fan, and saline sand deposits. Present on the northern portion of the lake are sandstone outcrops of the Oso Formation. The Lower Quail Canal and the Quail Detention Embankment are underlain by recently deposited thick alluvial silts and sands in the valleys. A small portion of the Lower Quail Canal, near Quail Lake, is underlain by sandstones of the Quail Lake Formation. As Project facilities pass adjacent to bedrock outcrops, they cross over the Miocene Peace Valley Formation of lacustrine shale and siltstone (Foster 2003), and the Pliocene sandstone of the Hungry Valley Formation (Federal Power Commission 1976). Soils developed on the alluvial deposits are a well-drained fine sandy loam, while those on the bedrock units are somewhat excessively drained loams. A United States Department of Agriculture (USDA)-National Resources Conservation Service (NRCS) Custom Soil Resource Report of the Quail Lake, Lower Quail Canal, and Quail Detention Embankment areas is presented in Appendix F of this PAD. A map showing the soil series around these areas is shown in Figure 4.3-4.

4.3.4.2 Faulting and Seismic Considerations

Quail Lake is a former sag pond located within the west-northwest trending rift zone of the San Andreas fault and is the only portion of the Project alignment that is located on an active fault (DWR 2012a). The Garlock fault is located approximately 7 miles northwest of Quail Lake and the San Gabriel fault is approximately 7 miles to the southwest.

To comply with the CWC and the California Code of Regulations (CCR), DWR is required to retain a consulting board to review and assess the safety conditions of SWP dams including the Quail Lake Embankment. Consultants are selected based on their knowledge of geotechnical, structural, and civil engineering, including their experience evaluating dam performance. Their independent assessments include the review of dam performance during earthquakes, evaluation of instrumentation data, inspection of each dam, and evaluation of studies performed by DWR. The consultants then prepare reports on each dam, approving dams as safe for continued operation and making recommendations. Based on these recommendations, DWR prepares action plans.

As a supplement to the FERC Part 12D safety inspection, FERC's Dam Safety Performance Monitoring Program requires that a Potential Failure Mode Analysis (PFMA) be performed for FERC-licensed dams. The PFMA involves document review and site visits to develop a comprehensive list of potential failure modes at each dam. From this review process, three documents are generated: the FERC Part 12D Safety Inspection report; the PFMA report; and the Supporting Technical Information Document, which summarizes project elements and details that do not change significantly over time.

4.3.4.3 Erosion Potential and Sedimentation

The Lower Quail Canal consists mostly of a sidehill excavation into native materials on the north side and a compacted earth fill embankment on the south side. The canal is lined with 4 inches of unreinforced concrete, which provides an erosion control surface of a compacted clay sublining. No joint sealant was applied to the concrete lining when constructed, so that hydrostatic pressures under the slabs could be relieved during drawdown operations. (DWR 2015a).

The sedimentation influx at Quail Lake is minimal, as virtually all waters entering the lake are from the SWP. Areas exhibiting surface erosion have been noted during past inspections of the natural bank along the northern shoreline of Quail Lake. Given the low relief of the surrounding topography, landsliding is not considered an issue.

In January 2015, DWR staff identified localized ground settlement along Lower Quail Canal's south road embankment. Observations to-date indicate that the settlement area is localized to a cut slope on the south side of Lower Quail Canal. The observed settlement appeared to be due to loss of soil through subsurface erosion and is believed to be associated with a non-Project gas pipeline trench that may have been poorly recompacted after gas line removal. This was considered by DWR to be a localized maintenance issue rather than a deeper-seated long-term issue. Additionally, there is an ongoing investigation to actively monitor possible cracks under the water surface in Lower Quail Canal. (DWR 2015a).

Licensees are not aware of any continuing problems related to erosion affecting Project roads at or around Quail Lake, the Lower Quail Canal, or the Quail Detention Embankment.

4.3.5 Peace Valley Pipeline Intake Embankment and Pipeline, Gorman Bypass Channel, and Warne Powerplant and Switchyard

4.3.5.1 Bedrock, Surface Deposits and Soils

Similar to Quail Lake, Peace Valley Pipeline is underlain by recently deposited thick alluvial silts and sands in the valleys and the Peace Valley Formation as it passes near the base of the many bedrock outcroppings.

The Gorman Bypass Channel was built on Quaternary alluvium derived primarily from the Peace Valley Formation. The Peace Valley Formation in this area is composed of alternating beds of sandstone and shale. The alluvial sediments are predominantly silty sands, clayey sands, and sandy clays. Sediments are of low density and are saturated at 5 to 10 feet below ground surface. (DWR 2007b).

The lower portion of the Gorman Bypass Channel and the area around the Warne Powerplant consists of undifferentiated sandstones, siltstones, and shales of the Ridge Basin Group (DWR 1974c).

Soils developed on the bedrock units are somewhat excessively drained loams, while soils on the alluvial deposits are a well-drained fine sandy loam. A USDA-NRCS Custom Soil Resource Report of the Peace Valley Pipeline Intake Embankment and Pipeline, Gorman Bypass Channel, and Warne Powerplant areas is presented in Appendix F of this PAD. A map showing the soil series around these areas is shown in Figure 4.3-4.

Peace Valley Pipeline Intake is inspected and reports are generated every 5 years consistent with Part 12D. In 2015, Licensees submitted the FERC Part 12D safety inspection for Peace Valley Pipeline Intake (identified as Quail Dam in the inspection and report). The Safety Review Board found the Peace Valley Pipeline Intake safe for continued operation.

Annually, Licensees perform reviews and updates to the Emergency Action Plan (EAP) for the Peace Valley Pipeline Intake. In addition to the EAP updates, Licensees conduct annual orientations, tabletop exercises, annual drills, and emergency equipment testing for the facility.

4.3.5.2 Faulting and Seismic Considerations

No active faults are known to cross or abut this portion of the Project. This area is in a wedge of crustal rock bound by the San Andreas fault to the north and the San Gabriel fault to the southwest.

4.3.5.3 Erosion and Sedimentation

No erosional or sedimentation issues have been reported with these mostly lined portions of the Project.

4.3.6 Warne Transmission Line

4.3.6.1 Bedrock, Surface Deposits and Soils

The 220 KV Warne Transmission Line that extends northeastward 3 miles from the Warne Powerplant Switchyard to interconnect with the electric grid crosses over the Hungry Valley Formation, a sequence of white conglomeratic sandstone, brown sandstone and interbedded gray and brown sandstone (Foster 2003). The Warne Transmission Line crosses small drainages that contain alluvial sediments of predominantly silty sands, clayey sands, and sandy clays. Soils developed on the bedrock units are somewhat excessively drained loams, while soils on the alluvial deposits are a well-drained fine sandy loam.

4.3.6.2 Faulting and Seismic Considerations

No active faults are known to cross or abut this portion of the Project. This area is in a wedge of crustal rock bound by the San Andreas fault to the north and the San Gabriel fault to the southwest.

4.3.6.3 Erosion and Sedimentation

The steep terrain in which the Warne Transmission Line is located is subject to ongoing erosion, which at times is exacerbated by heavy rains and loss of vegetation due to fire and other natural processes.

4.3.7 Pyramid Dam, Lake and Associated Facilities

4.3.7.1 Bedrock, Surface Deposits and Soils

Pyramid Dam, Lake and associated facilities are underlain by rocks of the Ridge Basin Group. Strata in the vicinity are Pliocene nonmarine sandstones, shales, siltstones, argillites, and conglomerate. Most of the bedded shales and siltstones possess zones of weakness parallel to the bedding. Bedrock exposed in the lake area is generally less dense and more deeply weathered than rock in proximity to the dam. (Barry 2013).

The strata are generally tilted to the northwest at 15 to 45 degrees, with more resistant sandstones, argillite, and conglomerate beds forming the ridges and the less resistant shale and siltstone units forming topographic lows (DWR 2007c). Small tight folds along east-to-southeast-trending axes are locally associated with the San Andreas and San Gabriel faults of the area.

Pyramid Dam is located in a precipitous canyon cut by Piru Creek through the sedimentary rocks of the Ridge Basin Group. The bottom of the canyon downstream of the dam is covered by a thin deposit of alluvium. The slopes adjacent to the dam have thin deposits of slopewash and stream terrace alluvium, except for the left abutment, where there is a thicker, more extensive slopewash-covered terrace.

Bedrock around the dam and the downstream portion of the lake consists of thinly bedded, relatively hard, sparsely jointed, compact, competent argillites with minor interbedded shales and siltstones. The argillite is composed of sand- to silt-sized quartz and feldspar grains in a microcrystalline calcareous matrix. These strata have been subjected to low grade regional metamorphism, potentially due to underlying intrusive activity, and are markedly more competent than the normal Ridge Basin Group rocks elsewhere in the block. (DWR 2014c).

Pyramid Dam was built on an isolated deposit of argillite (Federal Power Commission 1976). This hard argillite unit is unique in the Ridge Basin Group of sedimentary rocks and is found only at the dam site (DWR 2007c). Sedimentary beds in the deposit range from 2 inches to 2 feet thick and are permeable in some locations. Several hard, fine-grained sandstone beds are interbedded with the argillites, mainly under the downstream core of the dam. These sandstone beds daylight into the shell and filter of the dam. Two shale beds, each approximately 50 feet thick, cross beneath the downstream shell and extend across the emergency spillway to the west of the dam. The strata at the dam strike east-west, essentially parallel to the dam axis, and dip upstream (north) at 40 to 45 degrees. (DWR 1971 as referenced in DWR 2014c).

Surficial Quaternary alluvium, landslides, and historic artificial fills overlay the bedrock of the Ridge Basin Group. The Quaternary alluvium consists of unconsolidated gravel and sand with older Quaternary terrace deposits of coarse alluvial fan gravels and sands that unconformably lay on top the bedrock (DWR 1975). Alluvium within the arms of the lake, such as Canada de Los Alamos and West Fork Liebre Gulch, consist almost entirely of silts and sands (Barry 2013). Slopewash in the area of the lake is composed of small argillite fragments in a soil matrix with a thin soil mantle and unconsolidated sand, gravel, and boulders fill stream channels. Where streams and creeks enter Pyramid Lake, deltaic deposits of sand and gravel accumulate. (DWR 1975).

Landslide deposits are highly variable in nature, depending on the source formation, and vary from nearly intact to completely disturbed materials (Foster 2003). In 2013, DWR completed an investigation to define and evaluate areas of potential slope movement associated with Pyramid Lake. The report utilized a compilation of existing landslide mapping reports that cover the area surrounding Pyramid Dam and Lake. DWR concluded that the frequency and size of future landslides could increase with reservoir fluctuation, heavy precipitation, and/or seismic loading. Localized landslide movement of old landslides may be induced by undercutting of dip slopes; however, slope movements of such a magnitude to induce waves capable of overtopping Pyramid Dam are not anticipated. The primary landslide movements around the lake will likely be relatively slow, progressive slumping and sliding on north-facing slopes that are not expected to affect reservoir capacity or Project facilities. (DWR 2013a).

Soils developed on the bedrock units are somewhat excessively drained loams, while soils on the alluvial deposits are a well-drained fine sandy loam. A USDA-NRCS Custom Soil Resource Report of the Pyramid Dam and Lake areas is presented in Appendix F of this PAD. A map showing the soil series around these areas is shown in Figure 4.3-4.

4.3.7.2 Faulting and Seismic Considerations

No active faults are known to cross or abut this portion of the Project. This area is in a wedge of crustal rock bound by the San Andreas fault to the north and the San Gabriel fault to the southwest. The San Andreas fault is approximately 10 miles to the north-northeast, while the San Gabriel fault is approximately 1.5 miles to the southwest.

Pyramid Dam is inspected and reports are generated every 5 years, consistent with Part 12D. In 2015, Licensees submitted the FERC Part 12D safety inspection for Pyramid Dam. The Safety Review Board found the dam safe for continued operation.

Annually, Licensees perform reviews and updates to the EAP for the Pyramid Dam. In addition to the EAP updates, Licensees conduct annual orientations, tabletop exercises, annual drills, and emergency equipment testing for the facility.

4.3.7.3 Erosion and Sedimentation

Erosion

Two dark gray shale beds, each approximately 50 feet thick, were observed during initial construction beneath the downstream shell of Pyramid Dam, extending across the emergency spillway west of the dam. Erosion was observed in the emergency spillway associated with these shale beds and has since been addressed. (DWR 2007c).

In 2008, an erosion repair was performed on the fill slope immediately south of the Vista del Lago (VDL) Visitors Center. This feature was first noted in 2005 and was reportedly the result of run-off of water from the Visitor Center rooftop. (DWR 2011).

Inclinometers were installed in 2005 to assess whether the erosional feature could represent landslide type movement that might have contributed to cracking observed inside the Visitors Center (DWR 2011). After 2 years of monitoring the inclinometers, it was concluded that the erosional feature was a shallow mudflow type of movement and not the result a deep-seated stability problem (Barry 2013).

Licensees are not aware of any continuing problems related to erosion affecting Project roads at or around Pyramid Dam or Pyramid Lake.

Shoreline Erosion

In general, relatively little shoreline erosion, including erosion from lake level fluctuations, wave-induced erosion, and recreational boating has been observed occurring around Pyramid Lake (DWR 2014c). However, DWR has repaired localized erosion-related shoreline damage.

Regionally, the north-northwest regional tilt of the bedrock units and the relatively low strength of shale bedding planes have resulted in numerous bedding plane slips on natural dip slopes in landslide-prone formations (e.g., the Peace Valley Formation). Landslide volumes range from small block glides of several cubic yards to complex landslides of millions of cubic yards. Since the 1950s, all major landslides in the area have involved construction activities along highways. (Barry 2013).

Local movements around the shoreline may be induced by erosional undercutting of dip slopes or highly weathered rock such as found in old landslides. Large, fast slope failures of sufficient magnitude to produce reservoir waves and overtopping of the dam are not anticipated. Instead, relatively slow, progressive slumping and sliding is likely to occur on slopes adjacent to the reservoir. However, because of the potential volume and location of theses slides, they are not expected to significantly affect the storage capacity of the reservoir, or threaten Project facilities. (Barry 2013).

Sedimentation

Where streams and creeks enter Pyramid Lake, deltaic deposits of silt, sand and gravel accumulate. Licensees have implemented sediment removal projects, when necessary, to preserve operations where sediment accumulation has affected Project facilities. There is no available record of sedimentation rates at the lake, with the exception of a 2008 sediment removal project at the Los Angeles County Sheriff boat dock at Emigrant Landing. Licensees have not dredged or otherwise removed sediment from Pyramid Lake, nor are Licensees aware of any continuing problems related to a buildup of sediment in the reservoir.

4.3.8 Angeles Tunnel and Intake

4.3.8.1 Bedrock, Surface Deposits and Soils

The foundation rock for the Angeles Tunnel Intake and the Angeles Tunnel Portal consists of argillite of the Pliocene age portion of the Ridge Basin Group (DWR 1974c). South of the dam and tunnel intake, the Angeles Tunnel enters folded and fractured sandstone with conglomerate, shale, and siltstone interbeds, and continues through this unit for most of its length (Federal Power Commission 1976). The remainder of the tunnel is within Castaic Formation bedrock, which is discussed in Section 4.3.9. These strata have regionally tilted to the northwest.

The alignment and profile of the tunnel were chosen to avoid areas where extensive landslides exist and to provide adequate rock cover. Surficial deposits of alluvial silty to gravelly sands, gravels, slopewash and a thin layer of topsoil are found in canyons overlying the tunnel. (DWR 1974c). Soils developed on the bedrock units are somewhat excessively drained loams, while soils on the alluvial deposits are a well-drained fine sandy loam.

4.3.8.2 Faulting and Seismic Considerations

During construction of the tunnel, no fault traces were reported or mapped crossing its alignment (DWR 1974c). This area is in a wedge of crustal rock bound by the San Andreas fault to the north and the San Gabriel fault to the southwest. Relative to the intake structure and the upstream end of the tunnel, the San Andreas fault is approximately 8 miles to the north-northeast. The San Gabriel fault is roughly parallel with and approximately 2 miles southwest of the Angeles Tunnel.

4.3.8.3 Erosion and Sedimentation

Steep slopes in the Angeles Tunnel area are typical of the Ridge Basin area and can produce slopewash on hillsides or in talus piles at the bottom of the steep slopes (DWR 1974c). Typically, the more resistant sandstone forms vertical cliffs where the less resistant shale beds may be more prone to erosion. The steep terrain is subject to ongoing erosion that is exacerbated by heavy rains and loss of vegetation due to fire and other natural processes.

Licensees are not aware of any continuing problems related to erosion affecting Project roads at or around the Angeles Intake Works or the Angeles Tunnel.

4.3.9 Castaic Penstocks and Powerplant

4.3.9.1 Bedrock, Surface Deposits and Soils

The Castaic Penstock alignment traverses a bedrock sequence containing alternating layers of thinly bedded soft to hard siltstone, sandy siltstone, silty shale, and sandstone of the Castaic Formation. These strata uniformly strike roughly north-south parallel to Castaic Creek and dip gently westward. Weathering in these strata extends deeper in the more permeable sandstone than in the finer grained sediments. The depth to fresh, unfractured bedrock ranges from 19 to 68 feet, but is generally about 35 feet. Alluvial material overlies bedrock and ranges in depth from 0 to 22 feet. (Converse 1967).

Alluvial fan materials were excavated down to competent bedrock of the Castaic Formation during construction of the Castaic Powerplant and Switchyards. The fan material varied from 5 to 20 feet in thickness and consisted of mostly boulders, cobbles, and gravels (DWR 1963). The powerplant now bears on the Castaic Formation and the Switchyard is now underlain by a thick wedge of engineered fill underlain by the Castaic Formation. (Converse 1967).

Soils developed on the bedrock units are somewhat excessively drained loams, while soils on the alluvial deposits are a well-drained fine sandy loam. A USDA-NRCS Custom Soil Resource Report of the Castaic Penstocks and Powerplant areas is presented in Appendix F of this PAD. A map showing the soil series around these areas is shown in Figure 4.3-4.

4.3.9.2 Faulting and Seismic Considerations

During pre-construction investigations it was determined that there are no faults that would affect the alignments of the Castaic Penstocks, Powerplant or Switchyard (Converse 1967). The San Andreas fault is approximately 10 miles to the north-northeast, while the San Gabriel fault is approximately 2 to 3 miles southwest of the Castaic Penstocks and Powerplant.

4.3.9.3 Erosion Potential

Steep slopes in the Castaic Penstocks, Powerplant or Switchyard area are typical of the Ridge Basin area and can produce slopewash on hillsides or in talus piles at the bottom of the steep slopes (DWR 1974c). During pre-construction field investigations, it was determined that there are no landslides that would affect the alignment of the Castaic Penstocks or the Powerplant (Converse 1967).

Licensees are not aware of any continuing problems related to erosion affecting Project roads at or around the Castaic Penstocks or the Castaic Powerplant.

4.3.10 Elderberry Dam and Forebay

4.3.10.1 Bedrock, Surface Deposits and Soils

Elderberry Dam and Forebay are underlain by the Miocene-age, marine Castaic Formation, which in turn overlies the older Cretaceous Period and Paleocene Epoch, marine San Francisquito Formation. These bedrock units consist of siltstone, shaley siltstone, sandy siltstone, and sandstone conglomerate. The bedrock units are uniformly inclined to the west at dips of approximately 10 to 30 degrees, and are locally affected by minor folds, faults and shear zones. (DWR 2005c and Crowell 1982).

The core and abutments of Elderberry Dam are founded on well-bedded, sedimentary bedrock units and the shells are founded on alluvium in the streambed. The right abutment is an area of rugged topography and consisting of layers of resistant sandstone alternating with less resistant shaley siltstone. The bedrock strikes parallel to the stream axis and dips 10 to 25 degrees to the west. The average depth of the sound competent rock ranges between 16 and 41 feet. (DWR 2005c).

Soil, slopewash, creep materials, and talus form apron-like masses that occupy the lower portions of gullies, drainage channels, and the base of bluffs along Castaic Creek. Terrace deposits appear as elongated remnants of older, alluvial fans at various elevations above the creek. Castaic Creek and local tributaries contain relatively shallow accumulations of alluvium. (DWR 2005c).

Soils developed on the bedrock units are somewhat excessively drained loams, while soils on the alluvial deposits are a well-drained fine sandy loam. A USDA-NRCS Custom Soil Resource Report of the Elderberry Dam and Forebay areas is presented in Appendix F of this PAD. A map showing the soil series around these areas is shown in Figure 4.3-4.

4.3.10.2 Faulting and Seismic Considerations

No faults capable of producing earthquakes or displacement that would affect the integrity of Elderberry Dam and Forebay were observed during its initial construction (DWR 2005c). The San Andreas fault is approximately 11 miles to the north-northeast of the dam, while the San Gabriel fault is approximately 3 miles southwest of the dam.

Elderberry Forebay Dam is inspected and reports are generated every 5 years, consistent with Part 12D. In 2015, Licensees submitted the FERC Part 12D safety inspection for Elderberry Forebay Dam. The Safety Review Board found the dam safe for continued operation.

4.3.10.3 Erosion and Sedimentation

Elderberry Forebay receives its predominant inflow from SWP via Pyramid Lake, the Angeles Tunnel and the Castaic Powerplant. Castaic Creek, along with its main tributary Salt Creek, contributes minor inflows that increase during and after storm events, and due to snowmelt. The headwaters of Castaic Creek are located 11 river miles upstream of Elderberry Forebay. Castaic Creek flows along a natural channel until just above Elderberry Forebay, where it enters the Storm Bypass Channel and Check Dams, a series of three small check-dam basins, which drain into Elderberry Forebay, just downstream of the Castaic Powerplant tailrace. The three check-dam basins are designed to intercept sediment carried by creek water before entering Elderberry Forebay to ensure sustained efficiency of the Castaic Powerplant operation.

LADWP holds a CWA Section 404 permit (Permit Number: SPL-2007-01230-VEN) (USACE 2013) and a Lake and Stream Bed Alteration Agreement with CDFW (Agreement Number 1600-2010-0001-R5) to conduct routine and emergency maintenance activities associated with the Castaic Powerplant. This maintenance consists of sediment removal from the three check dam basins and usually occurs every 1 to 2 years, but may occur more often due to storm events. The three basins cover an area of approximately 21 acres. Sediment is moved and stored at a permanent location within the Castaic Powerplant boundary on Licensees-owned land.

In 2011, 7 miles of Castaic Creek, were determined to be a Critical Habitat Designation by the USFWS (74 Federal Register (FR) 52611-52664) after data from annual surveys indicated that a population of the federally endangered arroyo toad increased and were actively breeding in the area. Since the 2011 Critical Habitat designation, LADWP has applied for and been issued by USFWS two emergency permits to perform the maintenance activities at the check dam basins. Avoidance measures for the arroyo toad, as required under a 1997 Biological Opinion for the area (1-8-96-F-55 issued on April 21, 1997), were implemented while emergency repair and maintenance activities were conducted. (USACE 2013). Refer to Section 4.8 for further discussion of the arroyo toad.

Fine-grained portions of the Castaic Formation that underlies areas around Elderberry Forebay are particularly susceptible to landsliding (Foster 2003). Numerous landslides present in the Project area were evaluated during a 1995 study. Due to adverse bedding orientations and dipslope conditions, landslides were found to more commonly occur on eastern slopes than on the western slopes. Landslides on the western slopes are influenced by fractures and saturated slopes, and for the most part occur at oblique angles to the bedding planes. None of the landslides are threatening the integrity of the dam. (DWR 2005c).

Periods of heavy rainfall may trigger new landslides or re-activate old landslides. During a period of heavy rainfall in 1992, a portion of a pre-existing landslide west of the Elderberry Forebay failed. The landslide damaged a short section of roadway used for operations and maintenance purposes but did not enter the forebay. (Gomez, Sullivan, and Findlay 2000 as cited in DWR 2005c).

Significant rainfalls in January and February 2005 caused major landslides around the reservoir. These landslides partially closed access roads from Interstate 5 to the Castaic Powerplant and damaged the access road from the Castaic Powerplant to Elderberry Forebay Dam and spillway, limiting access to that via helicopter. The access roads and spillway have since been restored.

Licensees are not aware of any chronic problems related to erosion affecting Project roads at or around Elderberry Forebay or Elderberry Forebay Dam.

4.3.11 Castaic Transmission Line

4.3.11.1 Bedrock, Surface Deposits and Soils

The 230 kV Castaic Transmission Line that extends southeastward 11.4 miles from the Castaic Powerplant to interconnect with the electric grid overlies the Castaic Formation of shale and interbedded siltstone, sandstone and conglomerate (Foster 2003). This bedrock unit is uniformly inclined to the west at dips of approximately 10 to 30 degrees, and is locally affected by minor folds, faults and shear zones (DWR 2005c). The Castaic Transmission Line crosses small drainages that contain alluvial sediments of predominantly silty sands, clayey sands, and sandy clays. Soils developed on the bedrock units are somewhat excessively drained loams, while soils on the alluvial deposits are a well-drained fine sandy loam.

4.3.11.2 Faulting and Seismic Considerations

No active faults are known to cross or abut this portion of the Project. This area is in a wedge of crustal rock bound by the San Andreas fault to the north and the San Gabriel fault to the southwest. At its nearest point the San Gabriel fault is approximately 1.5 miles to the southwest of the Castaic Transmission Line. The two earthquakes shown in figure 4.3-2 at the southern end of the transmission line are the closest to occur near this portion of the Project, within a mile of its alignment, and occurred in 1965 and 1991. A third earthquake located approximately one mile west of the transmission line along Interstate 5 occurred in 1956. The Licensees found no documentation associating these earthquakes with any known fault(s).

4.3.11.3 Erosion

The steep terrain in which the Castaic Transmission Line is located is subject to ongoing erosion, which at times is exacerbated by heavy rains and loss of vegetation due to fire and other natural processes. Fine-grained portions of the Castaic Formation that underlies the area along the Castaic Transmission Line are particularly susceptible to landsliding. (Foster 2003).

4.3.12 Pyramid Reach

Pyramid reach is not within the Project boundary; however, as discussed below it may be affected by Project operations.

4.3.12.1 Bedrock, Surface Deposits and Soils

At elevation 2,200 feet, the upper end of Pyramid reach is characterized by steep side slopes and canyons with little sedimentation, while downstream the canyons open to wide alluvial reaches above Lake Piru at approximately 1,200 feet. Lake Piru was created by the construction of the Santa Felicia Dam, a non-Project facility. (Sanburg 2005).

The upper reaches of Pyramid reach descend through deeply incised bedrock canyons of Tertiary age non-marine sedimentary bedrock of the Ridge Basin Group. The downstream reach passes through Mesozoic and Precambrian, approximately 540 mya to 4 billion years ago, granitic rock and Tertiary sedimentary rock. Streambed alluvium in this reach is up to 25 feet thick and consists of lenses of sand, gravel, and mixtures of both, with boulders up to 6 feet in diameter. (DWR 2007c).

Soils are variable, depending upon the parent rock of alluvial deposits, ranging from somewhat excessively drained loam and coarse sandy loam to well-drained loam.

4.3.12.2 Faulting and Seismic Considerations

Pyramid reach crosses the San Gabriel fault approximately 3 miles downstream of Pyramid Dam and remains west of the fault thereafter. Inactive faults cross the lower reaches of the creek (as it nears Lake Piru) where bedrock is composed of Tertiary age marine and nonmarine sediments (Sanburg 2005).

4.3.12.3 Erosion Potential and Sedimentation

Pyramid Dam intercepts the sediment load that historically deposited sands and gravels on cobble banks, and formed wide terraces and sandy pool substrates along Pyramid reach. Sediment transport analysis conducted on Pyramid reach showed that upstream reaches are dominated by cobbles and gravel while lower reaches contain a greater proportion of fine sands, along with cobble, gravels, and coarse sands. (DWR 2004 as cited in Sanburg 2005)

The relatively rapid uplifting of the Transverse Ranges by tectonic processes provides a large quantity of erosion-prone material that cannot be totally transported by the existing precipitation regime of the area, resulting in deposited alluvium within canyons forming perched riparian areas that hold run-off from intermittent rainy seasons (Sanburg 2005). As such, pool morphology is a dynamic process. (DWR 2004 as cited in Sanburg 2005).

High flow or flood events can remove Pyramid reach streambed alluvial deposits and degrade pools, but pools are also reestablished elsewhere in a shifting morphological response to stream flow and aggradation. Increased erosion in high flow periods moves sediments and creates sand bars, and the force of flash floods can result in the creation of new stream pools. Monitoring studies conducted in Pyramid reach in 1991 and 1995 (McClelland 1991; Laber 1995 as cited in Sanburg 2005) examined pool morphology changes that can occur over a period of 4 years. These studies found that substrate deposition of sands and fine gravels in pools suitable for sensitive species usually develops in response to low and moderate flow regimes (Sanburg 2005).

4.3.13 Mineral Resources

There are no significant mineral resources mapped within the drainage basins that surround the Project (Figure 4.3-5). One mineral resource occurrence (gold and silver) was mapped in the Upper Piru Creek Drainage Basin east of the Project, approximately 2 miles south of the eastern shore of Quail Lake. No production took place at this site and there has been little activity since the discovery, with the exception of routine claim maintenance.

Four mining prospect locations have been mapped within the drainage basins that surround the Project. The first was mapped northwest of Quail Lake in the hills north of Peace Valley in the Upper Piru Creek Drainage basin and included an underground gold mine. The second was mapped southeast of Quail Lake within the Upper Piru Creek Drainage Basin and included a tin prospect. The third and fourth prospect locations were mapped in the Lower Piru Creek Drainage Basin adjacent to Castaic Creek, just north of the Castaic Powerplant and included gold and silver prospects. These four prospect mining locations went past the occurrence stage and may have included subsequent work including surface trenching, adits, shafts, drill holes, extensive geophysics, geochemistry and/or mapping. One past producer location was mapped in the Upper Castaic Creek Drainage Basin approximately 6 miles upstream of Elderberry Forebay. The primary commodity of this mine was gold recovered from an underground operation (http://mrdata.usgs.gov/). All claims are currently closed.

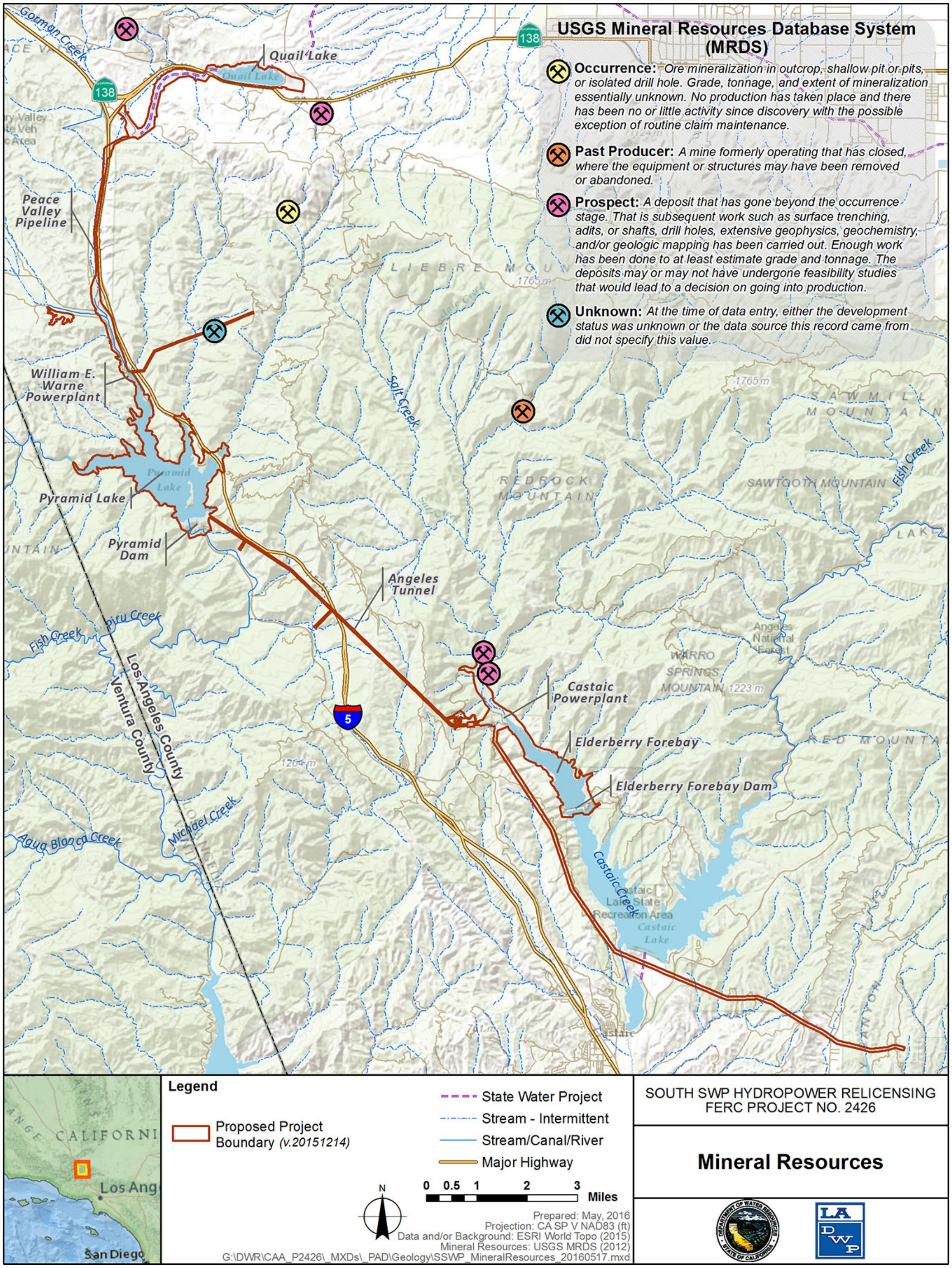


Figure 4.3-5. Mineral Resources in the Project Vicinity

4.4 WATER RESOURCES

This Section provides information regarding existing water resources conditions. Besides this general introductory information, this Section includes seven main sub-sections: Section 4.4.1 describes the Project area gage information; Section 4.4.2 describes the morphometric data for Pyramid Lake and Elderbery Forebay; Section 4.4.3 describes the potentially affected area and project hydrology; Section 4.4.4 describes the potentially affected water rights; Section 4.4.5 describes the designated beneficial uses and water quality standards; Section 4.4.6 describes the existing water quality for Piru Creek and Castaic Creek; and Section 4.4.7 describes the discharges from Warne and Castaic powerplants. Quail Lake is not discussed in this Section because it has no morphometric impact on the local stream flow, as described in Section 3.0.

4.4.1 Project Area Gage Information

Licensees operate and maintain 15 of the 17 gages in the Project area as listed in Table 4.4-1 and shown in Figure 4.4-1. Flow data for these gages is available from two sources as noted in the Table 4.4-1, the USGS National Water Information System (waterdata.usgs.gov) and the California Department of Water Resources California Data Exchange Center (cdec.water.ca.gov). The frequency of data updates is unique to each gage and can change over time as new data is obtained and reviewed. The period of record included in Table 4.4-1 should be used as a general description of the data availability at the time this report was written. These gages are in the Project area; however, they are not part of the Project facilities.

This page left blank intentionally.

Table 4.4-1. Gages in the Project Area

Gage ID	Gage Name	Gage Owner	Data Source	Data Reported (units)	Reported Frequency	Period of Published Record	
						Begin Date	End Date
11109395	CANADA DE LOS ALAMOS AB PYRAMID LK CA	DWR	waterdata.usgs.gov	Discharge (cfs)	Daily	1976-10-1	2015-9-30
11109398	WB CA AQUEDUCT A WILLIAM WARNE PP NR GORMAN CA	DWR	waterdata.usgs.gov	Discharge (cfs)	Daily	1995-101	2015-9-30
11109375	PIRU C BL BUCK C NR PYRAMID LK CA	DWR	waterdata.usgs.gov	Discharge (cfs)	Daily	1976-10-1	2015-9-30
11109520	PYRAMID LK NR GORMAN CA	DWR	waterdata.usgs.gov	Reservoir storage (AF)	Daily	1988-10-1	2015-9-30
11109525	PIRU C BL PYRAMID LK NR GORMAN CA	DWR	waterdata.usgs.gov	Discharge (cfs)	Daily	1988-10-1	2015-9-30
11109550	PIRU C AB FRENCHMANS FLAT CA	USGS	waterdata.usgs.gov	Discharge (cfs)	Daily	1972-3-22	2016-6-13
PYM	PYRAMID	DWR	cdec.water.ca.gov	Reservoir Elevation (feet)	Hourly	2007-10-24	Present
				Reservoir Storage (AF)	Hourly	2007-10-24	Present
				Reservoir Outflow (cfs)	Hourly	2007-10-24	Present
				Reservoir Storage (AF)	Monthly	1974-10-1	Present
11108075	CASTAIC C AB FISH C NR CASTAIC CA	DWR	waterdata.usgs.gov	Discharge (cfs)	Daily	1976-10-1	1993-9-30
11108080	FISH C AB CASTAIC C NR CASTAIC CA	DWR	waterdata.usgs.gov	Discharge (cfs)	Daily	1976-10-1	1993-9-30
11108090	ELDERBERRY CYN C AB CASTAIC C NR CASTAIC CA	DWR	waterdata.usgs.gov	Discharge (cfs)	Daily	1977-10-1	1993-9-30
11108092	ELDERBERRY FOREBAY NR CASTAIC CA	LADWP	waterdata.usgs.gov	Storage (AF)	Hourly	1995-10-1	2015-9-30
11108087	CASTAIC PP NR CASTAIC CA	LADWP	waterdata.usgs.gov	Discharge (cfs)	Daily	2009-10-1	2015-9-30
11108130	ELIZABETH LK CYN C AB CASTAIC LK NR CASTAIC CA	DWR	waterdata.usgs.gov	Discharge (cfs)	Daily	1976-10-1	1993-9-30
ECC	ELIZABETH CANYON CK	DWR	cdec.water.ca.gov	Discharge (cfs)	15 minute	2003-2-3	Present
CAS	CASTAIC	DWR	cdec.water.ca.gov	Reservoir Elevation (feet)	Hourly	2007-10-24	Present
				Reservoir Storage (AF)	Hourly	2007-10-24	Present
				Reservoir Outflow (cfs)	Hourly	2007-10-24	Present
				Reservoir Storage (AF)	Monthly	1974-10-1	Present
11108134	CASTAIC C BLW MWD DIV BLW CASTAIC LK NR CASTAIC	DWR	waterdata.usgs.gov	Discharge (cfs)	Daily	1994-10-1	2015-9-30
11108133	CASTAIC LK NR CASTAIC CA	USGS	waterdata.usgs.gov	Reservoir Storage (AF)	Daily	1988-10-1	2015-9-30

Sources: DWR 2016; USGS 2016
Key:
AF = acre-feet
cfs = cubic feet per second
DWR = California Department of Water Resources
LADWP = Los Angeles Department of Water and Power
USGS = United States Geological Survey

This page left blank intentionally.

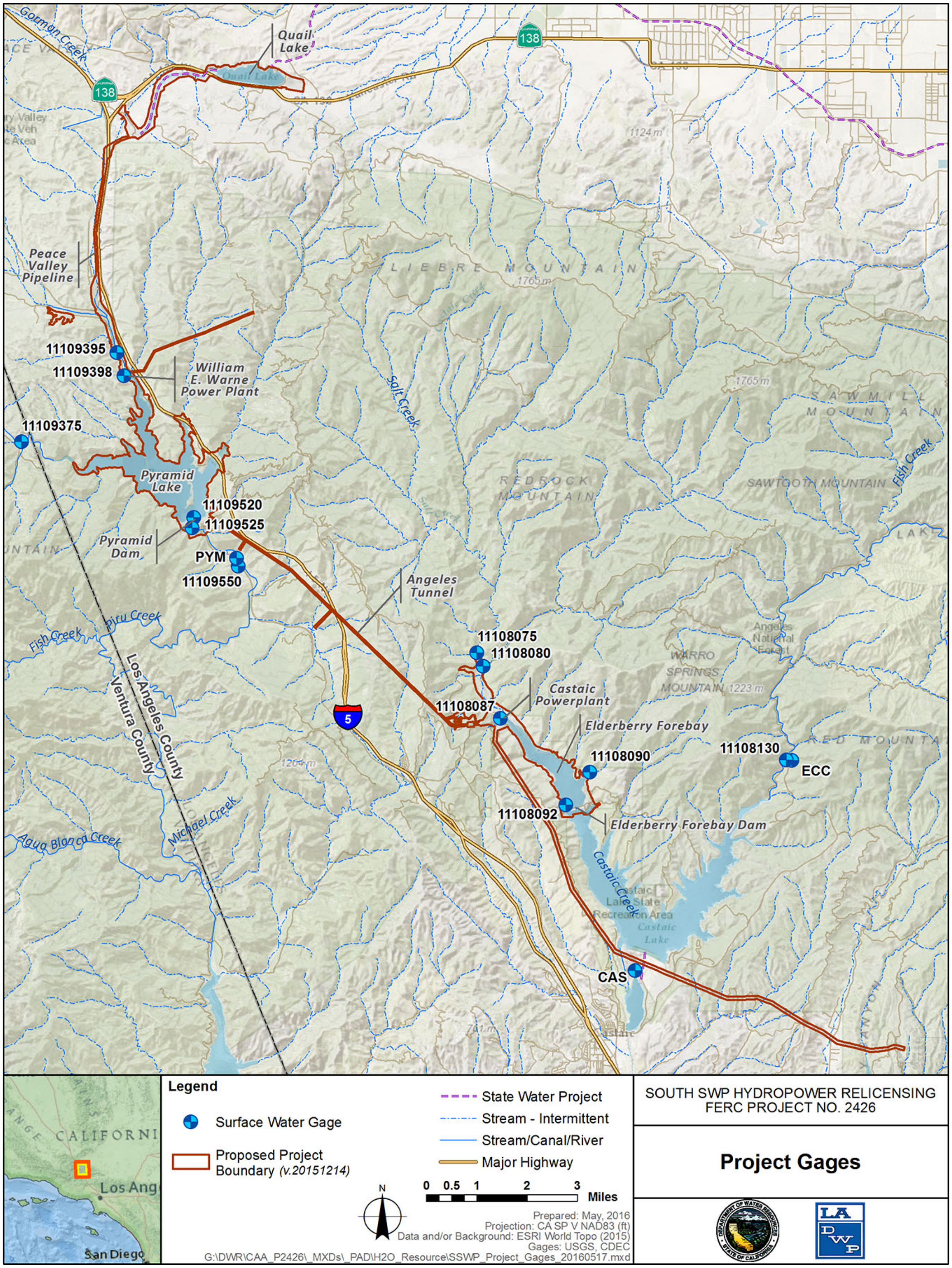


Figure 4.4-1. Gages in the Project Area

4.4.2 Morphometric Data

As described above, this water resources Section focuses on Pyramid Lake and Elderberry Forebay on Piru Creek and Castaic Creek, respectively. Quail Lake, the other Project impoundment, is not discussed in this Section as it has no morphometric impact on the local stream flow.

4.4.2.1 Pyramid Lake

Table 4.4-2 summarizes the available relevant morphometric characteristics of Pyramid Lake, including surface area, volume, maximum depth, mean depth, flushing rate, shoreline length, and substrate composition.

Table 4.4-2. Summary of Morphometric Characteristics of Pyramid Lake

Morphometric Characteristics	Pyramid Lake
NMWSE (feet)	2,578
Surface Area (acres)	1,300 at NMWSE
Volume (acre-feet)	169,902 at NMWSE 22,221 Useable Storage Capacity
Maximum Depth (feet)	280
Mean Depth (feet)	132
Flushing Rate (days)[1]	58.8
Shoreline Length (miles)	21 at NMWSE
Primary Substrate Composition[2]	Alluvial valley soils and stony mountainous soils

DWR *2014a, DWR 2015b*
Notes:
[1]*Average flushing rate, calculated using the average daily storage divided by the average daily outflow. The average monthly flushing rate varies seasonally with average monthly flushing rates of 43.6 days in July and 82.6 days in February.*
[2]*For more information related to the geology and soils in the Project area, see Section 4.3, "Geology and Soils."*
Key:
NMWSE = Normal maximum water surface elevation

4.4.2.2 Elderberry Forebay

Table 4.4-3 summarizes the available relevant morphometric characteristics of Elderberry Forebay, including surface area, volume, maximum depth, mean depth, flushing rate, shoreline length, and substrate composition.

Table 4.4-3. Summary of Morphometric Characteristics of Elderberry Forebay

Morphometric Characteristics	Elderberry Lake
NMWSE (feet)	1,530
Surface Area (acres)	500 at NMWSE
Volume (acre-feet)[1]	28,231 storage capacity at NMWSE
Maximum Depth (feet)[a]	140
Mean Depth (feet)	N/A
Flushing Rate (days)[2, b]	7.6
Shoreline Length (miles)	7 at NMWSE
Primary Substrate Composition[3]	Pale brown loams and silty clay loams

Sources: DWR 2014k, DWR 2014a, DWR 2015b
Notes:
[1]Average flushing rate, calculated using the average daily storage divided by the average daily outflow. The average monthly flushing rate varies seasonally with average monthly flushing rates of 6.2 days in June and 10.2 days in February.
[2]For more information related to the geology and soils in the Project area, see Section 4.3, "Geology and Soils."
Key:
NMWSE = Normal maximum water surface elevation

4.4.3 Potentially Affected Area and Project Hydrology

There are several operational constraints for the Project. First, Article 52 of the license requires Pyramid Lake natural inflows and outflows to be equal to the extent operationally feasible and consistent with safety requirements. Article 52 is discussed in greater detail in Section 3.2.3. Second, the informal agreement between DWR and USFWS, as noted in Section 3.2.3, requires the reschedule of natural releases to protect species. Finally, the Licensees do not have water rights to the natural inflows for Elderberry Forebay. More information on the agreements and operations can be found in Section 3.2.3. Flow exceedance curves for affected stream reaches can be found in Appendix D.

4.4.3.1 Piru Creek

This Section describes the natural stream inflow and outflow for Pyramid Lake. Pyramid Lake receives local inflow, including flows from Piru Creek and Gorman Creek, as measured at Gage 11109375 and Gage 11109395, respectively. Outflows from Pyramid Dam to Pyramid reach are required to match the natural inflow into Pyramid Lake to the extent operationally feasible, modified by the agreement between DWR and USFWS, and consistent with safety requirements (DWR 2007a, 2014a). Figure 3.2-9 shows natural inflow and natural outflow for Pyramid Lake for 2000 through 2014.

4.4.3.2 Castaic Creek

This Section describes the natural stream inflow and outflow for Elderberry Forebay, which receives local inflow from Castaic Creek, as measured at Gage 11108080. As described in Section 3.2.3.7, Licensees do not have water rights to the natural inflows to Elderberry Forebay. The natural inflows to Elderberry Forebay from Castaic Creek, and other local drainages (Figure 3.2-25), and the natural outflows to Castaic Lake (non-Project facility) (Figure 3.2-26) are balanced on a daily basis (DWR 2015b). Figures 3.2-27 and 3.2-28 show the monthly range of natural inflow and natural outflow from Elderberry Forebay.

4.4.4 Potentially Affected Water Rights

4.4.4.1 Local Water Rights

Table 4.4-4 lists the local water rights for Piru Creek and Castaic Creek that could potentially be affected by the Project. This table does not include the water rights required to operate the SWP. More information regarding the water rights and associated operations is available in Section 3.2.3.

4.4.4.2 SWP Water Supply Contracts

As part of the SWP, the Project utilizes water that is conveyed through the West Branch of the SWP to serve various contractors in Southern California who have long-term water supply contracts with DWR. Table 4.4-5 lists the SWP contractors that are served by SWP water conveyed through the Project and their associated maximum contractual annual water delivery amounts.

4.4.5 Designated Beneficial Uses and Water Quality Standards

SWRCB was created by the State Legislature in 1967 with the mission of ensuring the highest reasonable quality for waters of California, while allocating those waters to achieve the optimum balance of beneficial uses. The mission of the nine RWQCBs is to develop and enforce water quality objectives and implementation plans that will best protect the beneficial uses of the State's waters, recognizing local differences in climate, topography, geology, and hydrology. Within the Project area, Quail Lake is located within the Lahontan RWQCB. Pyramid Lake, Piru Creek, and Elderberry Forebay are within the jurisdiction of the Los Angeles RWQCB.

The RWQCBs establish water quality standards for their basins in their respective Water Quality Control Plans, commonly known as the Basin Plans. The Lahontan and Los Angeles Basin Plans: (1) designate beneficial uses for surface and ground waters; (2) set narrative and numerical objectives that must be attained or maintained to protect the designated beneficial uses and conform to the State's antidegradation policy; and (3) describe implementation programs to protect all waters in the region.

Table 4.4-4 Potentially Affected Piru Creek and Castaic Creek Water Rights

Local Water Right Users	Priority (date)	SWRCB Designation (application)	SWRCB Designation (permit)	SWRCB Designation (license)[a]	Source (waterbody)	Amount & Place of Diversion or Storage (amount & place)	Season (period)	Place of Beneficial Use	Purpose
California Department of Water Resources	5/3/1979	25988	18709	-	Piru Creek	55,000 AF/year (maximum diversion 3128 cfs) Storage in Pyramid Lake and Storage and Rediversion Castaic Lake (non-Project facility)	1/1-12/31	Within the Service Area of the State Water Project as shown on Map 1878-3 Revised December 1964, including Ventura County	Irrigation, domestic, municipal, industrial, salinity control, recreation, fish and wildlife enhancement, and incidental power
	1/4/1983	26058	18710	-	Castaic Creek	85,000 AF/ year Storage in Castaic Lake (non-Project facility)	1/1-12/31	Within the Service Area of the State Water Project as shown on Map 1878-3 Revised December 1964, including Ventura County	Irrigation, domestic, municipal, industrial, salinity control, recreation, fish and wildlife enhancement, and incidental power
United Water Conservation District	9/18/1947	12092A	11181	10173	Piru Creek	75,000 AF/year in Lake Piru (non-Project facility)	10/1-6/30	Santa Felicia Reservoir (non-Project facility)	Irrigation, domestic, municipal, industrial, recreational, and salinity control uses
						11,800 AF/year (maximum diversion 80 cfs) collected to Underground Storage via Piru Spreading Ground	1/1-12/31	Piru Spreading Ground	
	3/25/1982	27264	19373	13445		80,361.5 AF/year (maximum diversion 111 cfs) at Santa Felicia Dam (Lake Piru a non-Project facility)	1/1-12/31	San Felicia Dam Powerhouse (non-Project facility)	Power use

Source: State Water Resources Control Board. 2016.
Note:
[a]License information provided, where applicable. If no license information is provided, this indicates that the local water right user has a permit and for that water right, not a license.
Key:
AF= acre-feet
cfs = cubic feet per second

This page left blank intentionally.

Table 4.4-5. SWP Contractors Served by the West Branch of the SWP

SWP Contractor	Annual Maximum SWP Water Delivery Amount (AF)[2,3]
Castaic Lake Water Agency	95,200
Metropolitan Water District of Southern California[1]	1,911,500[1]
Ventura County Watershed Protection District	20,000
Total	**2,254,300**

Source: The State Water Project 2015 Draft Delivery Capability Report, April 2015
Note:
[1]Metropolitan Water District of Southern California is served by both the East and West Branch of the SWP. The value in the table represents the total contract amount for the Metropolitan Water District of Southern California.
[2]As specified in each contractor's long-term water supply contract.
[3]Downstream of Elderberry Forebay Dam
Key:
AF = acre-feet
SWP = State Water Project

4.4.5.1 Beneficial Uses

The Lahontan Basin Plan does not list waterbody-specific Beneficial Uses for Quail Lake, but it does define Beneficial Uses for minor surface waters in the Neenach Hydrologic Area (26.40), which includes Quail Lake (California RWQCB Lahontan Region 1995). Additionally, waters not specifically listed may be designated with the same Beneficial Uses as the streams, lakes, or reservoirs to which they are tributary (the tributary rule). The rest of the water bodies within the existing Project boundary are part of the Santa Clara River Watershed, the largest river system in southern California that remains in a relatively natural state. Table 4.4-6 presents Lahontan Basin Plan (Lahontan Regional Board 1995) and Los Angeles Basin Plan (Los Angeles Regional Board 1994) definitions of Beneficial Uses and summarizes the designated beneficial uses of Quail Lake, Pyramid Lake and Pyramid reach. Beneficial uses designated by the Regional Board are also summarized for Elderberry Forebay –a functioning part of the Castaic Power Plant. Note that beneficial use descriptions are the same in both Basin Plans.

4.4.5.2 Water Quality Objectives

The Los Angeles Basin Plan and the Lahontan Basin Plan present water quality objectives designed to protect established Beneficial Uses. Table G-1 in Appendix G presents narrative and numeric water quality objectives that apply to all surface waters in the areas covered by the Lahontan Basin Plan and the Los Angeles Basin Plan.

4.4.5.3 National Toxics Rule and California Toxics Rule

In addition to State standards in the Basin Plan, federal water quality standards for certain toxic pollutants are contained in the National Toxics Rule (NTR) (40 CFR § 131.36) and the California Toxics Rule (CTR) (40 CFR § 131.37). The EPA adopted the NTR on December 22, 1992, and later amended it on May 4, 1995, and November 9, 1999. About 40 criteria in the NTR are applied in California. This rule promulgates for 14 states, the chemical-specific, numeric criteria for priority toxic pollutants necessary to bring all states into compliance with the requirements of Section 303(c)(2)(B) of the CWA. For a few states, EPA promulgated a limited number of criteria which were previously identified as necessary in disapproval letters to such states, and which the state has failed to address. For other states, federal criteria are necessary for all priority toxic pollutants for which EPA has issued Section 304(a) water quality criteria guidance and that are not the subject of approved state criteria. These standards are the legally enforceable standards in the named states for all purposes and programs under the CWA, including planning, monitoring, National Pollutant Discharge Elimination System (NPDES) permitting, enforcement and compliance.

On March 2, 2000, the SWRCB adopted the Policy for Implementation of Toxics Standards for Inland Surface Waters, Enclosed Bays, and Estuaries of California (State Implementation Policy or SIP). The SIP establishes implementation provisions for priority pollutant criteria and objectives and provisions for chronic toxicity control. On May 18, 2000, the EPA adopted the CTR. The CTR promulgated new toxics criteria for California and incorporated the previously adopted NTR criteria that were applicable in the State. EPA promulgated this rule to protect human health and the environment and to fill a gap in California water quality standards that was created in 1994 when a State court overturned the State's water quality control plans containing water quality criteria for priority toxic pollutants. The rule promulgated (1) ambient aquatic life criteria for 23 priority toxics; (2) ambient human health criteria for 57 priority toxics; and (3) a compliance schedule provision which authorizes the State to issue schedules of compliance for new or revised NPDES permit limits based on the federal criteria. The State must use the criteria together with the State's existing water quality standards when controlling pollution in inland waters and enclosed bays and estuaries. The numeric water quality criteria contained in the final rule are identical to EPA's recommended CWA Section 304(a) criteria for these pollutants published in December 1998 (see 63 FR 68353).

Table 4.4-6. Designated Beneficial Uses of Surface Waters Potentially Affected by the Project

Beneficial Use	Description	Surface Waters			
		Quail Lake[1]	Pyramid Lake	Piru Creek[2]	Elderberry Forebay[3]
Municipal and Domestic Supply	Uses of water for community, military, or individual water supply systems, including but not limited to, drinking water supply.	X	E	P	E
Agricultural Supply	Uses of waters for farming, horticulture, or ranching, including but not limited to, irrigation, stock watering, and support of vegetation for range grazing.	X	E	E	E
Industrial Service Supply	Uses of waters for industrial activities that do not depend primarily on water quality, including but not limited to, mining, cooling water supply, geothermal energy production, hydraulic conveyance, gravel washing, fire protection, and oil well repressurization.		E	E	E
Commercial and Sportfishing	Beneficial uses of waters used for commercial or recreational collection of fish or other organisms, including but not limited to, uses involving organisms intended for human consumption.	X			
Industrial Process Supply	Uses of water for industrial activities that depend primarily on water quality.		E	E	E
Ground Water Recharge	Uses of waters for natural or artificial recharge of groundwater for purposes of future extraction, maintenance of water quality, or halting of saltwater intrusion into freshwater aquifers.	X	E	E	E
Hydropower Generation	Uses of water for hydropower generation.		E		E
Water Contact Recreation	Uses of waters for recreational activities involving body contact with water where ingestion of water is reasonably possible. These uses include, but are not limited to, swimming, wading, waterskiing, skin and scuba diving, surfing, whitewater activities, fishing, or use of natural hot springs.	X	E	E	E[4]
Noncontact Water Recreation	Uses of waters for recreational activities involving proximity to water, but not normally involving body contact with water where ingestion of water is reasonably possible. These uses include, but are not limited to, picnicking, sunbathing, hiking, beachcombing, camping, boating, tidepool and marine life study, hunting, sightseeing, or aesthetic enjoyment in conjunction with the above activities.	X	E	E	E
Warm Freshwater Habitat	Uses of water that support warm water ecosystems, including but not limited to, preservation or enhancement of aquatic habitats, vegetation, fish, or wildlife, including invertebrates.	X	E	E	E
Cold Freshwater Habitat	Uses of water that support cold water ecosystems, including but not limited to, preservation or enhancement of aquatic habitats, vegetation, fish, and wildlife, including invertebrates.	X	E	E	I
Wildlife Habitat	Uses of waters that support terrestrial ecosystems, including but not limited to, preservation and enhancement of terrestrial habitats, vegetation, wildlife (e.g., mammals, birds, reptiles, amphibians, invertebrates), or wildlife water and food sources.	X	E	E	E
Rare, Threatened, or Endangered Species	Uses of water that support habitats necessary, at least in part, for the survival and successful maintenance of plant or animal species established under State or federal law as rare, threatened, or endangered.		E	E[5]	E
Freshwater Replenishment	Uses of waters for natural or artificial maintenance of surface water quantity or quality (e.g., salinity).		P	E	E
Spawning, Reproduction, and/or Early Development	Uses of water that support high-quality aquatic habitats suitable for reproduction and early development of fish.			E	E
Wetland Habitat	Uses of water that support wetland ecosystems, including but not limited to, preservation or enhancement of wetland habitats, vegetation, fish, shellfish, or wildlife, and other unique wetland functions which enhance water quality, such as providing flood and erosion control, stream bank stabilization, and filtration and purification of naturally occurring contaminants.			E[6]	

Sources: California RWQCB Lahontan Region 1995 and California RWQCB Los Angeles Region 1994
Notes:
[1]Quail Lake beneficial uses include beneficial uses for minor surface waters of the Neenach Hydrologic Area. Additional beneficial uses as noted for Pyramid Lake may apply as per the tributary rule.
[2]Piru Creek from Agua Blanca Creek to Pyramid Lake.
[3]Noted beneficial uses are RWQCB designations only. LADWP considers Elderberry Forebay a functioning part of the Castaic Power Plant. The waterbody is not used for recreation, agricultural supply, municipal and domestic supply, groundwater recharge, or industrial service or process supply.
[4]Public access to reservoir and its surrounding watershed is prohibited by the Los Angeles County Department of Public Works.
[5]Condor refuge
[6]Waterbodies designated as WET may have wetlands habitat associated with only a portion of the waterbody. Any regulatory action would require a detailed analysis of the area.
Key:
E = Existing Beneficial Use
I = Intermittent Beneficial Use
P = Potential Beneficial Use
X = Designated Beneficial Use

This page intentionally left blank.

4.4.5.4 Waterbody-Specific Objectives

In addition to the general objectives, the Basin Plans establish waterbody-specific objectives for certain areas. Piru Creek, above the gaging station that is below Santa Felicia Dam, has specific water quality objectives (Table 4.4-7).

Table 4.4-7. Numerical Water Quality Objectives for Piru Creek

Waterbody	Water Quality Objectives (mg/L)					
	TDS	Sulfate	Chloride	Boron[1]	Nitrogen[2]	SAR[3]
Piru Creek above gaging station below Santa Felicia Dam	800	400	60	1.0	5	5

Sources: California RWQCB Los Angeles Region 1994 and Metropolitan Water District of Southern California 2015
Notes:
[1]Where naturally occurring boron results in concentrations higher than the stated objective, a site-specific objective may be determined on a case-by-case basis.
[2]Nitrate-nitrogen plus nitrite-nitrogen (NO3-N + NO2-N).
[3]Sodium adsorption ratio (SAR) predicts the degree to which irrigation water tends to enter into cation-exchange reactions in soil. SAR = Na+/((Ca++ + Mg++)/2)1/2
Key:
mg/L = milligrams per liter
TDS = Total dissolved solid

4.4.5.5 Total Maximum Daily Loads

The RWQCBs are responsible for implementing provisions and pollution-control requirements that the federal CWA specifies for surface waters of the United States within each region. CWA Section 303(d) requires the State to identify “impaired” waterbodies (surface waterbodies that do not fully achieve their designated beneficial uses and/or are in noncompliance with water quality objectives). Following the identification of impaired waterbodies, the State establishes a priority list that identifies the pollutants that cause the impairments and then develops pollutant-loading limits called Total Maximum Daily Loads (TMDL) for each pollutant. The TMDL analysis seeks to establish quantifiable and measurable numeric targets. These targets must ensure compliance with water quality standards (designated Beneficial Uses and Water Quality Objectives).

The 2012 Section 303(d) list does not classify Elderberry Forebay as impaired, but it includes Pyramid Lake for mercury in fish tissue. In Pyramid Lake, a total of 24 composite samples were collected from largemouth bass (*Micropterus salmoides*) and brown bullhead (*Ameiurus nebulosus)*; 14 of the 24 samples exceeded the Office of Environmental Health Hazard Assessment (OHHEA) fish tissue screening value for human health (SWRCB 2012). The expected TMDL completion date is 2021.

Piru Creek, from the gaging station below Santa Felicia Dam to its headwaters, is listed as impaired for pH and chloride. A total of 8 samples out of 12 taken from below Santa Felicia Dam from July 2001 to April 2004 exceeded the site-specific water quality objective for chloride for Piru Creek tributary to Santa Clara River, Reach 4 (60 milligrams per liter [mg/L] for the protection of Agricultural Supply beneficial uses). A total of 4 out of 24 samples exceeded the high end of the Basin Plan standard of 8.5 pH units. The expected TMDL completion date for Piru Creek is 2019.

4.4.6 Existing Water Quality

Project water quality monitoring has been conducted by Licensees since 1968. The water quality program monitors eutrophication, salinity and other parameters of concern for drinking water, recreation, and fish and wildlife purposes. Additional data are collected by the Metropolitan Water District of Southern California (MWD). Extensive water quality sampling and analysis is ongoing by both DWR and MWD; the frequency of monitoring by parameter is summarized in Tables 4.4-8 and 4.4-9. Additionally, the USGS studies surface-water quality in cooperation with local and state governments and with other federal agencies. The monitoring program consists of collection, analysis, data archiving, and dissemination of data and information describing the quality of surface water resources. Water quality stations are located in Figure 4.4-2. Results of water quality analyses are summarized below.

Table 4.4-8. Frequency of DWR Water Quality Monitoring in Pyramid Lake

Parameter	Monitoring Frequency Pyramid Lake
Project Standard Parameters (Alkalinity, Aluminum, Antimony, Arsenic, Barium, Beryllium, Boron, Cadmium, Calcium, Chloride, Chromium, Copper, Fluoride, Iron, Lead, Magnesium, Manganese, Mercury, Nitrate, Selenium, Silver, Sodium, Dissolved Solids, Specific Conductance, Sulfate, Turbidity, and Zinc)	Quarterly
Nutrients	Monthly
Total Organic Carbon	--
Turbidity	Quarterly
Bromide	Monthly
Reservoir Profile (pH, Dissolved Oxygen, Depth, Temperature, EC)	Weekly (Bi-monthly in winter)

Source: DWR 2015b

Table 4.4-9. Frequency of MWD Water Quality Monitoring - Castaic Lake (non-Project facility) at the Jensen Influent

Parameter	Monitoring Frequency
Aluminum, Copper	Monthly
Ammonia, Total + Nitrite	Monthly
Arsenic	Weekly
Bacteriological	Monthly
Bromide	Weekly
Chrome 6	Quarterly
Color	Quarterly
Cyanide, Total	Annually
Dissolved Organic Carbon	Weekly
Gamma Isotopics	Quarterly
General Minerals	Monthly
Gross Alpha & Beta	Quarterly
Methylene Blue Active Substances	Annually
Mercury	Bi-Annually
Nitrate/Sulfate	Monthly
Nitrite	Annually
Perchlorate	Quarterly
Phosphorus, Soluble Reactive	Monthly
Phosphorus, Total	Monthly
Taste and Odor	Bi-Weekly
Total Kjeldahl Nitrogen	Monthly
Total Organic Carbon	Weekly
Total Organic Nitrogen	Annually
Trace Metals	Bi-Annually
Tritium	Quarterly
Ultraviolet	Weekly
Volatile Organic Compounds	Quarterly

Source: DWR 2015b

Figure 4.4-2. Water Quality Monitoring Stations near the Project

4.4.6.1 General Parameters and Nutrients

Licensees collected surface water samples from the Quail Lake outlet (Station QU002000, see Figure 4.4-2) on February 10, 1999. Results are summarized in Tables 4.4-10 through 4.4-11. While the Lahontan Basin Plan does not have site-specific water quality objectives for Quail Lake, observed water quality in 1999 did not exceed narrative water quality objectives for surface waters in the Lahontan Region.

Table 4.4-10. Summary of DWR Water Quality Data for Quail Lake – General Parameters and Nutrients, February 1999

Parameter	Units	Reporting Limit	Result
Dissolved Boron	mg/L	0.1	0.2
Dissolved Chloride	mg/L	1	31
Dissolved Nitrate + Nitrite	mg/L as N	0.01	3.9
Total Dissolved Solids	mg/L	1	466
Dissolved Sulfate	mg/L	5	95
pH, sample 1	Std. units	0.1	7.8
pH, sample 2	Std. units	0.1	7.8
Settleable Solids	mg/L	0.1	< R.L.
Total Suspended Solids, sample 1	mg/L	1	23
Total Suspended Solids, sample 2	mg/L	1	22
Turbidity, sample 1	NTU	1	32
Turbidity, sample 2	NTU	1	33

Source: DWR 1973 through 2015. Water Data Library 1999, Station QU002000
Key:
< = less than
mg/L = milligrams per liter
N = Nitrogen
NTU = Nephelometric Turbidity Unit
R.L. = reporting limit

Table 4.4-11. Summary of DWR Water Quality Data for Quail Lake – Trace Elements, February 1999

Parameter	Units	Reporting Limit	Results
Total Aluminum	mg/L	0.01	< R.L.
Total Arsenic	mg/L	0.001	< R.L.
Dissolved Arsenic	mg/L	0.001	0.002
Total Barium	mg/L	0.05	< R.L.
Total Cadmium	mg/L	0.001	< R.L.
Dissolved Cadmium	mg/L	0.001	< R.L.
Total Chromium	mg/L	0.005	< R.L.
Dissolved Chromium	mg/L	0.005	< R.L.
Total Copper	mg/L	0.001	< R.L.
Dissolved Copper	mg/L	0.001	0.002
Total Iron	mg/L	0.005	< R.L.
Total Lead	mg/L	0.001	< R.L.
Dissolved Lead	mg/L	0.001	< R.L.
Total Manganese	mg/L	0.005	< R.L.
Total Mercury	mg/L	0.0002	< R.L.
Dissolved Mercury	mg/L	0.0002	< R.L.
Total Selenium	mg/L	0.001	< R.L.
Dissolved Selenium	mg/L	0.001	0.001
Total Silver	mg/L	0.001	< R.L.
Dissolved Silver	mg/L	0.001	< R.L.
Total Zinc	mg/L	0.005	< R.L.
Dissolved Zinc	mg/L	0.005	0.011

Source: DWR 1973 through 2015. Water Data Library 1999, Station QU002000
Key:
< = less than
mg/L = milligrams per liter
R.L. = reporting limit

4.4.6.2 Trace Elements

Results of analyses for trace elements in Quail Lake water are presented in Table 4.4-12. Arsenic, copper, selenium, and zinc were observed above the laboratory reporting limit. Of the inorganic chemicals for which maximum contaminant levels (MCL) exist, none of the observed concentrations exceed the MCLs or the Public Health Goals (PHG), with the exception of arsenic. MCLs are the maximum permissible level of a contaminant in water which is delivered to any user of a public water system. Primary MCLs are drinking water standards to address health concerns; secondary MCLs address compounds that affect the taste and odor of drinking water. The Calderon-Sher Safe Drinking Water Act requires OEHHA to develop a PHG for each drinking water contaminant that is regulated with an MCL. Drinking water that complies with all MCLs is considered safe to drink, even if some contaminants exceed PHG levels. A PHG represents a health-protective level for a contaminant that SWRCB and California public water systems should strive to achieve if it is feasible to do so.

The observed dissolved arsenic value of 0.002 mg/L is below the MCL of 0.01 mg/L, but above the PHG of 0.000004 mg/L. Dissolved zinc does not have an MCL or PHG; however, the observed concentration was below the EPA freshwater aquatic life criteria maximum concentration and criterion continuous concentration of 0.12 mg/L (corresponding to a total hardness of 100 mg/L) (EPA 2000).

4.4.6.3 Pesticides

Results of analyses for organic compounds in Quail Lake water are presented in Table 4.4-13. Of the 60 organic compounds tested by Licensees at Quail Lake in 1999, none of the compounds were observed above the laboratory reporting limit.

Table 4.4-12. Summary of DWR Water Quality Data for Quail Lake – Organic Chemicals, February 1999

Parameter	Units	Reporting Limit	Results
1,1,2-Tetrachloroethane	µg/L	0.5	< R.L.
1,1,1-Trichloroethane	µg/L	0.5	< R.L.
1,1,2,2-Tetrachloroethane	µg/L	0.5	< R.L.
1,1,2-Trichloroethane	µg/L	0.5	< R.L.
1,1-Dichloroethane	µg/L	0.5	< R.L.
1,1-Dichloroethene	µg/L	0.5	< R.L.
1,1-Dichloropropene	µg/L	0.5	< R.L.
1,2,3-Trichlorobenzene	µg/L	0.5	< R.L.
1,2,3-Trichloropropane	µg/L	0.5	< R.L.
1,2,4-Trichlorobenzene	µg/L	0.5	< R.L.
1,2,4-Trimethylbenzene	µg/L	0.5	< R.L.
1,2-Dibromo-3-chloropropane	µg/L	0.5	< R.L.
1,2-Dibromoethane	µg/L	0.5	< R.L.
1,2-Dichlorobenzene	µg/L	0.5	< R.L.
1,2-Dichloroethane	µg/L	0.5	< R.L.
1,2-Dichloropropane	µg/L	0.5	< R.L.
1,3,5-Trimethylbenzene	µg/L	0.5	< R.L.
1,3-Dichlorobenzene	µg/L	0.5	< R.L.
1,3-Dichloropropane	µg/L	0.5	< R.L.
1,4-Dichlorobenzene	µg/L	0.5	< R.L.
2,2-Dichloropropane	µg/L	0.5	< R.L.
2-Chlorotoluene	µg/L	0.5	< R.L.
4-Chlorotoluene	µg/L	0.5	< R.L.
4-Isopropyltoluene	µg/L	0.5	< R.L.
Benzene	µg/L	0.5	< R.L.
Bromobenzene	µg/L	0.5	< R.L.
Bromochloromethane	µg/L	0.5	< R.L.
Bromodichloromethane	µg/L	0.5	< R.L.
Bromoform	µg/L	0.5	< R.L.
Bromomethane	µg/L	0.5	< R.L.
Carbon tetrachloride	µg/L	0.5	< R.L.
Chlorobenzene	µg/L	0.5	< R.L.
Chloroethane	µg/L	0.5	< R.L.

Table 4.4-12. Summary of DWR Water Quality Data for Quail Lake – Organic Chemicals, February 1999 (continued)

Parameter	Units	Reporting Limit	Results
Chloroform	µg/L	0.5	< R.L.
Chloromethane	µg/L	0.5	< R.L.
Dibromochloromethane	µg/L	0.5	< R.L.
Dibromomethane	µg/L	0.5	< R.L.
Dichlorodifluoromethane	µg/L	0.5	< R.L.
Ethyl benzene	µg/L	0.5	< R.L.
Hexachlorobutadiene	µg/L	0.5	< R.L.
Isopropylbenzene	µg/L	0.5	< R.L.
Methyl tert-butyl ether	µg/L	1	< R.L.
Methylene chloride	µg/L	0.5	< R.L.
Naphthalene	µg/L	0.5	< R.L.
Styrene	µg/L	0.5	< R.L.
Tetrachloroethene	µg/L	0.5	< R.L.
Toluene	µg/L	0.5	< R.L.
Trichloroethene	µg/L	0.5	< R.L.
Trichlorofluoromethane	µg/L	0.5	< R.L.
Vinyl chloride	µg/L	0.5	< R.L.
cis-1,2-Dichloroethene	µg/L	0.5	< R.L.
cis-1,3-Dichloropropene	µg/L	0.5	< R.L.
m + p Xylene	µg/L	0.5	< R.L.
n-Butylbenzene	µg/L	0.5	< R.L.
n-Propylbenzene	µg/L	0.5	< R.L.
o-Xylene	µg/L	0.5	< R.L.
sec-Butylbenzene	µg/L	0.5	< R.L.
tert-Butylbenzene	µg/L	0.5	< R.L.
trans-1,2-Dichloroethene	µg/L	0.5	< R.L.
trans-1,3-Dichloropropene	µg/L	0.5	< R.L.

Source: DWR 1973 through 2015. Water Data Library 1999, Station QU002000
Key:
< = less than
µg/L = micrograms per liter
R.L. = reporting limit

Table 4.4-13. Summary of DWR Water Quality Data for Pyramid Lake – General Parameters, January 2010 through May 2015

Parameter	Units	Reporting Limit	2010 through 2015 Minimum	2010 through 2015 Maximum	2010 through 2015 Average[1]	Number of Samples
Total Alkalinity	mg/L as CaCO3	1	52	90	76	23
Dissolved Bromide	mg/L as CaCO3	0.01	0.07	.032	0.21	66
Dissolved Calcium	mg/L	1	13	33	23	22
Dissolved Chloride	mg/L	0.1	26	89	64	23
Dissolved Fluoride[2]	mg/L	0.1	<R.L.	0.2	<R.L.	14
Dissolved Hardness	mg/L as CaCO3	1	76	123	103	21
Dissolved Magnesium	mg/L	1	6	13	11	22
Dissolved Sodium	mg/L	1	25	78	53	22
Total Dissolved Solids	mg/L	1	148	346	259	27
Suspended Solids[3]	mg/L	0.1	1.1	3.5	2.3	7
Turbidity	NTU	1	<R.L.	6	1.6	25
Dissolved Sulfate	mg/L	1	23	77	46	23

Source: DWR 2010 through 2015, Station PY001000
Notes:
Data from surface samples, 1 meter depth
[1]Half of R.L. used for averaging where applicable
[2]Data from 2004 through 2007
[3]Data from 1990 through 1997
Key:
< = less than
CaCO3 = calcium carbonate
mg/L = milligrams per liter
NTU = Nephelometric Turbidity Unit
R.L. = reporting limit

DWR currently samples for carbamate pesticides, chlorinated organic pesticides, chlorinated phenoxy acid herbicides, sulfur pesticides, glyphosate, phosphorus/nitrogen pesticides, and volatile (purgeable) organics two to three times per year at several stations. Based on sampling from the SWP upstream of Quail Lake at the Tehachapi Afterbay, from March 2010 through June 2015, pesticides, herbicides, and volatile organics have not been detected with the following exceptions:

- 3/17/10 Diuron 1.5 micrograms per liter (µg/L) and Simazine 0.03 µg/L
- 6/16/10 Metolachlor 0.1 µg/L and Simazine 0.02 µg/L
- 3/16/11 Simazine 0.03 µg/L and Diuron 0.32 µg/L
- 6/14/11 Metolachlor 0.1 µg/L
- 3/21/12 Diuron 1.2 µg/L
- 6/20/12 Simazine 0.02 µg/L
- 3/20/13 Dacthal 0.02 µg/L and Simazine 0.06 µg/L
- 6/19/13 Simazine 0.03 µg/L

Diuron is a pre- and post-emergent herbicide treatment of both crop and non-crop areas; a mildewcide and preservative in paints and stains; and an algaecide in commercial fish production, residential ponds, and aquariums. The drinking water level of comparison (DWLOC) is 28 µg/L; neither MCLs nor drinking water health advisories have been established by the EPA Office of Water (EPA 2003).

Metolachor is a herbicide used for grass and broadleaf weed control. The federal drinking water health advisory for metolachor is 525 µg/L (Rivard 2003).

Simazine is a pre-emergence herbicide used for control of broad-leaved and grassy weeds on a variety of deep-rooted crops. The federal MCL and PHG are 4 µg/L (EPA 2014). This value was not exceeded in samples from the Tehachapi Afterbay upstream of Quail Lake from 2010 through June 2015. Dacthal is a pre-emergent herbicide used to control annual grasses and broadleaf weeds on ornamental turf and plants, strawberries, seeded and transplanted vegetables, cotton, and field beans. The EPA has concluded that Dacthal and its metabolites do not currently pose a significant cancer or chronic non-cancer risk from non-turf uses to the overall United States population from exposure through contaminated drinking water (EPA 1998). No federal MCL has been established.

4.4.6.4 Pyramid Lake

The large size of Pyramid Lake greatly reduces fluctuations in water quality, although substantial storm events and inflow from the watershed can affect water quality (SWP Contractors Authority and DWR 2012).

General Parameters

The Los Angeles Basin Plan does not establish site-specific water quality objectives for Pyramid Lake, but does set objectives for Piru Creek downstream of the reservoir. Based on data collected from January 2010 through May 2015, average total dissolved solids (TDS) (259 mg/L) is below the objective of 800 mg/L for Piru Creek above the gaging station below Santa Felicia Dam (Table 4.4-13). Similarly, average dissolved sulfate of 45 mg/L in Pyramid Lake is lower than the Piru Creek objective of 400 mg/L. Average dissolved chloride concentrations of 64 mg/L slightly exceed the Piru Creek objective of 60 mg/L.

Field Measurements

Field meters are used to collect monthly data for conductivity dissolved oxygen, temperature, pH, and turbidity at the surface (1 meter depth) of Pyramid Lake at station PY001000 (Table 4.4-14, Figure 4.4-2). Secchi depth is measured with a Secchi disc. Average dissolved oxygen in surface samples for the period of January 2010 through May 2015 exceeded the minimum Basin Plan objective of 6.0 mg/L for water bodies designated with a Cold Freshwater Habitat Beneficial Use. Peak dissolved oxygen levels in surface waters are observed in February; lowest levels are observed in August. The average pH of 8.5 is at the high end of the Basin Plan recommended pH range for all waters (6.5 to 8.5). Concentrations of alkaline compounds, such as bicarbonates, carbonates, and hydroxides influence the acidity and, therefore, the pH of surface waters. Geology and soils, plant activity, and wastewater discharges can influence alkalinity.

Table 4.4-14. Summary of DWR Water Quality Data for Pyramid Lake – Field Parameters, January 2010 through May 2015

Parameter	Units	Reporting Limit	2010 through 2015 Minimum	2010 through 2015 Maximum	2010 through 2015 Average	Number of Samples
Field Specific Conductance (EC)	µS/cm	1	244	581	439	21
Field Dissolved Oxygen	mg/L	0.1	6.0	11.7	8.8	49
Water Temperature	°C	0.1	10.2	28.8	18.1	50
Field pH	pH units	0.1	7.8	9.8	8.5	59
Field Secchi Depth	m	0.1	0.8	7.4	4.2	39
Turbidity	NTU	1	<R.L.	6.0	1.6	22

Source: DWR 2010 through 2015, Station PY001000
Note:
Data from surface samples
Key:
< = less than
ºC = Degrees Celsius
µS/cm = microsiemens per centimeter
m = meters
mg/L = milligrams per liter
NTU = Nephelometric Turbidity Unit
R.L. = reporting limit

In addition to surface samples, field parameters (temperature, conductivity, dissolved oxygen, and pH) are also measured by Licensees throughout the water column one to four times per month at three Pyramid Lake stations. Based on the most recent full year of data from these depth profiles (2014), monthly dissolved oxygen is depicted in Figure 4.4-3. In February, dissolved oxygen varied by less than 1 mg/L from the top to the bottom of the water column, and the lake was mixed and well oxygenated throughout. The minimum water temperature in February was 11.2 degrees Celsius (°C). In August, levels of dissolved oxygen at Station 1 varied by more than 7 mg/L. The lake was stratified with a thermocline at approximately 20 meters. In August, average dissolved oxygen above the thermocline (0 to 20 meters) at the deepest station (Station 1) was 8.8 mg/L; average dissolved oxygen below the thermocline (22 m to bottom) was 5.0 mg/L. The maximum water temperature in August was 25.7°C. The stratification observed is typical of a warm monomictic lake with one mixing in the winter; the lake does not freeze. The clinograde oxygen profiles in warmer weather reflect an excess of oxygen consumption in the hypolimnion. Based on these data, a thermocline developed in the lake in April and the lake was mixed again by November.

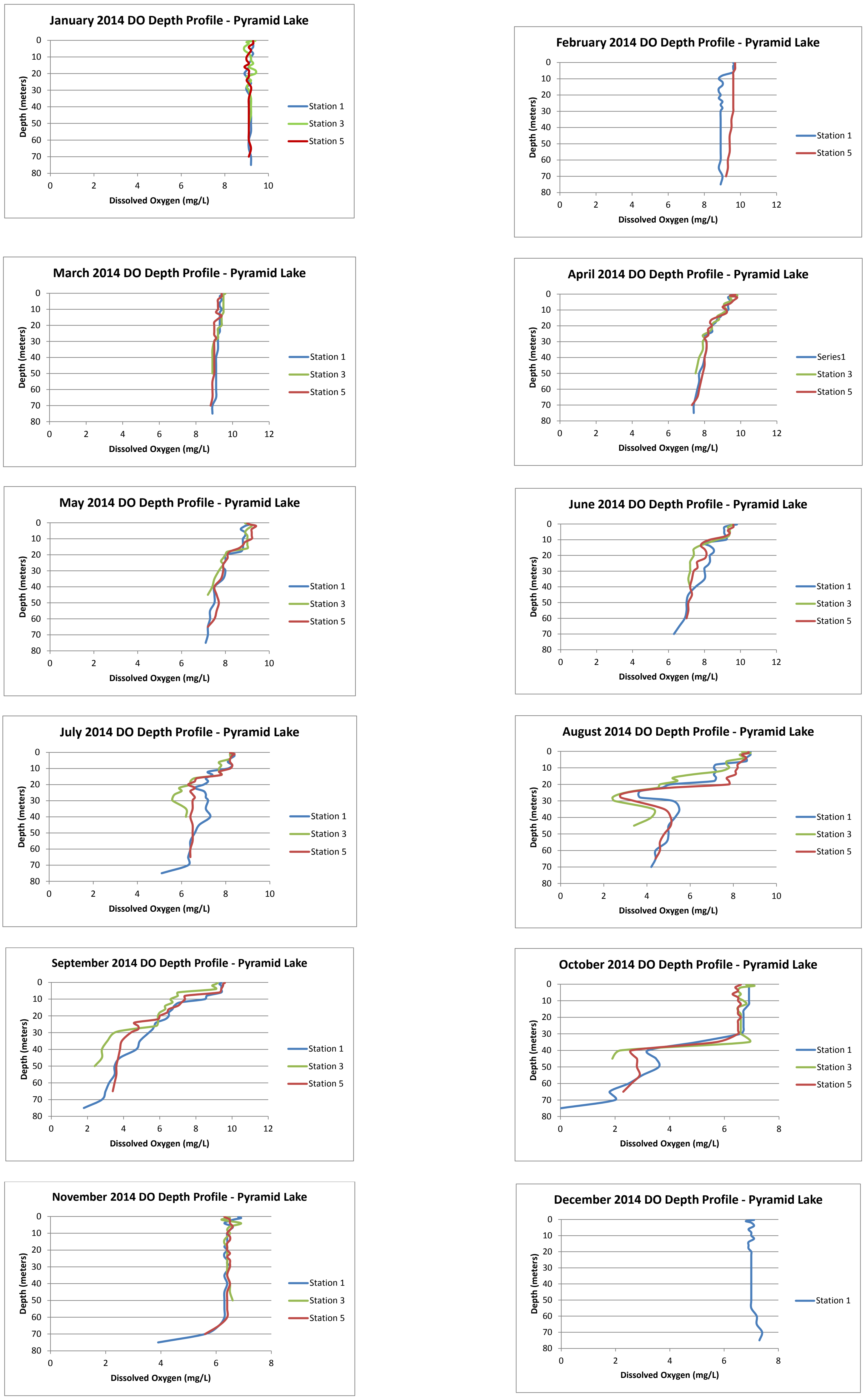
The Basin Plan objective for dissolved oxygen is a mean annual concentration greater than 7 mg/L, with no single determination less than 5.0 mg/L, except when natural conditions cause lesser concentrations. At all three stations (1, 3, and 5) the mean annual concentration for 2014 was 7.3 mg/L dissolved oxygen – just above the 7 mg/L standard. Individual dissolved oxygen concentrations below 5.0 were observed in 2014 due to natural lake stratification.

Nutrients

Nutrients in surface waters are required for the aquatic ecosystem to function properly. However, readily available nutrients, along with other favorable environmental conditions, can result in algal growth at levels that cause taste and odor in drinking water, produce algal toxins, add organic carbon. Anaerobic conditions from excess algal growth can also lead to high ammonia levels (SWP Contractors Authority 2012). Table 4.4.15 summarizes Pyramid Lake nutrient data from January 2010 through May 2015.

To prevent the development of biological nuisances, and to control accelerated or cultural eutrophication, the EPA recommendation is a maximum of 25 µg/L total phosphates as phosphorus (P) within lakes and reservoirs (EPA 1986). Average total phosphorus concentrations in Pyramid Lake are higher than this recommendation (50 µg/L as P); however, no specific phosphorus limitations are noted in the Los Angeles Basin Plan for Pyramid Lake (California RWQCB Los Angeles Region 1994). The Los Angeles Basin Plan objective states, "waters shall not contain biostimulatory substances in concentrations that promote aquatic growths to the extent that such growths cause nuisance or adversely affect the water for beneficial uses."

Observed maximum and average nitrogen levels are below the primary drinking water standards of 1 mg/L nitrite-nitrogen and 10 mg/L nitrate-nitrogen, and below the 5 mg/L nitrate-nitrogen plus nitrite-nitrogen objective for Piru Creek downstream of the reservoir. Over the five-year data period (January 2010 through May 2015), the highest observed dissolved ammonia nitrogen value of 0.04 mg/L would not exceed ammonia toxicity standards established by the Basin Plan



(Source: DWR 2010 through 2015)

Figure 4.4-3. Dissolved Oxygen Monthly Depth Profile Pyramid Lake, 2014

This page left blank intentionally.

Table 4.4-15. Summary of DWR Water Quality Data for Pyramid Lake – Nutrients, January 2010 through May 2015

Parameter	Units	Reporting Limit	2010 through 2015 Minimum	2010 through 2015 Maximum	2010 through 2015 Average[1]	Number of Samples
Dissolved Ammonia	mg/L as N	0.01	<R.L.	0.04	0.01	70
Dissolved Nitrate	mg/L	0.1	<R.L.	4.9	2.3	23
Dissolved Nitrate + Nitrite	mg/L as N	0.01	0.01	1.08	0.46	69
Total Kjeldahl Nitrogen	mg/L as N	0.1	<R.L.	1.20	0.32	67
Dissolved Ortho-phosphate	mg/L as P	0.01	<R.L.	0.08	0.03	68
Total Phosphorus	mg/L as P	0.01	<R.L.	0.08	0.05	66

Source: DWR 2010 through 2015, Station PY001000
Notes:
Data from surface samples
[1]Half the reporting limit value used for averaging where applicable
Key =
< = less than
mg/L = milligrams per liter
N = Nitrogen
P = Phosphorus
R.L. = reporting limit

Trace Elements

Results of analyses for trace elements in Pyramid Lake water are presented in Table 4.4-16. Eight parameters (arsenic, barium, boron, chromium, copper, iron, nickel, and selenium) were observed at or above the laboratory reporting limit in the dissolved phase. Of the inorganic chemicals for which MCLs exist, none of the observed concentrations exceed the MCLs or the PHGs, with the exception of arsenic. The maximum dissolved arsenic value of 0.007 mg/L is below the MCL of 0.01 mg/L but above PHG of 0.000004 mg/L. Boron does not have an MCL or PHG, and the observed maximum concentration is below the water quality objective of 1.0 mg/L for downstream waters (Piru Creek); 1.0 mg/L is also the California Department of Public Health (CDPH) State Notification Level (NL) for boron. Dissolved iron does not have a primary MCL, but the observed maximum is below the secondary MCL (consumer acceptance contaminant level) of 0.3 mg/L (CCR 2006).

Table 4.4-16. Summary of DWR Water Quality Data for Pyramid Lake – Trace Elements, January 2010 through May 2015

Parameter	Units	Reporting Limit	2010 through 2015 Minimum	2010 through 2015 Maximum	2010 through 2015 Average[1]	Number of Samples
Dissolved Aluminum	mg/L	0.01	<R.L.	<R.L.	<R.L.	23
Dissolved Antimony[2]	mg/L	0.005	<R.L.	<R.L.	<R.L.	4
Dissolved Arsenic	mg/L	0.001	0.001	0.007	0.0032	23
Dissolved Barium[3]	mg/L	0.005	0.024	0.043	0.033	14
Dissolved Beryllium	mg/L	0.001	<R.L.	<R.L.	<R.L.	23
Dissolved Boron	mg/L	0.1	0.1	0.3	0.20	22
Dissolved Cadmium	mg/L	0.001	<R.L.	<R.L.	<R.L.	23
Dissolved Chromium	mg/L	0.001	<R.L.	0.001	<R.L.	23
Chromium, hexavalent (Cr6+)[4]	mg/L	0.01	<R.L.	<R.L.	<R.L.	16
Dissolved Copper	mg/L	0.001	0.001	0.003	0.0014	23
Dissolved Iron	mg/L	0.005	<R.L.	0.016	<R.L.	23
Dissolved Lead	mg/L	0.001	<R.L.	<R.L.	<R.L.	23
Dissolved Manganese	mg/L	0.005	<R.L.	<R.L.	<R.L.	23
Dissolved Mercury	mg/L	0.0002	<R.L.	<R.L.	<R.L.	25
Dissolved Nickel	mg/L	0.001	<R.L.	0.001	<R.L.	23
Dissolved Selenium	mg/L	0.001	<R.L.	0.002	0.001	23
Dissolved Silver	mg/L	0.001	<R.L.	<R.L.	<R.L.	23
Dissolved Zinc	mg/L	0.005	<R.L.	<R.L.	<R.L.	23

Source: DWR 2010 through 2015, Station PY001000
Notes:
[1]Half the R.L. used for averaging where applicable
[2]Data from 2000
[3]Data from 2012 to 2015
[4]Data from 1972 to 1976
Key =
< = less than
R.L. = reporting limit
mg/L = milligrams per liter

DWR applies copper-based algaecides (copper sulfate pentahydrate, Komeen®, Nautique®, Captain XTR®, EarthTec®) on an as-needed basis to control algal blooms in SWP water (DWR 2014d) and in the Project area. These applications prevent the degradation of drinking water quality through elevated tastes and odors, and the production of algal toxins. Dissolved copper levels in water samples from Pyramid Lake (2010 through 2015 average of 0.0014 mg/L) are below the Action Levels of 1.3 and 0.3 mg/L established by the Lead and Copper Rule, 22 CCR § 64672.3.

Organic Chemicals

DWR collects samples for organic chemicals, including carbamate pesticides, chlorinated organic pesticides, chlorinated phenoxy herbicides, sulfur pesticides, glyphosate, phosphorus/nitrogen pesticides, and purgeable (volatile organics). Based on 2 years of data (1997 and 1998) from Station PY001000 (Figure 4.4-2), most organic chemicals have not been detectable in Pyramid Lake water (Table 4.4-17). Of the 64 compounds tested, results for five parameters were above the laboratory reporting limit during those two years:

- <u>1,2,4-Trimethylbenzene</u> - Used in United States commerce in the manufacture of trimellitic anhydride, dyes, and pharmaceuticals and as a solvent and paint thinner. The maximum observed concentration (0.58 µg/L) is well below the PHG of 330 µg/L (SWRCB 2015).

- <u>Toluene</u> - Occurs naturally as a component of crude oil and is produced in petroleum refining and coke oven operations; toluene is a major aromatic constituent of gasoline. The maximum observed concentration (1.4 µg/L) is below the Criterion Concentration for taste and odor of 42 µg/L (Federal Register, Vol. 54, No. 97, pp. 22138, 22139) and below the PHG of 150 µg/L (SWRCB 2015).

- <u>Methyl tert-butyl ether (MTBE)</u> – Used as a gasoline additive, designed to improve air quality. California has prohibited the use of MTBE in gasoline since January 1, 2004. In 1997, measured MTBE concentrations in Pyramid Lake ranged up to 27 µg/L. The most recent samples in Pyramid Lake (September and October 1998) were below the reporting limit (1 µg/L) for MTBE.

- <u>m-Xylene and o-Xylene</u> - Used in the chemical industry as solvents for products including paints, inks, dyes, adhesives, pharmaceuticals, and detergents. Used in the petroleum industry as antiknock agents in gasoline. The maximum observed concentration of m-xylene was 1.3 µg/L in 1997. The maximum observed concentration of o-xylene was 0.85 µg/L in 1997. Standards are for the sum of isomers: California Primary MCL of 1,750 µg/L and California PHG (SWRCB 2015) of 1,800 µg/L. The taste and odor standard is 17 µg/L (Federal Register, Vol. 54, No. 97, pp. 22138,22139).

Table 4.4-17. Summary of DWR Water Quality Data for Pyramid Lake – Organic Chemicals, 1997 through 1998

Parameter	Units	Reporting Limit	1997 through 1998 Minimum	1997 through 1998 Maximum	Number of Samples	Number of Samples over R.L.
1,1,1,2-Tetrachloroethane	µg/L	0.5	<R.L.	<R.L.	67	0
1,1,1-Trichloroethane	µg/L	0.5	<R.L.	<R.L.	67	0
1,1,2,2-Tetrachloroethane	µg/L	0.5	<R.L.	<R.L.	67	0
1,1,2-Trichloroethane	µg/L	0.5	<R.L.	<R.L.	20	0
1,1-Dichloroethane	µg/L	0.5	<R.L.	<R.L.	67	0
1,1-Dichloroethene	µg/L	0.5	<R.L.	<R.L.	67	0
1,1-Dichloropropene	µg/L	0.5	<R.L.	<R.L.	67	0
1,2,3-Trichlorobenzene	µg/L	0.5	<R.L.	<R.L.	67	0
1,2,3-Trichloropropane	µg/L	0.5	<R.L.	<R.L.	67	0
1,2,4-Trichlorobenzene	µg/L	0.5	<R.L.	<R.L.	67	0
1,2,4-Trimethylbenzene	µg/L	0.5	<R.L.	0.58	67	2
1,2-Dibromo-3-chloropropane	µg/L	0.5	<R.L.	<R.L.	67	0
1,2-Dibromoethane	µg/L	0.5	<R.L.	<R.L.	20	0
1,2-Dichlorobenzene	µg/L	0.5	<R.L.	<R.L.	67	0
1,2-Dichloroethane	µg/L	0.5	<R.L.	<R.L.	67	0
1,2-Dichloropropane	µg/L	0.5	<R.L.	<R.L.	67	0
1,3,5-Trimethylbenzene	µg/L	0.5	<R.L.	<R.L.	67	0
1,3-Dichlorobenzene	µg/L	0.5	<R.L.	<R.L.	67	0
1,3-Dichloropropane	µg/L	0.5	<R.L.	<R.L.	67	0
1,4-Dichlorobenzene	µg/L	0.5	<R.L.	<R.L.	67	0
2,2-Dichloropropane	µg/L	0.5	<R.L.	<R.L.	67	0
2-Chlorotoluene	µg/L	0.5	<R.L.	<R.L.	67	0
4-Chlorotoluene	µg/L	0.5	<R.L.	<R.L.	67	0
4-Isopropyltoluene	µg/L	0.5	<R.L.	<R.L.	67	0
Benzene	µg/L	0.5	<R.L.	<R.L.	67	0
Bromobenzene	µg/L	0.5	<R.L.	<R.L.	67	0
Bromochloromethane	µg/L	0.5	<R.L.	<R.L.	67	0
Bromodichloromethane	µg/L	0.5	<R.L.	<R.L.	67	0
Bromoform	µg/L	0.5	<R.L.	<R.L.	67	0
Bromomethane	µg/L	0.5	<R.L.	<R.L.	67	0
Carbon tetrachloride	µg/L	0.5	<R.L.	<R.L.	20	0
Chlorobenzene	µg/L	0.5	<R.L.	<R.L.	67	0
Chloroethane	µg/L	0.5	<R.L.	<R.L.	67	0
Chloroform	µg/L	0.5	<R.L.	<R.L.	67	0
Chloromethane	µg/L	0.5	<R.L.	<R.L.	67	0

Table 4.4-17. Summary of DWR Water Quality Data for Pyramid Lake – Organic Chemicals, 1997 through 1998 (continued)

Parameter	Units	Reporting Limit	1997 through 1998 Minimum	1997 through 1998 Maximum	Number of Samples	Number of Samples over R.L.
Dibromochloromethane	µg/L	0.5	<R.L.	<R.L.	67	0
Dibromomethane	µg/L	0.5	<R.L.	<R.L.	67	0
Dichlorodifluoromethane	µg/L	0.5	<R.L.	<R.L.	67	0
Ethyl benzene	µg/L	0.5	<R.L.	<R.L.	67	0
Ethylene Dibromide	µg/L	0.5	<R.L.	<R.L.	52	0
Hexachlorobutadiene	µg/L	0.5	<R.L.	<R.L.	67	0
Isopropylbenzene	µg/L	0.5	<R.L.	<R.L.	67	0
Methyl tert-butyl ether	µg/L	1	<R.L.	27	67	45
Methylene chloride	µg/L	0.5	<R.L.	<R.L.	67	0
Naphthalene	µg/L	0.5	<R.L.	<R.L.	67	0
Phenol	µg/L	1	<R.L.	<R.L.	1	0
Styrene	µg/L	0.5	<R.L.	<R.L.	67	0
Tetrachloroethene	µg/L	0.5	<R.L.	<R.L.	67	0
Toluene	µg/L	0.5	<R.L.	1.4	67	3
Trichloroethene	µg/L	0.5	<R.L.	<R.L.	67	0
Trichlorofluoromethane	µg/L	0.5	<R.L.	<R.L.	67	0
Vinyl chloride	µg/L	0.5	<R.L.	<R.L.	67	0
cis-1,2-Dichloroethene	µg/L	0.5	<R.L.	<R.L.	67	0
cis-1,3-Dichloropropene	µg/L	0.5	<R.L.	<R.L.	67	0
m + p Xylene	µg/L	0.5	<R.L.	<R.L.	15	0
m-Xylene	µg/L	0.5	<R.L.	1.3	55	4
n-Butylbenzene	µg/L	0.5	<R.L.	<R.L.	67	0
n-Propylbenzene	µg/L	0.5	<R.L.	<R.L.	67	0
o-Xylene	µg/L	0.5	<R.L.	0.85	67	2
p-Xylene	µg/L	0.5	<R.L.	<R.L.	47	0
sec-Butylbenzene	µg/L	0.5	<R.L.	<R.L.	67	0
tert-Butylbenzene	µg/L	0.5	<R.L.	<R.L.	67	0
trans-1,2-Dichloroethene	µg/L	0.5	<R.L.	<R.L.	67	0
trans-1,3-Dichloropropene	µg/L	0.5	<R.L.	<R.L.	67	0

Source: DWR 1973 through 2015. Water Data Library, Station PY001000
Key:
< = less than
µg/L = micrograms per liter
R.L. = reporting limit

Mercury and PCBs in Fish from Pyramid Lake

In 2013, OEHHA published Safe Eating Guidelines for Pyramid Lake, which recommended the maximum servings of fish per week by species due to contamination by mercury and polychlorinated biphenyls (PCB) (Table 4.4.18). The Statewide survey of fish was conducted by the Surface Water Ambient Monitoring Program (SWAMP) (Davis et al. 2010).

Table 4.4-18. Recommended Maximum Number of Fish Servings from Pyramid Lake per Week

Fish Species	Women 18 to 45 Years and Children 1 to 17 Years	Women and Men over 45 Years
Bullhead (*Salvelinus confluentus)*	0	0
Channel Catfish (*Ictalurus punctatus*)	1	2
Largemouth Bass (*Micropterus salmoides*)	0	1
Rainbow Trout (*Oncorhynchus mykiss*)	7	7

Source: OEHHA 2013

The EPA recommended water quality criterion for concentrations of methylmercury in fish tissue of trophic level 4 fish (150-500 mm; fillet wet weight) is 0.20 milligrams per kilograms (mg/kg). The OEHHA methylmercury threshold for fish tissue is 0.44 ppm. For the purposes of risk assessment, total mercury is analyzed for most fish studies and assumed to be 100 percent methylmercury (Klasing & Brodberg 2008). Fish tissue results for mercury in Pyramid Lake fish ranged from 28 ppb in rainbow trout (*Oncorhynchus mykiss*) to 514 ppb in largemouth bass (OEHHA 2013). The National Academy of Science guidelines (National Academy of Science 1972) establish a maximum total PCB concentration of 500 micrograms per kilograms (µg/kg) (wet weight) in tissue samples for protection of aquatic life from bioaccumulation of toxic substances. OEHHA adopted an advisory tissue level (ATL) of 120 ppb; the ATL is the threshold for considering a recommendation of no consumption. Fish tissue results for PCBs published in the 2013 Health Advisory ranged from 5 ppb in rainbow trout to 238 ppb in bullhead trout (*Salvelinus confluentus*).

In the water phase, the maximum dissolved mercury value in the last 5 years in Pyramid Lake was less than the reporting limit of 0.0002 mg/L, below the MCL of 0.002 mg/L and the PHG of 0.0012 mg/L.

A TMDL for mercury in Pyramid Lake is planned by 2021, consistent with Section 3.4 of the Listing Policy, which states, "a water segment shall be placed on the section 303(d) list if a health advisory against the consumption of edible resident organisms has been issued by OEHHA or DHS."

4.4.6.5 Pyramid Reach

The SWRCB has reviewed the discharge from Pyramid Lake to Pyramid reach per the requirements of Section 401 of the CWA (33 USC § 1341). Due to Pyramid Lake stratification in the warmer months, water discharged to Pyramid reach is expected to be cooler than the natural inflow to Pyramid Lake during the warmest times of the year. Water temperatures are not expected to exceed those that occurred under natural conditions. Therefore, the Project was found to comply with water quality standards for temperature (SWRCB 2009). Similar to temperature, any reduction in dissolved oxygen concentration as a result of the Project will occur because "natural conditions cause lesser concentrations," and not "as a result" of waste discharges. The Project was found to comply with Basin Plan dissolved oxygen Water Quality Objectives (SWRCB 2009).

DWR published a water quality assessment of Pyramid reach in July 1996 (DWR 1996) based on data from 1973 through 1990. Water quality in Pyramid reach during this period is summarized in Table 4.4.19. Water quality data were also collected in 2003, 2011, and 2012 for the SWAMP. These data are summarized in Table 4.4.20 and Table 4.4.21. Based on the data, exceedances of the Water Quality Objectives for Pyramid reach were not observed, with the exception of chloride, which exceeded the Basin Plan objective of 60 mg/L in 2003 and 2012. Additionally, while the median dissolved solids from 1973 through 1990 (DWR 1996) was below the Water Quality Objective of 800 mg/L, the maximum observed value of 1,744 mg/L was almost double the water quality objective. More recent TDS values (2011 and 2012) were well below the 800 mg/L standard (284 mg/L and 372 mg/L TDS, respectively). Results for trace elements were below MCLs and PHGs with the exception of arsenic levels above the PHG of 0.000004 mg/L.

Table 4.4-19. Summary of DWR Water Quality Data for Pyramid Reach, 1973 through 1990

Parameter	Units	Minimum 1973 through 1990	Maximum 1973 through 1990	Median 1973 through 1990
Dissolved Oxygen	mg/L	8.6	10.9	10.1
Temperature	Degrees Celsius	9.5	18.7	13.4
pH	Std. units	7.4	8.9	8
Dissolved Solids	mg/L	184	1744	328
Hardness	mg/L	88	1045	150

Source: DWR 1996
Key:
mg/L = milligrams per liter

Table 4.4-20. Summary of SWAMP Water Quality Data for Pyramid Reach – General Parameters and Nutrients, 2003, 2011, and 2012

Parameter	Units	2003 Result (Station 403STC083)	2011 Result (Station 403S01136)	2012 Result (Station 403S07024)
Temperature	Degrees Celsius	10.51	15.8	23.63
pH	Std units	6.78	7.69	8.58
Dissolved Oxygen	mg/L	--	9.11	12.81
Dissolved Oxygen Saturation	%	103.8	--	149.9
Dissolved Alkalinity	mg/L as $CaCO_3$	--	84	112
Total Alkalinity	mg/L as $CaCO_3$	--	84	130
Nitrate plus Nitrite	mg/L as N	--	0.404	--
Dissolved Nitrite	mg/L as N	ND	0.003	0.0028
Nitrate	mg/L as N	0.777	--	0.213
Total Nitrogen	mg/L	--	0.586	0.339
Ammonia	mg/L as N	ND	ND	0.012
Turbidity	NTU	1.5	2.48	2.91
Boron	mg/L	0.67	--	--
Dissolved Chloride	mg/L	91.4	47	68.7
Total Hardness	mg/L as $CaCO_3$	310	155	186
Dissolved Orthophosphate	mg/L as P	.0409	--	0.041
Total Phosphorus	mg/L as P	--	0.0493	0.0293
Total Dissolved Solids	mg/L	628	284	372
Chlorophyll a	µg/L	0.69	--	--
Dissolved Sulfate	mg/L	243	84.2	115

Source: SWAMP 2003, Station 403STC083; 2011, Station CEDEN-250071; 2012, Station 403S07024
Note:
Sampling Dates: February 20, 2003; June 13, 2011; and June 13, 2012
Key:
% - percent
µg/L = micrograms per liter
CaCO3 = Calcium Carbonate
mg/L = milligrams per liter
N = Nitrogen
ND = Non-detect
NTU = Nephelometric Turbidity Unit
P = Phosphorus

Table 4.4-21. Summary of SWAMP Water Quality Data for Pyramid Reach – Trace Elements, 2011 and 2012

Parameter	Units	2011 Result (Station 403S01136)	2012 Result (Station 403S07024)
Dissolved Aluminum	µg/L	3.38	ND
Total Aluminum	µg/L	85.2	11.4
Dissolved Arsenic	µg/L	1.75	2.23
Total Arsenic	µg/L	1.9	2.25
Dissolved Cadmium	µg/L	ND	0.01
Total Cadmium	µg/L	ND	0.01
Dissolved Chromium	µg/L	ND	0.22
Total Chromium	µg/L	0.27	0.23
Dissolved Copper	µg/L	1.23	1.32
Total Copper	µg/L	1.56	1.35
Dissolved Iron	µg/L	4.95	--
Total Iron	µg/L	146	--
Dissolved Lead	µg/L	ND	ND
Total Lead	µg/L	ND	ND
Dissolved Manganese	µg/L	2.49	4.78
Total Manganese	µg/L	29.1	5.89
Dissolved Nickel	µg/L	1.1	1.21
Total Nickel	µg/L	1.34	1.23
Dissolved Selenium	µg/L	0.93	0.93
Total Selenium	µg/L	1.29	0.89
Dissolved Silver	µg/L	ND	ND
Total Silver	µg/L	0.09	ND
Dissolved Zinc	µg/L	ND	ND
Total Zinc	µg/L	0.79	ND

Source: SWAMP 2011, Station 403S01136; 2012, Station 403S07024
Note:
Sampling Dates: June 13, 2011; June 13, 2012
Key:
µg/L = micrograms per liter
ND = Non-detect

4.4.6.6 Elderberry Forebay

Data from USGS for two dates in 2004 and one date in 2005 are summarized in Table 4.4-22.

Table 4.4-22. Summary of USGS Water Quality Data for Elderberry Forebay, 2004 and 2005

Parameter	Units	Detection Limit	Minimum	Maximum	Average
Dissolved ammonia	mg/L as N	0.04	ND	ND	ND
Dissolved Calcium	mg/L	0.01	18.2	48.8	30.2
Dissolved Chloride	mg/L	0.2	30	62.6	50.3
Dissolved Fluoride	mg/L	0.17	ND	0.39	0.19
Dissolved Nitrate and Nitrite	mg/L as N	0.06	0.37	0.62	0.52
Dissolved Iron	µg/L	6.4	ND	20.9	10.9
Dissolved Magnesium	mg/L	0.008	11.20	16.90	13.77
Dissolved Manganese	µg/L	0.8	1.01	9.12	5.39
Dissolved Nitrate	mg/L as N	not noted	0.37	0.62	0.52
Dissolved Nitrite	mg/L	0.008	ND	ND	ND
Total Nitrogen	mg/L	0.03	0.56	0.92	0.77
Total Organic Nitrogen	mg/L	0.18 - 0.30	ND	ND	ND
Dissolved Organic Nitrogen	mg/L	0.23	ND	ND	ND
pH	std units	0.1	7.3	8.0	7.7
Dissolved Phosphate	mg/L	0.006	0.03	0.07	0.06
Total Phosphorus	mg/L	0.004	0.064	0.089	0.080

Table 4.4-22. Summary of USGS Water Quality Data for Elderberry Forebay, 2004 and 2005 (continued)

Parameter	Units	Detection Limit	Minimum	Maximum	Average
Dissolved Potassium	mg/L	0.16	2.43	3.13	2.80
Dissolved Silica	mg/L	0.04	15	16.4	15.63
Dissolved Sodium	mg/L	0.1 - 0.2	34.5	46.4	39.8
Sodium adsorption ratio	none		1.08	1.9	1.58
Specific conductance	µS/cm @25 ºC	2.6	378	485	433
Dissolved sulfate	mg/L	0.18	27.5	112	60.8
Total dissolved solids	mg/L	10	228	334	278
Total Hardness	mg/L CaCO3	not noted	91.6	191	131.9

Source: USGS 2004, 2005, Station 11108092
Note:
Sampling Dates: July 21, 2004; September 23, 2004; and February 27, 2005
Key:
ºC = Degrees Celsius
µg/L = micrograms per liter
µS/cm = microsiemens per centimeter
CaCO3 = Calcium Carbonate
mg/L = milligrams per liter
N = Nitrogen
ND = Non-detect

4.4.7 Discharges from Powerplants

4.4.7.1 Warne Powerplant

DWR discharges once-through, non-contact cooling water and drainage sump water to Pyramid Lake from the Warne Powerplant per the requirements of the Los Angeles RWQCB Order No. R4-2010-0089-A01 (NPDES Permit No. CA0059188) and Time Schedule Order (TSO) that became effective on April 5, 2012. The TSO order expires on June 1, 2016. The design flow of the facility is 1.97 million gallons per day (MGD). To demonstrate compliance with permit conditions, water quality monitoring is conducted at the intake, two effluent locations prior to entry into the powerplant tailrace to Pyramid Lake and at the Pyramid Lake inlet (receiving water).

4.4.7.2 Castaic Powerplant

LADWP pumps water back from Elderberry Forebay to Pyramid Lake and releases water from Elderberry Forebay to Castaic Lake (non-Project facility). The pumping of water from Elderberry Forebay to Pyramid Lake connects waters of the United States without subjecting the transferred water to intervening industrial, municipal, or commercial use (California RWQCB Los Angeles Region 2013). Elderberry Forebay releases water into Castaic Lake (non-Project facility). Discharges from Castaic Powerplant that are subject to NPDES waste discharge requirements specified in Los Angeles RWQCB Order No. R4-2013-0093 (NPDES No. CA0055824) are summarized in Table 4.4-23.

Table 4.4-23. Summary of Discharges Associated with Castaic Powerplant

Outfall/Discharge Point No.	Operations	Maximum Discharge	Description/Treatment
001 (reporting required but no effluent limitations)	Pump back water from Elderberry Forebay to Pyramid Lake	1.1 billion gpd	Pump back water from Elderberry Forebay to Pyramid Lake/untreated water
002 (reporting required but no effluent limitations)	Recharge from Elderberry Forebay to Castaic Lake.	1.5 billion gpd	Discharge water from Elderberry Forebay to Castaic Lake (non-Project facility)/untreated water
Outfall/Discharge Points that Discharge to Elderberry Forebay:			
003	Unit 7 Tailrace	380 MGD	No treatment
004	Oil water separator	179,505 gpd	Oil water separator
005	Dewatering, gallery, seal drain sumps	9,100 gpd	No treatment
	Compressor after cooler	3,000 gpd	No treatment
	Cooling water from air compressors	302,400 gpd	No treatment
	Industrial use water	1,500 gpd	No treatment
006	Backwash water from potable water system	1200 to 1500 gpd	Settling basin
[1]	Generator and turbine cooling water – Units 1, 2, 3, 4, 5, and 6	12,402,000 gpd	No treatment
[1]	Air compressor after-cooling water	691,200 gpd	No treatment
Total Discharges to Elderberry Forebay		**393,590,205 gpd (393.59 MGD)**	

Source: California RWQCB Los Angeles Region 2013
Note:
[1]No designated Outfalls/Discharge Serial Number because the waste streams are discharged through underwater discharge points to Elderberry Forebay. These waste streams are not included in the Report of Waste Discharge.
Key:
gpd = gallons per day
MGD – million gallons per day
NPDES = National Pollutant Discharge Elimination System

4.5 FISH AND OTHER AQUATIC RESOURCES

This Section provides information regarding existing fish and other aquatic resources. For the purpose of this PAD, aquatic resources include fish, aquatic amphibians, semi-aquatic reptiles, aquatic mollusks, benthic macroinvertebrates, and aquatic ferns, vascular plants and algae. Terrestrial amphibians, reptiles and mollusks are discussed in Section 4.6. Besides this general introductory information, this Section includes eight main sub-sections: Section 4.5.1 lists and describes special-status aquatic species that may be affected by the Project; Section 4.5.2 describes aquatic invasive species (AIS) that could occur in Project reservoirs or conveyance facilities, and provides for each species a brief life history of the species, its status, and any known occurrences and abundance within or adjacent to the Project area; and Sections 4.5.3 through 4.5.8 describe existing, relevant and reasonably available information regarding the use of algaecides and aquatic herbicides, fish, amphibians, reptiles and turtles, aquatic mollusks, benthic macroinvertebrates, aquatic macrophytes, algae, and cyanobacteria known or suspected to occur at Project facilities or to be affected by the Project. Aquatic species that are listed as FT, FE, or proposed or a candidate for listing under ESA, are addressed in Section 4.8.

4.5.1 Special-Status Aquatic Species

For the purpose of this PAD, a special-status aquatic species is considered one that is found on NFS lands and listed by the USFS as Sensitive (FSS); listed by NMFS as a Species of Concern (NMFS-S); listed by the State as threatened or endangered under CESA; listed by CDFW as a species of special concern (SSC); or considered fully protected under State law (CFP).

Licensees developed the list of special-status species known or with the potential to occur in the Project vicinity by first reviewing the CDFW website which lists SSC, as well as species listed by other agencies (CDFW 2015a). A query of the CDFW California Natural Diversity Database (CNDDB) (CDFW 2015a) was then performed based on a search of the USGS 7.5-minute quadrangles in which the Project is located (i.e., Lebec, La Liebre Ranch, Black Mountain, Liebre Mountain, Whitaker Peak, Warm Springs Mountain, and Newhall), and the adjacent quadrangles (i.e., Burnt Peak, Cobblestone Mountain, Green Valley, Piru, Val Verde, and Mint Canyon) covering approximately 774 square miles. This is an area much larger than that potentially affected by the Project, but is intended to ensure a comprehensive list.

With respect to anadromous salmonids (*Oncorhynchus sp.*), one of the purposes of the Magnuson-Stevens Fishery Conservation and Management Act of 1976, as amended (16 U.S.C. §§ 1801-1891d) (MSA) is to conserve and manage anadromous fishery resources of the U.S. (16 U.S.C. § 1801(b)(1)). The Pacific Fisheries Management Council is responsible for implementing the MSA in California including developing fishery management plans in coordination with NMFS (16 U.S.C. § 1852(a)(1)(F)). The MSA was amended in 1996 to establish a new requirement to describe and identify "Essential Fish Habitat" (EFH) in each fishery management plan (16 U.S.C. § 1855(b)). EFH is defined in the MSA regulations as… "*those waters and substrate* *necessary to fish for spawning, breeding, feeding, or growth to maturity*." (50 C.F.R. § 600.10). For Pacific salmon, EFH "*includes all those water bodies occupied or historically accessible*" in specified hydrologic units (50 C.F.R. § 600.412). The designation does not identify specific Chinook salmon races (e.g., spring-run or fall-run) but instead is for "Pacific salmon" which would include steelhead. For the purpose of EFH designations, NMFS uses fourth field hydrologic unit codes (HUC) developed by the United States Geological Survey (USGS) as defined in the USGS publication *Hydrologic Unit Maps, Water Supply Paper 2294, 1987* to identify EFH areas.

Within the Project area, the Pacific Fisheries Management Council has not designated any freshwater EFH for Pacific salmon (50 C.F.R. § 660.412). The closest EFH hydrologic unit to the Project area is the San Francisco – South Coast HUC, over 100 miles to the north.

On the basis of these queries and additional literature and information searches, Licensees determined that six special-status aquatic or semi-aquatic species are known to occur or have the potential to occur in the Project vicinity. Four of these species were documented in the CNDDB database, including two fish, one snake, and one turtle species. DWR then researched the known distribution, habitat associations and requirements of these species to exclude from further consideration species known to be endemic to restricted geographic areas and habitat types not found in the Project vicinity. None of the identified species were excluded.

Based on Licensees' review, the arroyo chub (*Gila orcutti*), Santa Ana sucker (*Catostomus santaanae*), foothill yellow-legged frog (*Rana boylii*), western spadefoot (*Spea hammondii*), two-striped garter snake (*Thamnophis hammondii*), "south coast garter snake" (i.e., occurrences of California red-sided garter snake [*Thamnophis sirtalis infernalis*] from coastal Ventura County to San Diego County), and southern western (or western) pond turtle (*Actinemys* [*Emys*] *pallida* [or *marmorata pallida]*), each designated as a SSC are the only special-status aquatic species that may occur in the Project area or otherwise may potentially be affected by continued Project Operations and Maintenance (O&M). Arroyo chub and Santa Ana Sucker are not native to the Project area, but introduced individuals or populations may occur in the Project area. A summary of these species is provided in Table 4.5-1.

4.5.1.1 Arroyo Chub[12]

The arroyo chub (*Gila orcutti*) is native to coastal drainages of the Los Angeles plain, where much of its habitat has been lost or degraded by development. Although extirpated in most of its native range, arroyo chub was inadvertently or intentionally introduced into other watersheds (Miller 1968, Swift et al. 1993). Moyle et al. (2015) assigned a "high" concern status to this

[12] Photo credit: Paul Barrett, USGS [public domain], via Wikimedia Commons

species based on occurrences within the native range, and “moderate” concern status when introduced populations outside of the native range are also considered.

Arroyo chub is a relatively small minnow (Family Cyprinidae), usually no larger than 4.8 inches standard length (SL) (Moyle 2002). It is adapted for warm waters with low oxygen and wide temperature fluctuations (Castleberry and Cech 1986). Streams with slow-moving water, mud or sand substrate, and greater than 40 centimeters (cm) depth are preferred habitat (Wells and Diana 1975), although individuals have been found in pool habitats with gravel, cobble, and boulder substrates (Feeney and Swift 2008).

Arroyo chub typically spawns in June and July, although spawning can occur from February through August, because the eggs ripen in small batches (Tres 1992). Eggs hatch in 4 days at 75°F.

Greenfield and Deckert (1973) found that algae comprised 60 to 80 percent of the stomach contents of sampled arroyo chubs. Other food items include insects and small crustaceans. A floating water fern (*Azolla* sp.) has also been identified as an important food source (Greenfield and Deckert 1973).

There are three CNDDB records of arroyo chub in the Project vicinity, summarizing information from other sources, which reported occurrences in the Santa Clara River from 3 miles east of Piru Creek to east of the Interstate 5 bridge, in Soledad Canyon, and at the McBean Bridge in Valencia. A single account of Arroyo chub was documented by a USFS stream survey of Agua Blanca Creek in August of 1979 (USFS 1979), in which they were reported as abundant, averaging 30 fish per 100 feet in the lower section of Agua Blanca Creek. Arroyo chub were also mentioned by S. Chubb in comments on the Snowy Trail EIS (Chubb 1995). Although Licensees did not discover any recent information documenting arroyo chub in the Project area downstream of Pyramid Dam, there is a potential that a small population exists.

Table 4.5-1. Summary of Factors Reviewed to Develop the List of State Special-Status Species Potentially Affected by the Project

Common Name	Scientific Name	Federal and State Status	Known Occurrences in Project Vicinity	Project Vicinity Within Species Known Native Range	Conclusion
Arroyo Chub	*Gila orcutti*	SSC	Yes	Yes	Include
Santa Ana Sucker[1]	*Catostomus santaanae*	FT in native range only, SSC	Yes	Yes	Include
Sacramento hitch	*Lavinia exilicauda*	SSC	Yes	No	Include
Foothill yellow-legged frog	*Rana boylii*	SSC	Yes	Yes	Include
Western spadefoot	*Spea hammondii*	SSC, BLMS	Yes	Yes	Include
Two-striped garter snake	*Thamnophis hammondii*	SSC	Yes	Yes	Include
South Coast garter snake	*Thamnophis sirtalis infernalis*	SSC	Yes	Yes	Include
Southern western (or western) pond turtle	*Actinemys* [*Emys*] *pallida* [or *marmorata pallida]*	SSC, FSS, BLMS	Yes	Yes	Include

Source: CDFW 2015a
Note:
[1]Santa Ana Sucker - Introduced population in the Santa Clara drainage is not covered by ESA listing
Key:
BLMS = BLM sensitive species
FSS = USFS sensitive species
FT = Federally Threatened
SSC = State species of special concern

4.5.1.2 Santa Ana Sucker[13]

Santa Ana sucker (*Catostomus santaanae*) is a relatively small fish, usually less than 6.3 inches SL. This species is endemic to a few watersheds in southern California, including the Los Angeles, San Gabriel, and Santa Ana Rivers. The native population is listed under the ESA as threatened, with designated Critical Habitat within the Santa Ana and San Gabriel rivers, and Big Tujunga Creek. However, introduced populations outside of the natural range, which include the Project area, are not included in the listing rules. Santa Ana sucker was likely introduced to the Santa Clara River some time prior to 1930 (Moyle 2002).

Santa Ana sucker prefers small streams with moderate to fast flowing and cool (71.6ºF) water. It generally seeks cover under overhanging vegetation, but will occupy areas without cover, if deep pools are present. It can be found over gravel, cobble, and boulder substrates and only occasionally in habitats with mud or sand (Moyle 2002). It is capable of very high reproductive rates, enabling it to quickly re-populate streams after a disturbance. This fact likely contributed to its evolution in southern California streams that are prone to flash floods.

Licensee identified three records of Santa Ana sucker in the CNDDB from the vicinity of the Project. The occurrences are from the Santa Clara River from Santa Paula to Valencia, Sespe Creek, Castaic Creek near the confluence of the Santa Clara River, Piru Creek downstream of Lake Piru, and a 1975 record from near Blue Point Campground upstream of Lake Piru (CDFW 2015a). A single account of Santa Ana sucker was documented in a USFS stream survey of Agua Blanca Creek in August 1979 (USFS 1979), in which they were reported as abundant, averaging 20 fish per 100 feet in the lower section of Agua Blanca Creek. Although Licensees did not discover any recent records documenting Santa Ana sucker in the Project area downstream of Pyramid Dam, there is a potential that a small population exists.

4.5.1.3 Sacramento Hitch[14]

Sacramento hitch (*Lavinia exilicauda*) is native to Central California, including the Sacramento-San Joaquin River system in low elevation streams and the Delta. Currently the species occurs in scattered small populations across much of the native range, with the exception of the southern San Joaquin River and its tributaries where they are absent (CDFW 2015). Outside of its native range, populations of Sacramento hitch have been established in San Luis Reservoir and other reservoirs. These occurrences are attributed to transport by the

[13] Photo credit: Manna Warburton, California Fish Website, copyright © 2015 Regents of the University of California
[14] Photo from: http://www.biologicaldiversity.org/resourcespace/?c=90&k=f449c606f0

SWP (Moyle 2002). Moyle et al. (2015) assigned a “moderate” concern status to this species.

This is a large deep-bodied minnow, which may grow to over 350 mm SL. Habitats are typically warm water, with tolerance for temperatures greater than 30°C and tolerance for salinities up to 9 ppt (Moyle 2002), and include lowland clear streams, turbid sloughs, lakes and reservoirs. When in streams, Sacramento hitch inhabit pools or runs with aquatic vegetation and prefer gravel substrates to mud substrates. Spawning typically starts in February and can end as late as July. Females are usually sexually mature in 2 to 3 years, whereas males may mature in the first, second, or third year. Fecundity may be as high as 50,000 to 60,000 eggs per female. Hitch spawn in riffles of tributaries of lakes and rivers, and potentially sloughs after spring rains. Spawning occurs over gravel and eggs hatch in 3 to 7 days at temperatures from 15° to 22°C. Young hitch will reside around aquatic plants or other areas of cover in shallow water (Moyle 2002).

Feeding occurs mainly during daylight hours in open waters or at the surface (Moyle 2002). Small hitch feed on drift at the heads of pools during the summer. Diet is comprised of aquatic insects, terrestrial insects, and filamentous algae.

According to the literature, hitch have been observed in Pyramid Lake (DWR 2001 and Moyle 2002). DWR (1997) included hitch in the list of species that could be found in Quail Lake. Despite these references, Licensees could not find specific information documenting the observations.

4.5.1.4 Foothill Yellow-legged Frog[15]

Foothill yellow-legged frog (*Rana boylii*; FYLF) is a stream-adapted species usually associated with streams containing backwater habitats and coarse substrates (Jennings and Hayes 1994). Populations of FYLF persist on at least some portions of most drainages with known historical occurrences, except in parts of southern California where they are mostly extirpated (NatureServe© 2012). FYLF populations may require both mainstem and tributary habitats for long-term persistence. Streams too small to provide breeding habitat for this species may be critical as seasonal habitats, such as in winter and during the hottest part of the summer (Van Wagner 1996). Evidence suggests that habitat use by young-of-the-year (YOY), subadult and adult frogs differs by age-class and can change seasonally (Randall 1997; Haggarty 2006). Breeding tends to occur in spring or early summer. A site in northwestern California was studied for 6 years, and the period of breeding activity varied from 3 to 7.5 weeks (Wheeler and Welsh 2008). Eggs are laid in areas of shallow, slow moving waters near the shore.

[15] Photo source: Stephen Nyman, PhD

FYLF is infrequent in habitats where introduced fish and American bullfrogs (*Lithobates catesbeianus*) are present (Jennings and Hayes 1994). Tadpoles may be particularly vulnerable to predation by introduced fish, such as smallmouth bass (*Micropterus dolomieu*) (Paoletti et al. 2011), and American bullfrogs (Kupferberg 1996, 1997).

FYLF was historically present in the Project vicinity, including presence on Piru Creek; however, the most recent, verifiable record from the region occurred in April 1970 on a section of Piru Creek inundated by Pyramid Lake approximately 10 miles north of the Temescal Ranger Station and upstream of the Piru Gorge. Another reliable, but unverifiable observation occurred on Piru Creek approximately 0.6-1.2 miles south of Frenchman's Flat in July 1977 (Jennings and Hayes 1994). Surveys for arroyo toad in a 4.5 mile section of Pyramid reach downstream of Pyramid Dam have not detected FYLF. Based on the available information, it is unlikely that this species still occurs.

4.5.1.5 Western Spadefoot[16]

The western spadefoot (*Spea hammondii*) range is located throughout the California Central Valley and adjacent foothills, and is usually common where it occurs, although the current distribution has been substantially reduced by conversion of native habitats. The species is known from near sea level to about 4,500 feet elevation (Jennings and Hayes 1994; Morey 2005); however, most populations are found below 3,300 feet (Morey 2005). Breeding habitats include vernal pools, vernal playas, rainwater pools, stock ponds, and pools in intermittent streams. Although most breeding sites dry seasonally, permanent ponds are occasionally used. Absence of fish is usually a prerequisite for successful breeding.

This species occurs primarily in grasslands, but populations also occur within open valley-foothill hardwood woodlands or open chaparral, where breeding habitat is present and soils are suitable for burrowing. Populations may adapt well to rangeland practices, but reportedly do not long persist in areas converted to irrigated agriculture.

On July 1, 2015 (80 FR 56423), USFWS published results of a petition review (also known as a "90-day finding") to consider listing western spadefoot under the ESA, determining that the petition presented "substantial scientific or commercial information indicating that the petitioned actions may be warranted." Therefore, USFWS initiated a more thorough review of available data to determine whether listing is warranted. The results of the 90-day finding have no immediate effect on the regulatory status of the species (i.e., western spadefoot is not a candidate species or proposed for listing under the ESA).

[16] Photo credit: Chris Brown, USGS [public domain], via Wikimedia Commons

Western spadefoot is typically an "explosive breeder," often emerging and spawning within 1 or 2 days after relatively warm, winter or spring rains. Eggs develop and hatch in a few days and larvae complete metamorphosis in 30 to 79 days (Morey 2005). Similar to other spadefoot species, western spadefoot larvae are capable of feeding on animal tissue and may be cannibalistic. After metamorphosis, juvenile and adult western spadefoot are terrestrial and primarily fossorial, and may spend long periods buried in loose soil or occasionally in existing mammal burrows.

Within the Los Angeles coastal plain, western spadefoot is likely extirpated and much of the suitable habitat within the adjacent foothills has also been lost. There are 16 CNDDB records of western spadefoot in the Project vicinity, including records from San Francisquito Canyon east of the Project and Grasshopper Canyon approximately 3.37 miles south-southwest of Elderberry Forebay (CDFW 2015), with breeding occurrences associated with storm-water detention basins, rainwater pools within road-ruts and other anthropogenic depressions, and pools within intermittent streams. Although Licensees did not discover information documenting western spadefoot in the Project area, there is a potential that the species exists.

4.5.1.6 Two-striped Garter Snake[17]

The two-striped garter snake (*Thamnophis hammondii*) is a highly aquatic snake found from Monterey and San Benito Counties, California, to northwest Baja California, Mexico in the Coast, Transverse, and Peninsular Ranges and coastal plain. Known occurrences are distributed from sea level to about 8,000 feet elevation, mostly associated with streams (Jennings and Hayes 1994; Stebbins 2003). Jennings and Hayes (1994) reported evidence that two-striped garter snake has been extirpated or has declined due to habitat loss and degradation attributable to urbanization, flood control projects, overgrazing, introduced species, and deliberate killing, and suggested that drought may have accelerated these declines. However, Frost et al. (2007) indicate that two-striped garter snake "is probably the most common snake in southern California away from urban areas," warranting the International Union for Conservation of Nature (IUCN) Red List category of "Least Concerned."

Preferred habitats for the two-striped garter snake include rocky, perennial or intermittent streams; large, low gradient streams; and ponds (e.g., oases, stock ponds, and storm-water retention ponds), provided, in each case, that dense riparian vegetation is also present (Jennings and Hayes 1994; Frost et al. 2007). Two-striped garter snake is primarily aquatic-feeding, with fish, fish eggs, amphibians, and earthworms documented as prey (Stebbins and McGinnis 2012). Although it is rarely found far from water, uplands adjacent to riparian areas may be used in winter

[17] Photo credit: Connor Long (Own work) [CC BY-SA 4.0 (http://creativecommons.org/licenses/by-sa/4.0)], via Wikimedia Commons

(Jennings and Hayes 1994). Two-striped garter snake is ovoviviparous and an individual may bear as many as 25 young in a single litter.

There are eight records in the Project vicinity of two-striped garter snake in the CNDDB, including repeated observations on Castaic Creek upstream of Elderberry Forebay, Piru Creek downstream of Lake Piru, and along the Santa Clara River (CDFW 2015a). Small numbers (i.e., two to four) of two-striped garter snakes have also been observed each year during annual sensitive species surveys performed since 2010 along Pyramid reach downstream of Pyramid Lake between Ruby Canyon and Lake Piru (Environmental Science Associates 2010, 2011, 2012, 2013, 2014, 2015).

4.5.1.7 South Coast Garter Snake[18]

The "South Coast garter snake" is defined as a form of common garter snake (*Thamnophis sirtalis*) occurring on the coastal plain from the Santa Clara River Valley in Ventura County to San Diego County (Jennings and Hayes 1994). However, no studies have been published to support a separate taxonomic designation and therefore, the South Coast garter snake is generally treated as a geographic isolate of the more widely distributed California red-sided garter snake. Jennings and Hayes (1994) describe habitats of the South Coast garter snake as "marsh and upland habitats near permanent water that have good strips of riparian vegetation." These habitats, probably never common, have been substantially lost or degraded by urbanization, flood control projects, agriculture, and introduced species.

The habitat requirements of South Coast garter snake are summarized as shallow, permanent, low gradient water and associated dense, multi-storied vegetation (San Bernardino Valley Municipal Water District 2014). Although data are lacking, Jennings and Hayes (1994) suggest that South Coast garter snake may be primarily aquatic-feeding, with known prey including amphibian larvae, fish, and insects. Clutches of up to 20 live-born young have been reported (Jennings and Hayes 1994).

There are no records of South Coast garter snake in the Project vicinity in the CNDDB (CDFW 2015a). Jennings and Hayes (1994) includes a map showing verified locations where museum specimens of South Coast garter snake were collected or sightings reported along the Santa Clara River (populations identified as "extant") and on Piru Creek near the Santa Clara River (populations identified as "extinct"). The upstream limits to their historical distribution in the Project vicinity are unknown; however, apparent preference for low-gradient marshy, streams suggests that South Coast garter snake may never have occurred along Piru Creek or Castaic Creek in the Project area. The species is nonetheless included as potentially occurring because of its uncertain distribution.

[18] Photo credit: David A. Hoffman (Own work) [CC BY-NC-ND 2.0] via Flickr

4.5.1.8 Southern Western Pond Turtle[19]

Western pond turtles (*Actinemys* [*Emys*] *pallida* [or *marmorata pallida*]) are the only freshwater turtles native to California. Long considered a single species, the two subspecies, southwestern pond turtle and northwestern pond turtle, have been recently elevated to two separate but full species on the basis of molecular evidence (Spinks et al. 2014). Populations in the central Coast Range of California south of San Francisco are assigned to southern western pond turtle. Because much of the published information on western pond turtles is derived from studies of northern western pond turtle, our understanding of southern western pond turtle, summarized in the following account, may not be entirely accurate.

Both species of western pond turtle are considered habitat generalists and may occur in a wide variety of aquatic habitats, including pools, side channels, and backwaters of streams; ponds, lakes, ditches, and marshes, although natural habitats of the southern western pond turtle were likely mostly associated with streams (Jennings and Hayes 1994). The southern western pond turtle is experiencing substantial declines due to loss of habitat, introduced species, and historical over-collection (Jennings and Hayes 1994), and is designated as SSC.

Although highly aquatic, pond turtles often overwinter in forested habitats and eggs are laid in shallow nests in sandy or loamy soil in summer at upland sites as much as 1,200 feet from aquatic habitats (Jennings and Hayes 1994). Hatchlings do not typically emerge from the covered nests until the following spring. Reese and Welsh (1997) documented western pond turtle away from aquatic habitats for as much as 7 months a year and suggested that terrestrial habitat use was at least in part a response to seasonal high flows. Basking sites are an important habitat element (Jennings and Hayes 1994) and substrates include rocks, logs, banks, emergent vegetation, root masses, and tree limbs (Reese undated). Terrestrial activities include basking, overwintering, nesting, and moving between ephemeral sources of water (Holland 1991). During the terrestrial period, Reese and Welsh (1997) found that radio-tracked western pond turtles were burrowed in leaf litter.

Breeding activity may occur year-round in California, but egg-laying tends to peak in June and July in colder climates, when females begin to search for suitable nesting sites upslope from water. Adult western pond turtles have been documented traveling long distances from perennial watercourses for both aestivation (i.e., hibernation in response to high temperatures and arid conditions) and nesting, with long-range movements to aestivation sites averaging about 820 feet, and nesting movements averaging about 295 feet (Rathbun et al. 2002). Introduced species of turtles (e.g., red-

[19] Photo credit: Yathin S. Krishnappa, [CC BY-SA 3.0 (http://creativecommons.org/licenses/by-sa/3.0)], via Wikimedia Commons

eared sliders [*Trachemys scripta elegans*]) or 'pond slider' likely compete with western pond turtle for basking sites, and American bullfrogs and predatory fish species may prey on western pond turtle hatchlings.

There are 13 CNDDB records of southern western pond turtle in the Project vicinity, including multiple records from the Santa Clara River, Fish Creek, and Pyramid reach, and a record from Lake Piru (CDFW 2015). As many as 17 southern western pond turtles have been observed in annual sensitive species surveys performed since 2010 along Pyramid reach several miles downstream of Pyramid Lake between Ruby Canyon and Lake Piru (Environmental Science Associates 2010a, 2011, 2012, 2013, 2014c, 2015c, 2015d).

4.5.2 <u>Aquatic Invasive Species</u>

On August 18, 2015, Licensees generated a list of AIS by using the Nonindigenous Aquatic Species (NAS) application available at the USGS website (USGS 2015a). The query that was run included Los Angeles County and surrounding areas. Those species that did not occur within 100 miles of the Project vicinity or have suitable habitat within the Project area, and those occurrences dated prior to issuance of the existing license were eliminated. Five species were left for consideration from the NAS list of AIS.

Licensees also utilized Cal WeedMapper, a web application used as a tool for mapping invasive plant distribution, and California State Parks Division of Boating and Waterways (DBW) databases to generate a list of invasive aquatic plant species that occur or have the potential to occur within or near the existing Project boundary. Licensees identified three further AIS from these queries (Cal-IPC 2015, DBW 2015).

Additionally, coontail (*Ceratophyllum demersum*), Eurasian watermilfoil (*Myriophyllum spicatum*) and sago pondweed (*Stuckenia pectinata*) were identified per DWR's Aquatic Pesticides Application Plan (DWR 2014d, DWR 2016a). Red-eared slider was also identified as a species likely to occur in the Project area based on evidence that indicates this species occurs on Piru Creek below Lake Piru (UWCD 2014).

A number of invasive cyanobacteria species have been documented in the Project area (DWR 2014). According to 2014 DWR phytoplankton sampling data, *Anabaena lemmermannii,* Aphanizomenon spp., Pseudanabaena spp., *Worenchinia naegelianum,* Microcystis spp., and Gleotrichia spp. are invasive cyanobacteria species located in Pyramid Lake (DWR 2014). For discussion purposes, invasive cyanobacteria species have been combined in one assemblage.

Finally, Licensees added zebra mussel (*Dreissena polymorpha*) and quagga mussel (*Dreissena rostriformis bugensis*) to the list, as they are considered a high threat species by the State. The U.S. has listed zebra mussels as Restricted Species under the Lacey Act (18 U.S.C. 42), and both species are regulated under Fish and Game Code (FGC) § 2301 and § 2302.

The discussion of AIS below is focused on the occurrence and the potential occurrence of these 15 AIS – one turtle, two amphibians, five mollusks (snails and bivalves), cyanobacteria and six aquatic plants. Table 4.5-2 lists the 15 AIS known to occur or with the potential to occur in the Project area.

4.5.2.1 Red-eared Slider[20]

The red-eared slider (*Trachemys scripta elegans*) is a medium-sized turtle (adults are usually less than 8 inches carapace length) native to the Midwest south to the Gulf of Mexico. Although other subspecies of pond sliders are also considered invasive, the red-eared slider is by far the most widely distributed because of its popularity in the pet trade. Escaped and deliberately released red-eared sliders have led to numerous, established populations in at least 23 states outside of the species native range, as well as populations in other countries. Within California, the USGS NAS reports red-eared slider occurrences in 13 counties, primarily located in various calm water habitats with abundant aquatic vegetation and urbanized areas in the San Francisco Bay Area and interior southern California. Red-eared sliders are a conservation concern in California because it competes successfully with native western pond turtles.

Sliders mate between March and June, and after eggs have developed the female seeks out suitable terrestrial nesting sites, often significant distances from water. Nesting occurs from April to July in locations that are unshaded, and have well-drained soil. Individuals may nest multiple times in the same year. In California, hatching typically occurs between July and September; however, hatchlings sometimes do not emerge from nest-hole chambers until the following spring (Stebbins and McGinnis 2012).

The red-eared slider is omnivorous, and its diet has been documented to include aquatic plants, crustaceans, insects, snails, fish, amphibian larvae, and various types of carrion (Stebbins 2003; CaliforniaHerps.com). During cold periods, red-eared slider is inactive under water or concealed below the surface on land.

In 2014, UWCD captured red-eared sliders in Piru Creek below the Santa Felicia Dam 18 miles south of the Project, during an aquatic species eradication effort (UWCD 2014). This species has the potential to occur within the Project vicinity.

[20] Photo credit: Trisha M. Shears [Own work] [public domain], via Wikimedia Commons

Table 4.5-2. Aquatic Invasive Species Known to Occur or with the Potential to Occur in the Project Vicinity

Species	Status or Listing: (1) CCR, (2) FGC, (3) Lacey Act, (4) Cal-IPC, (5) CDFA	Habitat Requirements	Known to Occur in the Project Vicinity
Red-eared (Pond) Slider (*Trachemys scripta elegans*)	None	Calm water habitats with abundant aquatic vegetation (Stebbins 2003 and Californiaherps.com).	No. The closest reported occurrence was in Piru Creek just below the Santa Felicia Dam, approximately 9 miles south of the Project (UWCD 2014).
American bullfrog (*Lithobates catesbeianus*)	None	Quiet waters of ponds, lakes, reservoirs, irrigation ditches, streams, and marshes (CDFW 2014b)	Yes. Occurrences reported in Piru Creek downstream of Pyramid Dam. (Environmental Science Associates 2010a, 2011, 2012, 2013, 2014a, 2015a)
African clawed frog (*Xenopus laevis*)	(1) 14 CCR § 671(c)(3), Restricted Species	Warm, stagnant grassland ponds as well as in streams in arid and semi-arid regions (Garvey 2000).	Yes. Occurrences reported at a majority of study areas along the Santa Clara River in 2008 (SCRTR 2008).
European Ear Snail (*Radix auricularia*)	14 CCR Section 671(c)(9)None	Freshwater lakes, ponds, and slow-moving rivers with mud bottoms (Sytsma et al. 2004).	No. The closest reported occurrence was in a non-specific water body in Ventura in 2001, approximately 30 miles from the Project (USGS 2015a)
Asian clam (*Corbicula fluminea*)	None	Freshwater lakes, reservoirs and streams, and often buried in sandy, bottom sediments (USGS 2015b)	No. The closest reported occurrence was in Lake Piru, near Filmore, in 1979 roughly 11.5 miles south of the Project. A second occurrence was noted in an unspecified reach of the Los Angeles Aqueduct in 1969, approximately 21 miles east of the Project. (USGS 2015a).
Quagga mussel (*Dreissena rostriformis bugensis*)	(1) 14 CCR § 671(c)(10),Restricted Species; (2) FGC §§ 2301 and 2302, Regulated	Freshwater lakes, reservoirs and streams and colonize soft and hard substrates (USGS 2015c)	No. An occurrence was reported in Lake Piru in 2013 downstream of Pyramid Lake, approximately 23 miles from the Project (ACWA 2013)
Zebra mussel (*Dreissena polymorpha*)	(1) 14 CCR § 671(c)(10), Restricted Species; (2) FGC §§ 2301 and 2302, Regulated; (3) Federal Lacey Act (18 U.S.C. 42) lists zebra mussels as injurious wildlife	Freshwater lakes, reservoirs and streams and colonize any stable substrate (USGS 2015d)	No. The closest reported occurrences were in San Justo Reservoir, San Benito County, in 2008, approximately 209 miles northwest of the Project, and in a pump at Ridgemark Golf Course in 2012, approximately 204 miles northwest of the Project (USGS 2015a).

Table 4.5-2. Aquatic Invasive Species Known to Occur or with the Potential to Occur in the Project Vicinity (continued)

Species	Status or Listing: (1) CCR, (2) FGC, (3) Lacey Act, (4) Cal-IPC, (5) CDFA	Habitat Requirements	Known to Occur in the Project Vicinity
New Zealand mudsnail *(Potamopyrgus antipodarum)*	(1) 14 CCR § 671(c)(9), Restricted Species	Freshwater and brackish lakes, reservoirs and streams (CDFW 2015b)	No. The closest reported occurrence by NAS was in a manmade channel in Anaheim in 2013, approximately 73 miles south of the Project (USGS 2015a).
Cyanobacteria Species	None	Freshwater bodies (USGS 2015)	Yes. Pyramid Lake (DWR 2014).
Eurasian watermilfoil (*Myriophyllum spicatum*)	(4) Cal-IPC ‘high’	Typical habitat includes fresh to brackish water of ponds, lakes, slow-moving streams, reservoirs, estuaries and canals, 3-32 feet in depth. (NPS 2010)	Yes. Pyramid Lake in 2015 (DWR 2016a).
Sago Pondweed (*Stuckenia pectinata*)	None	Semi-permanent to permanently flooded areas where the water is less than 8 feet deep (Casey 2010)	Yes. Pyramid Lake (DWR 2014, 2016a).
Coontail or Hornwart (*Ceratophyllum demersum*)	None	Inland and coastal ponds, lakes, and slow moving streams and rivers (Department of Ecology 2015).	Yes. Pyramid Lake (DWR 2014).
Water hyacinth (*Eichhornia crassipes*)	(4) Cal-IPC “high”	Both natural and man-made freshwater systems (e.g., ponds, sloughs and rivers) (Cal-IPC 2015b).	No. The closest reported occurrence in the Thousand Oaks quadrangle, south west of the Project (Cal-IPC 2015a).
Parrot’s feather milfoil *(Myriophyllum aquaticum)*	(4) Cal-IPC “high”	Ponds, lakes, rivers, streams, canals, and ditches, usually in still or slow-moving water, but occasionally in faster-moving water of streams and rivers (Cal-IPC 2015c)	No. The closest reported occurrence was reported in the Sunland quadrangle, south of the Project (Cal-IPC 2015a).
Water Primrose (*Ludwigia* spp.)	(4) Cal-IPC ‘high’	Persists in both wet and dry transitional zones, such as lakes, ponds, reservoirs, rivers, stream, canals, bogs, marshes, riparian and bottomland habitats (Cal-IPC 2015d)	No. The closest reported occurrence was in the Simi Valley and Thousand Oaks quadrangles, just southwest of the Project (Cal-IPC 2015a)

Sources: USGS 2015a, 2015b, 2015c; ACWA 2013; Casey 2010; DWR 2014; Department of Ecology 2015; Cal-IPC 2015
Key:
Cal-IPC = California-Invasive Plant Council
CCR = California Code of Regulations
CDFA = California Department of Food and Agriculture
FGC = Fish and Game Code

4.5.2.2 American Bullfrog[21]

The American bullfrog (*Lithobates catesbeianus*) is the largest frog in North America (up to 8 inches snout to vent length [SVL]). Native to eastern and central North America, the American bullfrog was first introduced to California in the 20th century as a food source, and was spread further by fish stocking. The species is currently widespread and well-established in California, with populations found up to 6,000 feet elevation (Zeiner et al. 1988).

American bullfrog is highly aquatic and closely associated with permanent or semi-permanent water bodies, including ponds, lakes, reservoirs, irrigation ditches, streams, and marshes, and are capable of dispersing long distances during wet periods (CDFW 2015a). In California, breeding can occur as early as March and as late as July, depending on local conditions, but generally later than native amphibians in the same areas and over a longer period of time (Jones et al. 2005; Cook and Jennings 2007). Breeding sites are often characterized by abundant submerged aquatic or emergent vegetation. Individual clutches are large (10,000 to 20,000 eggs per female). Tadpoles are found primarily in warm, shallow water, and grow to large sizes before metamorphosing, often in their second year (Jones et al. 2005). The presence of predatory fish, particularly black bass (*Micropterus* spp.) and sunfish (*Lepomis* spp.), is a good indicator of bullfrog habitat suitability. Larvae benefit by the presence of fish feeding on predatory aquatic insects that could have preyed upon bullfrog larvae; bullfrog larvae are generally avoided in the presence of fish (Kruse and Francis 1977; Werner and McPeek 1994; Adams et al. 2003).

Similar to most native frogs, American bullfrog is an opportunistic, gape-limited predator; however, because this species grows to such a large size, a broad array of species are potential prey, particularly those closely associated with aquatic habitats, including smaller frogs, turtles, fish, and crayfish, as well as aerial insects, birds, and bats (Nafis 2013; CDFW 2014). American bullfrog has also been implicated in the spread of the chytrid fungus, *Batrachochytrium dendrobatidis*, the agent in the potentially fatal disease of frogs called chytridiomycosis, although several native frog species have also been shown to be carriers (Padgett-Flohr 2008; Feller et al. 2011).

Management methods for American bullfrog are limited to localized populations, as eradicating bullfrogs from large water bodies is currently infeasible. Currently, there are only a few methods for managing bullfrogs, including chemical control, bullfrog-specific traps and hunting. Prevention remains the best means of management (Snow and Witmer 2010).

[21] Photo credit: Jarek Tuszynski [CC BY-SA 3.0 (http://creativecommons.org/licenses/by-sa/3.0)], via Wikimedia Commons

American bullfrog was documented in 2008 along the Santa Clara River during a bioassessment project prepared for the Santa Clara River Trustee Council (SCRTR 2008). The species is well-established on Pyramid reach, where it is regularly observed during annual sensitive species surveys (Environmental Science Associates 2010, 2011, 2012, 2013, 2014, 2015). As a result of potential habitat in the Project area and its known occurrence just downstream, this species has the potential to occur in the Project area.

4.5.2.3 African Clawed Frog[22]

The African clawed frog (*Xenopus laevis*) is a smooth-skinned frog that grows to more than 5.5 inches SVL. Native to sub-Saharan Africa, the African clawed frog was brought to the United States in the 1940s and widely used as a standard laboratory animal, human pregnancy test animal, and sold in the pet trade (California Herps 2015).

African clawed frog is classified as a "detrimental animal" and restricted by 14 CCR § 671, FGC § 2110 (Importation, Transportation and Possession of Restricted Species), because it poses a threat to native wildlife. As such, it is illegal to import, transport, or possess live animals of this species, except under permit from CDFW.

Reproducing populations of African clawed frog are known to occur in Arizona and in California, where the species is well-established in San Diego, Los Angeles, and Orange Counties, and adjacent parts of Ventura and San Bernardino Counties. Crayon (2005) indicates that warm-water lotic (i.e. moving water) systems, including areas of brackish water, are particularly vulnerable to infestation once the species becomes established along a channel, although drought may limit its spread and predatory fish may limit size of populations.

The African clawed frog is highly aquatic; however, individuals are capable of dispersing over land in response to habitats drying out and more often will bury themselves within the mud of drying ponds. They are opportunistic scavengers and predators, known to take a wide variety of prey, although aquatic invertebrates tend to predominate where diets of wild frogs have been studied (Crayon 2005). Other frogs, fish eggs, and small fish (at least under confined or high density conditions) may also be vulnerable prey items. Cannibalism on larvae may also allow African clawed frog to persist in areas where other prey are scarce.

Efforts to eradicate African clawed frog populations in California have included draining ponds, using poisons, and capturing and removing frogs (Crayon 2005). However,

[22] Photo credit: Chris Brown, USGS [public domain], via Wikimedia Commons

these approaches have generally been unsuccessful because of the difficultly in eliminating entire populations and sites are usually recolonized from adjacent areas.

African clawed frog was documented in 2008 throughout a majority of unspecified study areas along the Santa Clara River during a bioassessment project prepared for the Santa Clara River Trustee Council (SCRTR 2008). As a result of potential habitat in the Project area and multiple vectors that could reasonably transport the species to the Project area, this species has the potential to occur in the Project area.

4.5.2.4 European Ear Snail[23]

The European ear snail (*Radix auricularia*) is a small freshwater mollusk inhabiting lakes, ponds, and slow-moving rivers with mud bottoms. The species can live on rock or vegetation in low and high flow environments and is tolerant of oxygen depleted conditions and extreme pollution (USGS 2015c). The spread of the species can be attributed to the translocation of eggs on plant material via the aquarium trade as well as, the movement of boats and equipment between water bodies (Golden Sands 2015).

The species self-fertilizes and partakes in two breeding events per year. One individual can produce up to 1,300 eggs each year. The European ear snail feeds mostly on decaying organic material and algae. It is an important host organism to many trematode parasites, especially the liver flukes *Fasciola gigantica* and *F. hepatica*. The species is also an important prey item for few fish and turtle species. Its impacts to native aquatic organism communities are largely unknown (Golden Sands 2015).

Manual removal of snails is possible, but infeasible in most cases. This snail's preference for soft substrates makes access difficult for eradication purposes, and those individuals burrowed into the substrate are often hard to find. Pesticides are used to control snails, but are not species-selective. They may be effective on the European ear snail, but other snails would also likely be harmed by the use of pesticides. No effective biological control agent is known at this time (Golden Sands 2015).

NAS reported one occurrence of European ear snail in a non-specific water body in Ventura in 2001, approximately 30 miles from the Project (USGS 2015a). As a result of potential habitat in the Project area and potential transport to the Project area on recreational boats and equipment, this species has the potential to occur within the Project area.

[23] Photo from: <http://nas.er.usgs.gov/queries/factsheet.aspx?SpeciesID=1012>

4.5.2.5 Asian Clam[24]

The Asian clam (*Corbicula fluminea*) is a small freshwater mollusk, native to southern Asia, eastern Mediterranean and the Southeast Asian islands to Australia. The species was first located in the United States in 1938 in the Columbia River and is believed to have been brought over by immigrants as food. Bait buckets, aquaculture and intentional introductions for consumptive purposes are thought to be responsible for its spread (USGS 2015d).

The Asian clam is known to inhabit lakes, reservoirs and streams often covering themselves in sandy, bottom sediments. These bivalves cause serious structural damage, weakening dams and related structures. The species has a low tolerance to cold water, which causes fluctuations in population numbers. Additionally, the Asian clam exhibits sensitivity to salinity, drying, low pH and siltation (USGS 2015d). Management methods include mechanical removal, barrier placement, and chemical and temperature alteration to water systems. (USGS 2015d).

Per SFD staff, the Asian clam is known to occur in project reservoirs. The 2007 biological survey completed for the boat dock sediment removal project observed Asian clam in grab samples at Pyramid Lake (DWR 2016a).

4.5.2.6 Quagga Mussel[25]

The quagga mussel (*Dreissena rostriformis bugensis*) is a small freshwater mollusk native to the Dnieper River drainage of Ukraine and the Ponto-Caspian Sea. The discharge of ballast water from large ocean liners deposited the mollusk in North America. Quagga mussel was first found in the United States in 1989 in the Great Lakes and has since spread west (USGS 2015). Larval drift and attachment to recreational and commercial boating vessels have enabled their spread throughout other regions of the United States.

The quagga mussel inhabits lakes, reservoirs and rivers. It can colonize a variety of hard substrates and is capable of causing extensive damage to hydropower facilities, pumping plants, and raw water conveyance systems by clogging small diameter pipes, intakes and fish screens, and interfering with recreational opportunities (Mackie and Claudi 2010). Ecological impacts associated with the quagga mussel include changes in the phytoplankton community due to filter feeding, increase in water clarity causing an increase in macrophyte growth and possibly harmful algal blooms, alteration of the benthic community, and biofouling of native mussels and clams (Mackie and Claudi 2010).

---

[24] Photo from: <m.wxxi.org>
[25] Photo from: < http://www.100thmeridian.org/Images/Mead/quagga.jpg>

Quagga mussels cannot tolerate salinity over 10 ppt (Mackie and Claudi 2010). Studies and field surveys have demonstrated that if calcium levels are low (less than 12 mg/L), the adult quagga mussel will not survive and veligers (i.e., larvae) will not develop. Other parameters that inhibit their survival and development include pH, water hardness and temperature (Mackie and Claudi 2010). A vulnerability analysis concluded that the Project area provides suitable habitat for the quagga mussel (Claudi and Prescott 2011).

Research is being done on the management of the quagga mussel; however, preclusion is currently the only effective approach (USGS 2015). Biological control research has concentrated on species that prey on veligers or attached mussels, predominantly birds and fish. Most of these predators do not occur in North America and comparable species have not been observed preying on dreissenids at levels that can limit populations of mussels. In California, native and non-native predators include redear sunfish (*Lepomis microlophus*), smallmouth bass (*Micropterus dolomieu*), diving ducks (Aythyinae ssp.), and crayfish (Cambaridae spp.) (Hoddle 2014).

Under 14 CCR § 671(c)(10), the quagga mussel is listed as a Restricted Species, which means it is "unlawful to import, transport, or possess live [quagga mussels] except under permit issued by the department." Additionally, pursuant to this regulation, all species of *Dreissena* are termed detrimental, which means they pose a threat to native wildlife, the agricultural interests of the State, or to public health or safety.

In addition, FGC §§ 2301 and 2302 provide specific regulations on dreissenid mussels, including quagga and zebra mussels. FGC § 2301 states that nobody shall: "possess, import, ship, or transport in the state, or place, plant, or cause to be placed or planted in any water within the state, dreissenid mussels." This law gives the director of CDFW, or his or her designee, the right to conduct inspections of conveyances, order conveyances to be drained, impound or quarantine conveyances, and close or restrict access to conveyances to prevent the importation, shipment, or transport of dreissenid mussels. Additionally, FGC § 2301 requires a public or private agency that operates a water supply facility to prepare and implement a plan to control or eradicate dreissenid mussels if detected in their water system. This law also requires any entity which discovers dreissenid mussels to immediately report the finding to CDFW.

Pursuant to FGC § 2302, any person, or federal, State, or local agency, district, or authority that owns or manages a reservoir where recreational, boating, or fishing activities are permitted, shall: (1) assess the vulnerability of the reservoir for introduction of dreissenid mussels; and (2) develop and implement a program designed to prevent the introduction of dreissenid mussels. At a minimum, the prevention program shall include public education, monitoring, and management of the recreational, boating, and fishing activities that are permitted. DWR completed its vulnerability assessment and implemented a prevention program in 2011.

Beginning in 2007, DWR began early detection monitoring, and developed and implemented the confidential Quagga and Zebra Mussel Rapid Response Plan (DWR 2010b). The purpose of this plan is to coordinate a rapid, effective, and efficient intraand interagency response to a reported sighting of mussels in order to delineate, contain, control and, when feasible, eradicate zebra and quagga mussel populations if they are introduced into or become established in SWP waters that includes Project waters. The plan outlines immediate actions necessary to respond to non-confirmed sightings and positively confirmed populations of quagga or zebra mussels. The plan describes methods to: determine the distribution of mussels in a SWP facility and/or waterbody; manage pathways (control water flow and other vectors); conduct short- and long-term monitoring; and apply appropriate and immediate control measures on new mussel populations within the SWP (DWR 2010b).

DWR conducts early detection monitoring for veliger and adult quagga and zebra mussels. Larval vertical tow surveys are conducted twice monthly at the water quality station at Pyramid Lake. Attached mussel monitoring occurs monthly at Pyramid Lake. There was no evidence of quagga mussel in the Project area in 2015 (DWR 2015d).

Additionally, Los Angeles County DPR has implemented an Invasive Species Boat Inspection Program, which covers Pyramid Lake. In 2011, an agreement between Los Angeles County DPR and DWR was made to aid in reducing introduction potential. That same year a physical watercraft inspection process was implemented. There have been no quagga mussels detected to date. Los Angeles County DPR also provides public outreach and education regarding quagga and zebra mussels to Pyramid Lake visitors.

A discovery of quagga mussels was reported to the CDFW in 2013 from UWCD staff at Lake Piru. Lake Piru now institutes a mandatory inspection program, where recreationists must inspect their boats and fill in a survey form or risk citations. However, the reservoir has not been closed to recreation at this time. UWCD is developing a Quagga Mussel Monitoring and Control Plan in consultation with CDFW, which will be filed with FERC (ACWA 2013).

Due to the close proximity of a known infestation of quagga mussels and the possibility of recreationists using both Lake Piru and the Project area for boating, there is a potential for quagga mussels to be introduced into the Project area.

4.5.2.7 Zebra Mussel[26]

The zebra mussel (*Dreissena polymorpha*) is a small freshwater mollusk, native to the Black, Caspian and Azov Seas. The discharge of ballast water from a single commercial cargo ship into the Great Lakes in 1988 is responsible for their introduction into the United States. Larval drift along with attachment to recreational and commercial boating vessels have enabled their spread (USGS 2015f).

[26] Photo from: <http://watrnews.com/2012/07/zebra-mussels-found-in-lake-ray-roberts/>

Zebra mussels inhabit lakes, reservoirs and rivers. It can colonize a variety of substrates and is capable of causing extensive damage to hydropower facilities, pumping plants, and raw water conveyance systems by clogging small diameter pipes, intakes and fish screens, as well as interfering with recreational opportunities (Mackie and Claudi 2010). Ecological impacts associated with the zebra mussel include changes to the phytoplankton community due to filter feeding, increase in water clarity causing an increase in macrophyte growth and possibly harmful algal blooms, alteration of the benthic community, and biofouling of native mussels and clams (Mackie and Claudi 2010).

The zebra mussel can tolerate only very low salinity (less than 10 ppt). Additionally, data show that if calcium levels are low (less than 12 mg/L), adult mussels will not survive and veligers will not develop (Mackie and Claudi 2010, Claudi and Prescott 2011). Other parameters that hinder survival and development include pH, water hardness and temperature (Mackie and Claudi 2010). A vulnerability analysis concluded that the Project area provides suitable habitat for the zebra mussel (Claudi and Prescott 2011).

Extensive research is being conducted on post introduction management and although there are promising leads, prevention is seen as the most effective strategy (USGS 2015f). Research on biological control methods has focused on predators, particularly birds (i.e., 36 species) and fish (i.e., 53 species that eat veligers and attached mussels). In California, native and non-native species predators include redear sunfish, smallmouth bass, diving ducks and crayfish (Hoddle 2014).

The Federal Lacey Act (18 U.S.C. 42) lists zebra mussels as injurious wildlife, whose importation, possession, and shipment within the United States is prohibited. If found, any zebra mussels brought into the United States will be promptly destroyed or exported by the USFWS at the cost of the importer.

Similar to the quagga mussel, the zebra mussel warrants protection under the CCR and FGC (see quagga mussel description above).

NAS reported two occurrences of zebra mussel in central California. The first occurrence was at San Justo Reservoir, San Benito County, in 2008, approximately 209 miles northwest of the Project. The second occurrence was reported in a pump in Hollister, San Benito County, at Ridgemark Golf Course in 2012, roughly 204 miles northwest of the Project (USGS 2015a).

As described in detail above for quagga mussel, DWR began early detection monitoring in 2007, and developed and implemented the confidential Quagga and Zebra Mussel Rapid Response Plan (DWR 2010b).

4.5.2.8 New Zealand Mudsnail[27]

New Zealand mudsnail (*Potamopyrgus antipodarum*) is a small freshwater mollusk native to the lakes and streams of New Zealand. Ballast water discharge from cargo ships into the Great Lakes is likely responsible for their introduction into the United States. Since then, attachment to recreational and commercial boating vessels has facilitated their spread (CDFW 2015c).

New Zealand mudsnails inhabit brackish lakes, reservoirs and streams. It can endure high siltation and benefit from disturbance and high nutrient flows. Individuals compete with other grazers, causing decreases in species richness. Declines in algal production can reduce food resources available to native species (CDFW 2015c).

Under 14 CCR § 671(c)(9)(A), the New Zealand mudsnail is listed as a Restricted Species, which means it is "unlawful to import, transport, or possess live [New Zealand mudsnail]…except under permit issued by the department." Additionally, pursuant to this regulation, New Zealand mudsnails are termed "detrimental," which means they pose a threat to native wildlife, the agricultural interests of the State, or to public health or safety.

There are few management strategies for New Zealand mudsnails, primarily for smaller water bodies that can be isolated. Methods include chemical control and draining water to allow temperature fluctuations that affect substrate temperatures. CDFW has recommended methods for decontaminating equipment and boats after using them in known infested waters (CDFW 2015c). Management in large water bodies is difficult, and research is ongoing.

The closest reported occurrence by NAS was in a manmade channel in Anaheim in 2013, approximately 73 miles south of the Project (USGS 2015a). The species has the potential to occur in the Project area.

4.5.2.9 Cyanobacteria Species[28]

Cyanobacteria, often called blue-green algae, occur in most freshwater ecosystems. Cyanobacteria are photosynthetic, nitrogen fixers. Nitrogen fixers fix atmospheric nitrogen into organic forms of nitrogen (i.e., nitrate or ammonia). Blooms of cyanobacteria occur as a result of access nutrients, optimal temperature and light, and lack of water turbulence (USGS 2015).

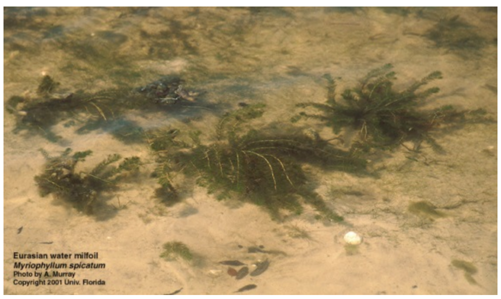
[27] Photo from < http://www.seagrant.umn.edu/newsletter/2006/06/images/mudsnail.jpg>
[28] Photo from: http://ks.water.usgs.gov/cyanobacteria.

Water quality issues are associated with cyanobacteria blooms. Cyanobacteria produce compounds including 2-methylisoborneol and geosmin that bring about unpleasant taste and odor in drinking water and make fish unpalatable (USGS 2015).

According to 2014 DWR phytoplankton sampling data from Pyramid Lake, *Anabaena lemmermannii,* Aphanizomenon spp., Pseudanabaena spp., *Worenchinia naegelianum,* Microcystis spp., and Gleotrichia spp. are invasive cyanobacteria species (DWR 2014).

In order to control cyanobacteria blooms, DWR applies aquatic herbicides on an as-needed basis in Pyramid Lake. A 2015 Annual Monitoring Report only reported the use of diquat to treat aquatic weeds in Pyramid Lake. No treatments were applied in Pyramid Lake in 2015 to specifically control cyanobacteria (DWR 2016a).

4.5.2.10 Eurasian Watermilfoil[29]



Eurasian watermilfoil (*Myriophyllum spicatum*) grows submerged, rooted in mud or sand, with branching stems 12 to 20 ft long that widen towards the root. Its leaves are finely divided, feather-like, 0.5 to 1.5-in long and whorled in groups of 3 to 6 (commonly 4) around the stem. Its spike of flowers, 1.5 to 3.0–in long, extends up from the water surface, and is typically pink in color (Cal-IPC 2014; DiTomaso et al. 2013).

Watermilfoil grows rapidly in spring (March-April), creating dense mats on the surface of freshwater lakes, ponds, and slow-moving waters (Cal-IPC 2014). In the early 1990s, it was present but uncommon in San Francisco Bay Area ditches and lake margins, as well as in the Sacramento-San Joaquin Delta (SFEI 2014). The University of Reno reports that in 2002, Eurasian watermilfoil covered over 160 acres of Lake Tahoe (Donaldson and Johnson 2002). Watermilfoil is now widespread throughout California, especially through the Central Valley in the Sacramento River Watershed, its tributaries, and the Delta.

The key factor for the establishment of Eurasian watermilfoil is still water (Donaldson and Johnson 2002). Eurasian watermilfoil reproduction is primarily vegetative via rhizomes, stem fragments, and axillary buds. Some populations produce seeds, although seed reproduction appears to be insignificant (DiTomaso et al. 2013). Watermilfoil can tolerate a wide range of environmental conditions, including low light levels, high or low nutrient waters, and freezing water temperatures. In waters where temperatures do not drop below 10°C, there is little seasonal die-back (Cal-IPC 2014); high temperatures promote multiple periods of flowering and fragmentation. Eurasian watermilfoil also creates its own habitat by trapping sediment and initiating a favorable environment for further establishment. It is an opportunistic species that prefers

[29] Photo from http://www.sfei.org/nis/milfoil.html.

disturbed substrates with much nutrient runoff (Cal-ICP 2014). Watermilfoil can grow on sandy, silty, or rocky substrates, but grows best in fertile, fine-textured, inorganic sediments. The plant will thrive in brackish waters with a salinity of up to 10 parts per thousand. As the plant is easily spread by vegetative fragments, transport on boating equipment plays the largest role in contaminating new water bodies. A single stem fragment hitching a ride on a boat or trailer can spread the plant from lake to lake (Donaldson and Johnson 2002).

Efforts are underway to identify insects which are native to Nevada or California that prey on the plant and help control Eurasian watermilfoil. A North American native milfoil weevil (*Euhrychiopsis lecontei*) has been identified in several studies in other states and Canada as a possible control species. Triploid grass carp may also be an effective biocontrol mechanism; however, grass carp prefer other submerged weeds, including native species, to watermilfoil (DiTomaso 2013). Other control techniques for this species includes mechanical removal, herbicide treatment, benthic barriers (such as mats to prevent establishment), and tillage (Invasive Species Compendium 2014). Mechanical removal can help remove stem densities, but escaped stem fragments can drift to other areas and develop into new plants (DiTomaso 2013). The most effective technique is to prevent its spread and establishment in new waterbodies.

Infestations of Eurasian watermilfoil are an ongoing problem at Pyramid Lake. In some areas of the lake, Eurasian watermilfoil beds can pose a risk to swimmers as swimmers can become entagled in the plant (DWR 2014). Currently, DWR has measures in place to control this non-native species at Pyramid Lake. When DWR deems necessary, herbicides are applied to the lake to reduce populations. In 2015, DWR treated Pyramid Lake three times with herbicides (diquat) to control the invasion (DWR 2016a).

Eurasian watermilfoil is given a “high” invasive plant rating by the Cal-IPC, meaning “the species has severe ecological impacts on physical processes, plant and animal communities, and vegetation structure” (Cal-IPC 2014).

4.5.2.11 Sago Pondweed[30]

Sago pondweed (*Stuckenia pectinata*) is a freshwater plant that can grow up to 3 feet tall. Sago pondweed is generally submersed except the reproductive stalk that flowers between June and September. The flower stalk can be up to 2 inches long and the fruits are yellow to brown. Sago pondweed is considered a noxious weed in waters used for recreational purposes and irrigation. Dense formations of sago pondweed beds may also limit movement of feeding fish and inhibit fishing success (Casey 2010).

Sago pondweed occurs worldwide and is found submerged in semi-permanent to permanently flooded areas where the water is less than 8 feet deep. The species can be found at elevations from sea level to almost 16,000 feet above sea level. Sago pondweed grows on nearly all substrates and tolerates high salinity, pH fluctuations, and alkaline water (Casey 2010). According to DWR's Aquatic Pesticides Application Plan, Pyramid Lake is subject to infestations of aquatic weeds including sago pondweed (DWR 2014d, 2016). As previously mentioned, DWR applied herbicides at Pyramid Lake in 2015 to control invasive plants including sago pondweed (DWR 2016a).

4.5.2.12 Coontail[31]

Coontail (*Ceratophyllum demersum*) is a rootless perennial possessing stiff whorls of forked olive-green leaves. The leaves are sometimes coated with lime, giving them a crunchy texture. Coontail tends to form dense colonies either anchored in the mud or floating freely near the surface. The species prefers inland and coastal ponds, lakes, and slow moving streams and rivers (Department of Ecology: State of Washington. 2015).

The aquarium and pond trade are largely responsible for its initial introduction. Its existence can affect phytoplankton development in multiple ways: by competition for nitrogen, competition for light, and allelopathy (i.e., chemical inhibition of one species by another). A dense bed of coontail can remove up to 0.0035 ounce of nitrogen per 10.8 square feet per day during the preliminary growth stages. Contaminated nets, boat trailers and anchors, and drainage machinery have facilitated its spread. The

[30] Photo from: http://newfs.s3.amazonaws.com/taxon-images-1000s1000/Potamogetonaceae/stuckenia-pectinata-ff-dcameron-a.jpg
[31] Photo from: http://www.discoverlife.org/mp/20p?see=I_MWS119649&res=640&guide=Wildflowers&cl=US/IN

fragmentation of shoots, and formation of turions[32] also are important means of distribution to new habitats. (GISD 2015).

According to the DWR's Aquatic Pesticides Application Plan, Pyramid Lake is subject to infestations of aquatic weeds including coontail and is treated to reduce the infestations of this aquatic invasive plant (DWR 2014d, 2016).

4.5.2.13 Water Hyacinth[33]

Water hyacinth (*Eichhornia crassipes*) is a free-floating perennial. It has bushy, fibrous roots and is found in bulky mats on the water surface. Seedlings are most often rooted in mud along shorelines or on floating mats (DiTomaso et al. 2013; Cal-IPC 2015e).

Native to Central and South America, the water hyacinth was introduced into the United States in 1884 as an ornamental plant for water gardens. In California, water hyacinth typically is found below 660 feet elevation in the Central Valley, the San Francisco Bay area, and the South Coast region (Cal-IPC 2015e).

Water hyacinth can be found in both natural and man-made freshwater systems. Water hyacinth obtains nutrients directly from the water and grows at a considerable pace, doubling its size every 10 days in warm weather. The species has the ability to alter water quality beneath its mats by lowering pH, dissolved oxygen and light levels, and increasing carbon dioxide and turbidity (Cal-IPC 2015e).

Vegetative reproduction occurs from late spring through fall. Water hyacinth reproduces primarily from runners, and in as little as a week, the number of individuals can double. Plant fragments spread via a number of mechanisms, including the break off of daughter plants. Water hyacinth also reproduces by seed, which can spread by flowing water and by clinging to the feet or feathers of birds (Cal-IPC 2015e; DiTomaso et al. 2013).

At present, aquatic herbicides remain the primary tool available to control water hyacinth. Two weevils (*Neochetina eichhorniae* and *N. bruchi*) and a moth (*Sameodes albiguttalis*) have been introduced as biological controls, but have not demonstrated much success (Cal-IPC 2015e).

The California Invasive Plant Council (Cal-IPC) gives water hyacinth a "high" invasive plant rating, meaning "the species has severe ecological impacts on physical processes, plant and animal communities, and vegetation structure" (Cal-IPC 2015e).

[32] A bud type that is capable of growing into a complete plant.
[33] Photo from: <http://www.sfei.org/nis/hyacinth.html>

Cal WeedMapper reports the closest occurrence of water hyacinth in the Thousand Oaks quadrangle, south west of the Project (Cal-IPC 2015a). The species has the potential to occur in the Project vicinity due to the potential to be transported to reservoirs on boats and other recreation equipment, and the presence of suitable habitat present in the Project area.

4.5.2.14 Parrot's Feather Milfoil[34]

Parrot's feather milfoil (*Myriophyllum aquaticum*) is an aquatic perennial that forms dense mats of intertwined brownish rhizomes in the water column (Cal-IPC 2015f). Stems are submerged and can grow up to 16 feet in length. The emerged leaves are light gray-green and resemble a bottlebrush. The bottlebrush appearance results from the whorled feather-like leaves (DiTomaso et al. 2013).The species was thought to be introduced in the 1800's to early 1900's from South America as an aquarium plant and pond ornamental.

In California, parrot's feather milfoil grows most rapidly from March until September. In spring, the shoots start to grow from overwintering rhizomes as water temperature surges (Cal-IPC 2015f).

Parrot's feather milfoil occurs in ponds, lakes, rivers, streams, canals, and ditches, typically in still or slow-moving water, but occasionally in faster-moving water. With its resilient rhizomes, parrot's feather milfoil can be transported long distances. Once rooted, new plants produce rhizomes that spread through sediments and stems that grow until they reach the water surface. (Cal-IPC 2015f).

Biological, mechanical, and chemical controls have all been attempted. Of the available methods, chemical control seems to have the highest likelihood for success. Biological control is largely unsuccessful, with many biological control foragers finding the plant unpalatable. Mechanical control is problematic due to the plant's ability to regenerate from small fragments and its speedy growth rate. There are numerous chemical treatments that may work, but many do not specifically target milfoil and may damage native species as well (Invasive Species Compendium 2014).

Parrot's feather milfoil is given a "high" invasive plant rating by the Cal-IPC, meaning "the species has severe ecological impacts on physical processes, plant and animal communities, and vegetation structure" (Cal-IPC 2015f).

Cal WeedMapper reported occurrences of parrot's feather milfoil in the Sunland quadrangle, south of the Project (Cal-IPC 2015a). The species has the potential to occur in the Project area due to the potential to be transported to Project waters by recreation boats and other recreation equipment, and the presence of suitable habitat present in the Project area.

[34] Photo from http://www.ecy.wa.gov/programs/wq/plants/weeds/aqua003.html.

4.5.2.15 Water Primrose[35]

Several water primrose species (*Ludwigia* spp.) are found in California. Non-native species include Uruguay water-primrose (*L. hexapetala*) and creeping water primrose (*L. peploides* ssp. *montevidensis*), among others. Water primrose is part of an aquatic plant family of which most species are native to South America. Water primroses are emergent perennials with stems up to 10 feet long (Cal-IPC 2015d).

Water primrose reproduces vegetatively and by seed. Water primrose establishes in areas with disturbed hydrology, high nutrient loading and flooding. The species favors shallow, stagnant, nutrient-rich water such as flood control channels, irrigation ditches, and holding ponds (Cal-IPC 2015d).

The genus' main mode of dispersal is through flowing water when fragments break and can catch onto boats and other watercraft. Water primrose can also be consumed and possibly transported by waterfowl. Additionally, it is a common ornamental plant which makes it likely to be widely-spread by humans (Cal-IPC 2015d).

Water primrose species winged water-primrose (*L. decurrens*), *L. hexapetala*, and Peruvian water-primrose (*L. peruviana*) are listed by CDFA as Q-rated noxious weed species (CDFA 2015). Q-rated weeds are newly-listed pests that are treated as A-rated pending further study. Water primrose is rated as a "high" level invasive by the Cal-IPC, meaning "the species has severe ecological impacts on physical processes, plant and animal communities, and vegetation structure" (Cal-IPC 2015d).

Cal WeedMapper reported water primrose in the Simi Valley and Thousand Oaks quadrangles, just southwest of the Project boundary (Cal-IPC 2015a). The species has the potential to occur in the Project area due to the potential to be transported to the reservoir on boats and other recreation equipment and the suitable habitat present in the Project area.

4.5.3 <u>Use of Algaecides and Aquatic Herbicides</u>

As described in an April 25, 2014 NOI related to its NPDES Permit for Residual Aquatic Pesticide Discharges to Waters of the United States from Algae and Aquatic Weed Control Applications, DWR treats algae and aquatic weeds in SWP aqueducts, reservoirs and forebays. The DWR Aquatic Pesticides Application Plan associated with the NOI describe treatment areas, control tolerances, herbicide application and best management practices (BMP) implemented at the Project's Quail Lake and Pyramid Lake.

[35] Photo from http://www.cal-ipc.org/ip/management/plant_profiles/Ludwigia_hexapetala.php.

4.5.3.1 Quail Lake

Aquatic herbicides are applied to Quail Lake to manage taste and odor problems associated with the growth of cyanobacteria. Additionally, some species of cyanobacteria produce toxins that are harmful to human and animal health. Species identified in SWP reservoirs of southern California have included *Microcystis* sp., *Gloeotrichia* sp., and *Anabaena* sp. Quail Lake is also prone to influxes of aquatic weeds.

For aquatic weeds, the application area is determined yearly as a result of a vegetation survey and post analysis of impacts performed by DWR staff. The application area for aquatic algae is dependent on the source of taste and odor production, as determined by a Solid Phase Microextraction (SPME) analysis performed weekly by DWR staff. For each application, a map is generated showing the treatment area, immediate adjacent areas, and water bodies receiving treated water.

Chelated copper products (Komeen® or Nautique®), copper sulfate pentahydrate crystals, EarthTec®, Diquat, Endothall, Fluridone, Imazamox, Sodium carbonate peroxyhydrate, and Triclopyr have all been proven successful in treating algae and aquatic weed infestations. DWR's SFD has two licensed Pest Control Advisors (PCA) and six to eight certified Qualified Applicators (QAC). These individuals are trained to ensure that applications are at rates consistent with label requirements, in a manner that avoids potential adverse effects, and to ensure that proper storage and disposal practices are followed. The lake is closed for public access during treatment.

The effectiveness of the treatment is assessed 1 week after the application. Water quality monitoring is conducted before, during and after treatments. In addition, water quality is monitored downstream at Pyramid Lake quarterly, and the analytical results are available online through DWR's Water Data Library (DWR 2015b).

Appropriate parties are notified by email at least 48 hours prior to a treatment. The notification includes the treatment date and time as well as when releases will resume from the lake. Public notices are posted to inform the public of lake closures. Additionally, a PCA submits a written recommendation for use of the aquatic herbicide to the County Agricultural Commissioner.

4.5.3.2 Pyramid Lake

Aquatic herbicides are applied to Pyramid Lake to control taste and odor problems associated with the growth of cyanobacteria. Pyramid Lake experiences occurrences of algal blooms. Cyanobacteria species identified in the lake have included *Microcystis* sp., *Gloeotrichia* sp., and *Anabaena* sp. Pyramid Lake is subject to influxes of aquatic weeds including coontail, Eurasian watermilfoil, and sago pondweed. However as noted above, those aquatic invasive species are treated periodically.

The tolerance for invasive aquatic species should be extremely low and eradication of this class of plants is often a desired outcome, if technically possible. The tolerance for the presence of aquatic weed growth, particularly coontail and Eurasian watermilfoil, in the public access areas is zero.

For aquatic weeds, the application area is determined yearly as a result of a vegetation survey and post analysis of impacts performed by DWR staff. The application area for aquatic algae is dependent on the source of taste and odor production, as determined by a SPME analysis performed weekly by DWR staff, or cyanotoxin production as determined by enzyme linked immunosorbent assay (ELISA) performed monthly to bi-weekly by a contract laboratory. For each application, a map is generated showing the treatment area, immediate adjacent areas, and water bodies receiving treated water.

Chelated copper products (CaptainXTR® and EarthTec®), Diquat, granular formulations of endothall Fluridone, Imazamox, PAK®27 (sodium carbonate peroxyhydrate), and Triclopyr have all been proven successful in treating algae or aquatic weed infestations. DWR's SFD has two licensed PCAs and six to eight certified QACs. These individuals are trained to ensure that applications are at rates consistent with label requirements, in a manner that avoids potential adverse effects, and to ensure that proper storage and disposal practices are followed. The lake is closed for public access during treatment.

4.5.3.3 Elderberry Forebay

As described in a May 28, 2015 NOI related to its NPDES Permit for Residual Aquatic Pesticide Discharges to Waters of the United States from Algae and Aquatic Weed Control Applications, LADWP treats algae and aquatic weeds. The LADWP Aquatic Pesticides Application Plan associated with the NOI described treatment areas, control tolerances, herbicide application and BMPs implemented at Castaic Creek check dams and Elderberry Forebay. Invasive species are regularly removed from Elderberry Forebay. Pretreatment or preconstruction surveys are done prior to any invasive species removal and debris removal to check for sensitive species that may be affected.

Invasive plant species, including tamarisk, Spanish broom, and tree tobacco, are removed by mechanical means or by hand when feasible. Following mechanical removal, remaining stumps are treated with herbicide. Roundup® or other herbicide containing glyphosate is used because of its proven effectiveness. LADWP will apply pesticides only when there is a low chance of precipitation per the 7 day forecast, and will endeavor to apply herbicides only when the treatment areas are dry.

Herbicide is applied by LADWP personnel, contractors, or subcontractors who have either a QAC or a license issued by the State of California Department of Pesticide Regulation. These individuals are trained to ensure that herbicides are applied at rates consistent with label requirements and in a manner that avoids potential adverse effects.

4.5.4 Fish

4.5.4.1 Quail Lake

There is little information available regarding fish populations in Quail Lake. A single DWR brochure describes six species of fish that can be found in the lake including, striped bass (*Morone saxatilis*), channel catfish (*Ictalurus punctatus*), Sacramento blackfish (*Orthodon microlepidotus*), tule perch (*Hysterocarpus traski*), threadfin shad (*Dorosoma petenense*), and hitch (*Lavinia exilicauda*) (DWR 1997).

4.5.4.2 Gorman Creek

Licensees were unable to find any information regarding fish species residing in Gorman Creek, which is an ephemeral creek.

4.5.4.3 Piru Creek Upstream of Pyramid Lake

Piru Creek upstream of the NMWSE of Pyramid Lake is designated as a Heritage and Wild Trout Water even though CDFW had historically stocked rainbow trout in Piru Creek upstream of Pyramid Lake until 1979. CDFW developed a 5-year plan to guide the management of fish in Piru Creek upstream of Pyramid Lake (Bloom 2012). Wild Trout Waters are defined as supporting self-sustaining populations, have aesthetic value, have adequate environmental productivity, and are open to the public for angling. Management of Wild Trout Waters may include stocking with native strains of trout, although CDFW does not currently stock fish in Piru Creek upstream of Pyramid Lake. The plan states that CDFW manages the stream as a “fast-action” fishery (catching more than two fish per hour) through the use of adaptive management of regulations. Because this reach is designated as a Heritage and Wild Trout Water, fishing is limited to using artificial lures with barbless hooks. CDFW 2017 special fishing regulations Article 7.50 specifies a daily bag limit of two fish all year caught with artificial lures with barbless hooks. Trophy size fish (greater than 18 inches) are largely absent; however, large adfluvial trout from Pyramid Lake are occasionally observed spawning in the creek (Bloom 2012).

CDFW conducted depletion electrofishing and snorkel surveys periodically between 1996 and 2008 (Bloom 2012). Estimated density of rainbow trout ranged from zero to 830 fish per mile with an average of 324 fish per mile, and the weight of fish captured ranged from 0 to 3.2 ounces with an average of 1.7 ounces (Bloom 2012). Snorkel surveys were conducted in the creek and its tributaries in 2008 (CDFW 2008). Densities ranged from 0 to 2,648 fish per mile with an average of 852 fish per mile. YOY fish (age 0+) were only identified in Alamo and Mutau Creeks where they made up 23 and 48 percent of the observed fish, respectively. Fish less than 5.9 inches were the most common size class in Bucks, Piru, and Alamo Creeks, and averaged 79 percent of the population in those streams. YOY was the most common size class in Mutau Creek (48 percent).

Between 1996 and 2008, CDFW surveys found five species of non-native fish in Piru Creek upstream of Pyramid Lake: striped bass, channel catfish, largemouth bass, and green sunfish (*Lepomis cyanellus*). Migration by these species may be blocked at most flows by the USGS gaging station on Buck Creek or by a remnant piece of concrete which used to line the creek downstream from the confluence of Buck Creek and Piru Creek. However, largemouth bass have been caught by anglers upstream from the gage. Three additional Arizona-style road crossings (i.e., the road is built into the streambed) may present barriers to migration: Forest Road 8N12 crosses Seymour Creek one mile upstream from the confluence with Lockwood Creek, Forest Road 8N24 crosses Piru Creek, and Forest Road 8N01 crosses Piru Creek at Gold Hill. Those road crossings have not been evaluated for fish passage (Bloom 2012).

4.5.4.4 Pyramid Lake

The existing license includes the establishment of a self-propagating warm water fishery and a put-and-take rainbow trout fishery in Pyramid Lake (DWR 2002). The initial fish stocking in 1974 consisted mainly of largemouth bass and rainbow trout (FERC 1982). Additional species that have been documented in the lake include: striped bass, white catfish (*Ameiurus catus*), bigscale logperch (*Percina macrolepida*), hitch, Sacramento blackfish, tule perch, and shimofuri goby (*Tridentiger bifasciatus*) (CDFG 2001).

Other fish species have been cited as present in the reservoir by CDFG (2001) and CDFW (2013a and 2013b) although Licensees were unable to find this data in the results of any fish surveys or stocking records. Threadfin shad and inland silversides (*Menidia beryllina*) are the primary forage fish found in Pyramid Lake (CDFW 2013b). Table 4.5-3 presents the complete list of fish documented in Pyramid Lake and those that have been historically stocked.

Table 4.5-3. Summary of Species Documented in Pyramid Lake Including the Most Recent Date Recorded, and the Species that were Historically Stocked in the Lake

Species	Date of Last Observation	Historically Stocked	Sources
Warm Water Species			
Threadfin shad (*Dorosoma petenense*)	October 22, 2013	Yes	CDFG 2001
Common carp (*Cyprinus carpio*)	--[1]	Yes	CDFW 2013b
Goldfish (*Carassius auratus*)	--[1]	Yes	CDFW 2013b
Golden shiner (*Notemigonus crysoleucas*)	--[1]	Yes	CDFW 2013b
Sacramento blackfish (*Orthodon microlepidotus*)	--[1]	Yes	CDFG 2001
Brown bullhead (*Ameiurus nebulosus*)	October 22, 2013	Yes	CDFW 2013b
Inland silversides (*Menidia beryllina*)	October 22, 2013	Yes	CDFG 2001
Striped bass (*Morone saxatilis*)	October 22, 2013	Yes	CDFG 2001; CDFW 2013b
Bluegill (*Lepomis macrochirus*)	October 22, 2013	Yes	CDFG 2001; CDFW 2013b
Green sunfish (*Lepomis cyanellus*)	--[1]	Yes	CDFG 2001
White crappie (*Pomoxis annularis*)	October 22, 2013	Yes	CDFG 2001; CDFW 2013b
Black crappie (*P. nigromaculatus*)	October 22, 2013	Yes	CDFG 2001; CDFW 2013b
Largemouth bass (*Micropterus salmoides*)	October 22, 2013	Yes	CDFG 2001; CDFW 2013b
Smallmouth bass (*M. dolomieu*)	October 22, 2013	Yes	CDFG 2001; CDFW 2013b
Bigscale logperch (*Percina macrolepida*)	--[1]	Yes	CDFG 2001
Tule perch (*Hysterocarpus traski*)	--[1]	Yes	CDFG 2001
Shimofuri gobi (*Tridentiger bifasciatus*)	October 22, 2013	Yes	CDFW 2013b
Prickly sculpin (*Cottus asper*)	October 22, 2013	Yes	CDFW 2013b

Table 4.5-3. Summary of Species Documented in Pyramid Lake Including the Most Recent Date Recorded, and the Species that were Historically Stocked in the Lake (continued)

Species	Date of Last Observation	Historically Stocked	Sources
Cold Water Species			
Rainbow trout (*Oncorhynchus mykiss*)	May 21, 2013	Currently Stocked	CDFG 2001; CDFW 2013a; ESA 2015

Sources: CDFG 2001 and CDFW 2013a and CDFW 2013b.
Note:
[1]These species were listed by L. Tavares in CDFG 2001, and in CDFW 2013a and CDFW 2013b, however no references were given and no field surveys were cited. While it is certainly reasonable that these species would be found as part of a warm water fishery in California, no direct evidence for their presence was located by Licensees.
Key:
CDFW = California Department of Fish and Wildlife
DWR = California Department of Water Resources
ESA = Environmental Science Associates

The most recent fish surveys in Pyramid Lake conducted by CDFW were in May and October 2013. Boat electrofishing was used to sample the littoral zone along the lake shoreline. Sampling was conducted along 16 transects, each 0.53 miles long that were randomly selected out of a total of 37 transects. Each transect was sampled for roughly 10 minutes with current applied to the water. Sampling was conducted at night with a four person crew. Fish were identified to species and measured for length and weight.

The May sampling was completed on May 21, 2013. A total of 214 fish from 11 species was collected (Table 4.5-4). Largemouth bass was the most abundant species (27 percent of the catch by abundance) followed by white catfish (19 percent), while only a single brown bullhead and a prickly sculpin (*Cottus asper*) were captured. A total of 116.95 generator minutes resulted in a total catch per unit effort (CPUE) of 1.85 fish per minute (CDFW 2013a).

The October 22 general fish survey produced over five times more fish than the May event with a total of 1,124 total fish captured. More than half of the catch was largemouth bass, and a single white crappie (*Pomoxis annularis*) represented the only species not captured in the previous event. The total fishing effort was also greater with a total of 161.8 generator minutes, resulting in a CPUE of seven fish per minute.

CDFW considered the fish populations at Pyramid Lake to be in good condition (CDFW 2013b). Largemouth bass, smallmouth bass, bluegill (*Lepomis macrochirus*), black crappie (*P. nigromaculatus*), white catfish, striped bass, and channel catfish all had relative weights that showed their populations to be in good condition. Relative stock densities (RSD) for largemouth bass were favorably out of balance with a larger than normal proportion of fish over 12 inches in length. In contrast, RSD for smallmouth bass showed a population weighted toward the stock size (greater than 7.9 inches) and RSD for bluegill showed a balanced population. CDFW is developing this data set to eventually observe population trends, with a second round of surveys scheduled for 2017 (CDFW 2013b).

Table 4.5-4. Abundance, Catch per Unit Effort (CPUE), and Length of Fish Captured by CDFW in Pyramid Lake in May and October of 2013

Species	Number of Fish	Percent of Total Catch	CPUE (fish/minute)	Length Range (inches)
May				
Largemouth bass (*Micropterus salmoides*)	58	27	0.50	1.2-20.7
White catfish (*Ameiurus catus*)	41	19	0.35	11.8-20.5
Striped bass (*Morone saxatilis*)	29	14	0.25	5.0-14.3
Channel catfish (*Ictalurus punctatus*)	27	13	0.23	13.4-23.6
Bluegill (*Lepomis macrochirus*)	23	11	0.20	2.5-8.1
Smallmouth bass (*Micropterus dolomieu*)	20	9	0.17	4.1-15.2
Shimofuri gobi (*Tridentiger bifasciatus*)	5	2	0.04	2.3-3.1
Rainbow trout (*Oncorhynchus mykiss)*	5	2	0.04	9.2-14.2
Prickly sculpin (*Cottus asper*)	4	2	0.03	1.3-2.8
Brown bullhead (*Ameiurus nebulosus*)	1	0	0.01	13.0
Black crappie (*Pomoxis nigromaculatus*)	1	0	0.01	15.0
May Total	**214**		**1.85**	

Table 4.5-4. Abundance, Catch per Unit Effort (CPUE), and Length of Fish Captured by CDFW in Pyramid Lake in May and October of 2013 (continued)

Species	Number of Fish	Percent of Total Catch	CPUE (fish/minute)	Length Range (inches)
October				
Largemouth bass (*Micropterus salmoides*)	591	53	3.67	2.6-19.3
Bluegill (*Lepomis macrochirus*)	134	12	0.83	1.3-9.3
Black crappie (*Pomoxis nigromaculatus*)	98	9	0.61	2.4-13.2
Smallmouth bass (*Micropterus dolomieu*)	91	8	0.56	2.0-14.4
Striped bass (*Morone saxatilis*)	77	7	0.48	4.6-22.1
White catfish (*Ameiurus catus*)	63	6	0.39	8.9-23.1
Channel catfish (*Ictalurus punctatus*)	60	5	0.37	6.5-26.3
Shimofuri gobi (*Tridentiger bifasciatus*)	7	1	0.04	2.78-3.5
Prickly sculpin (*Cottus asper*)	1	0	0.01	3.7
Brown bullhead (*Ameiurus nebulosus*)	1	0	0.01	13.3
White crappie (*Pomoxis annularis*)	1	0	0.01	3.3
October Total	**1,124**		**7.0**[1]	

Sources: CDFW 2013a and CDFW 2013b
Note:
[1]The CPUE data total is 6.98, which was rounded to 7.0 in the CDFW report.
Key:
CPUE = Catch per Unit Effort

4.5.4.5 Fish Stocking

Fish stocking at Pyramid Lake was one of two fish mitigation measures included in the existing License Exhibit S when it was issued in March of 1978. The Exhibit S was revised in 1982, with amendments issued in 1999 and 2000 to reflect changes in fish stocking and reporting requirements. The mitigation measure required fish stocking for the purpose of:

- Establishing a self-sustaining warm water fishery, and
- Supporting a put-and-take trout stocking program at Pyramid Lake.

Pyramid Lake was initially stocked with 700 largemouth bass and 4,000 rainbow trout in 1974 (FERC 1982). Licensees were unable to find any records for the stocking of other species at the time.

Since 1982, CDFW has been contracted by DWR to stock rainbow trout in Pyramid Lake at a variety of levels under several management plans. The existing Exhibit S requires the annual stocking of 20,000 pounds of catchable rainbow trout at Pyramid Lake (DWR 2013a). Stocking status reports with annual creel surveys are required to be reported on a biennial schedule, and have been filed with FERC since 2000.

CDFW has consistently stocked more than the required 20,000 pounds of catchable rainbow trout in all but 1 year (Table 4.5-4). CDFW stocks larger-sized fish (about one to two fish per pound) in an attempt by CDFW to reduce the impact of predation by striped bass on planted fish (DWR 2014b).

4.5.4.6 Creel Surveys

Creel survey data have been reported for Pyramid Lake in 9 out of the 16 years that stocking occurred. Metrics collected varied from year to year. When it was reported, the return to creel (percent of stocked trout captured), ranged from 1.21 to 28 percent. This is well below the goal of 50 percent used by CDFW for put-and-take fisheries (DWR 1998). The catch per unit effort for trout ranged from 0.1 to 0.578 (Table 4.5-5). In most years, CPUE was well below the CDFW goal of 0.5 fish per hour (Table 4.5-5). Anglers, however, were satisfied with their overall angling experience (average of 71.3 percent) and the size of the fish they were catching (average of 57.1 percent). Anglers were less than satisfied with the number of fish caught (average of 42.6 percent) in the years when surveys were conducted.

Table 4.5-5. Annual Fish Stocking and Creel Survey Data for Pyramid Lake from 2000 through May 2016

Year	Stocking		Creel Surveys				
					Angler Satisfaction		
	Number of Fish	Weight (pounds)	Trout CPUE	Return to Creel (percent)	Overall	Number of Fish Caught	Size of Fish Caught
					Percent Satisfied (Average Rating)[6]		
2000	26,780	24,200					
2000-2001			0.26	NR	82	24	69
2001	24,160	20,500					
2001-2002			0.2	14[1]	85	49	51
2002	24,209	22,800					
2002-2003			NR	NR	NR	NR	NR
2003	29,029	25,800					
2003-2004			0.13	28[1]	84	59	81
2004	14,990	14,000					
2004-2005			0.1	8[1]	84	58	78
2005	27,948	27,700					
2005-2006[2]			NR	NR	NR	NR	NR
2006-2007	32,538	26,900	NR	10[3]	81	73	89
2007-2008	29,024	24,000	NR	NR	NR	NR	NR
2008-2009[4]	26,309	21,519	NR	NR	NR	NR	NR
2009			NR	9	67 (2.68)	33 (2.09)	43 (2.33)
2009-2010	25,915	23,400	NR	NR	NR	NR	NR
2010-2011	31,270[5] (41,550)	24,350[5] (30,300)	NR	NR	NR	NR	NR
2011-2012	25,915[5] (30,647)	23,400[5] (26,650)	NR	NR	NR	NR	NR

Table 4.5-5. Annual Fish Stocking and Creel Survey Data for Pyramid Lake from 2000 through 2015 (continued)

Year	Stocking		Creel Surveys				
					Angler Satisfaction		
	Number of Fish	Weight (pounds)	Trout CPUE	Return to Creel (percent)	Overall	Number of Fish Caught	Size of Fish Caught
					Percent Satisfied (Average Rating)[6]		
2012-2013	22,847	24,002	NR	NR	NR	NR	NR
2013-2014	24,492	24,050	NR	NR	NR	NR	NR
2014[4]			0.405	1.21	53 (2.58)	27 (1.89)	27 (1.88)
2014-2015	23,545	24,000	0.578	1.74	34 (2.28)	18 (1.69)	19 (1.72)
2015-2016[7]	21,605	24000	0.713	9.45	27 (2.11)	16 (1.52)	17 (1.56)

Sources: DWR 2002; DWR 2004a; DWR 2006; DWR 2013; DWR 2014, DWR 2015e, Environmental Science Associates 2010b, Environmental Science Associates 2014c, and Environmental Science Associates 2015c
Notes:
[1]Extrapolated value (from Tavares 2002)
[2]Prior to 2006 stocking allotments were tracked on a calendar year basis. Beginning in 2006-2007, stocking was tracked based on the State fiscal year cycle (July 1 through June 30).
[3]Only six days of Creel Surveys were performed at Pyramid Lake in 2006-2007
[4]CDFG provided incomplete creel census data in 2006 and no data in 2007 and 2008. DWR entered into a new contract with a private contractor to conduct the creel census surveys beginning in 2009 for Pyramid Lake. Creel data was not yet completely analyzed for the 2012-2014 reporting period prior to the deadline for filing the report with FERC. Only 45 days of creel surveys were performed at Pyramid Lake in 2014 (March – July)
[5]The 2010-2012 stocking reports was first filed with FERC on January 30, 2013. The 2010-2012 stocking report was revised to correct errors in the fiscal year timeframe and stocking quantities in Tables 1 and 2. The revised report was filed on June 2, 2014 and it reflects the correct stocking data.
[6]From 2000 to 2009, CDFG reported angler satisfaction as "satisfied or not satisfied". From 2009 to 2015, Environmental Science Associates reported angler satisfaction on a scale of 1 to 4, 1 representing "poor fishing experience" and 4 representing "excellent fishing experience".
[7]This data is based on preliminary mid-year data from October 2015 through February 2016 that is subject to change following completion of the remaining surveys for the 2015-2016 survey period.
Key:
CPUE = Catch per Unit Effort
NR = Not Reported

4.5.4.7 Pyramid Reach

Historically, several native fish inhabited the Pyramid reach including rainbow trout (NMFS Pad Questionnaire, FERC 2008), speckled dace (*Rhinichtys osculus*), Arroyo chub and Santa Ana sucker (Table 4.5-6) (DWR 2004b, Swift et al. 1993). Based on the historical occurrences in the Santa Clara River, it is likely that the unarmoured threespine stickleback (*Gasterosteus aculeatus williamsoni*) was part of the Pyramid reach fish community in the past, although no records of this species have been found (DWR 2004b, Swift et al. 1993).

Table 4.5-6. Fish Species in the Pyramid Reach

Species	Date of Last Observation	Native/Introduced	Sources of Information
Historical Species			
Rainbow trout (*Oncorhynchus mykiss)*	1987	N	FERC 2004a
Santa Ana sucker (*Catostomas santaanae)*	--	N/I	FERC 2008
Arroyo chub (*Gila orcuttii*)	--	N/I	DWR 2004b
Prickly sculpin (*Cottus asper*)	--	N	FERC 2004
Speckled dace (*Rhinichtys osculus*)	1946	N	DWR 2004b
Unarmored threespine stickleback (*Gasterosteus aculeatus williamsoni*)	--	N	FERC 2008
Current Species			
Largemouth bass (*Micopterus salmoides*)	1987	I	FERC 2004
Bluegill (*Lepomis macrochirus*)	1987	I	FERC 2004
Brown trout (*Salmo truta*)	1987	I	FERC 2004
Green sunfish (*Lepomis cyanellus*)	1987	I	FERC 2008
Catfish sp.	1987	I	FERC 2008
Partially armoured threespine stickleback (*Gasterosteus aculeatus microcephalus*)	--	N	FERC 2008

Sources: FERC 2004, 2004a, 2008; DWR 2004b
Key:
DWR = California Department of Water Resources
I = Introduced
FERC = Federal Energy Regulatory Commission
N = Native

Surveys conducted by CDFG in the Pyramid reach in 1987 detected only two native species, rainbow trout and prickly sculpin (FERC 2004a). In its Environmental Assessment for the Amended Exhibit S and Article 51 to the existing license (FERC 2008), FERC noted that the partially armored threespine stickleback (*Gasterosteus aculeatus microcephalus*) can be found throughout the Piru Creek watershed, including the Project area, although no reference was cited by FERC. Other introduced species found during CDFG surveys in 1987 included bluegill, green sunfish, largemouth bass, catfish, and brown trout (*Salmo truta*) (FERC 2008).

CDFW conducted snorkel surveys on two major tributaries to the Pyramid reach in June of 2008, Fish and Agua Blanca Creeks, to determine if the fisheries in the two streams met the minimum criteria for designation as Heritage Waters. Both creeks flow generally west to east where they meet Piru Creek. Fish Creek and the North Fork of Fish Creek join each other approximately 1 mile upstream of the confluence with Piru Creek. Agua Blanca Creek joins Piru Creek approximately 5 miles downstream of the Fish Creek confluence. These tributary streams are flashy with the potential for very high flows in the rainy season, but with typical low flows and the potential to run dry in sections during the summer.

A total of 488.5 feet of Fish Creek was surveyed in six sections, with an average wetted width of 10.8 feet and average depth of 0.5 feet. A total of 288 rainbow trout was counted (fish density of 0.05 fish per square feet) and 285 (99 percent) were less than 5.9 inches in length. No YOY were observed in Fish Creek (Weaver and Mehalick 2008). CDFW only reported results for rainbow trout and did not include documentation of or results for other fish species.

A total of 304.3 feet of the North Fork of Fish Creek was surveyed in five sections, with an average width of 7.4 feet and average depth of 0.88 feet. A total of 103 rainbow trout was observed (fish density of 0.5 fish per square feet), 99 (96 percent) of which were less than 5.9 inches in length. Similar to Fish Creek, no YOY were observed.

Agua Blanca Creek had the lowest density of the three creeks surveyed. A total of 208 rainbow trout was counted in 834 feet in 13 sections of stream. Average width and depth were not reported for Agua Blanca Creek. Fish length included a larger range in Agua Blanca Creek, from YOY (less than 2 inches) to large (12 to 17.9 inches), although 86 percent of fish were still in the small (less than 5.9 inches) size class.

<u>Stocking</u>

Fish in the Pyramid reach have been managed by both CDFW and USFS since the 1930's including the stocking of catchable size rainbow trout starting in 1931 and steelhead and largemouth bass in 1933 (FERC 2004). Brown trout, catfish, bluegill, and green sunfish (Table 4.5-6) also occur in the Pyramid reach (FERC 2008), but their origins are unknown.

CDFW has primarily stocked rainbow trout since the 1940s in Pyramid reach (FERC 2004). In 1980, DWR developed the Piru Creek Fishery Enhancement Plan, which directed the stocking of 25,000 catchable size trout between Pyramid Dam and Frenchman's Flat (DWR 1980). CDFW realized that this level of stocking was not sustainable and exceeded the carrying capacity of the creek. As a result, DWR amended Exhibit S of the existing license to allow for lower stocking levels that were developed in consultation with CDFW.

FERC Order Modifying and Approving Amendment to Exhibit S (89 FERC ¶62,066; 2426-144 issued on October 25, 1999) amended the fisheries management portion of the Exhibit S to allow annual stocking of 4,000 pounds of catchable size rainbow trout (CDFW 2013). The plan also called for a fishery status report every 2 years that includes the number of fish stocked and the results of any fisheries studies conducted during the period. CDFW determined that the stocking allotment of 4,000 pounds again exceeded the carrying capacity of the creek (DWR 2004) and planted closer to 3,000 pounds catchable size trout in the Pyramid reach during fiscal years 2004/2005 through 2007/2008 (CDFW 2013). The Piru Creek Fishery Enhancement Plan, which was amended by the October 28, 2009 FERC Order to reflect this practice and directed the surplus 1,000 pounds of fish to be stocked between Pyramid Dam and a remnant concrete creek lining upstream of Frenchman's Flat (FERC 2008). This structure is identified as a weir in the FERC EA (2008).

On August 12, 2008, CDFW suspended fish stocking in many of California's lakes and streams including the Pyramid reach (DWR 2013) as part of a settlement to end a lawsuit for violation of CEQA. The Final Environmental Impact Report (FEIR)/Environmental Impact Statement (EIS) for the CDFW fish hatchery-stocking program was released in 2010 (ICF 2010). CDFW selected an alternative that requires a pre-stocking evaluation to be completed prior to commencing fish stocking operations in any watershed that was not excluded. Additionally, the pre-stocking evaluation requires consultation under Section 7 of the ESA with NMFS and USFWS for potential impacts to federally listed species (DWR 2016c). As a result, DWR filed an amendment with FERC to modify the trout stocking requirement in the Pyramid reach until CDFW completes its Section 7 ESA consultation (i.e. when a Biological Opinion is issued), and file a trout stocking plan with FERC (DWR 2011). FERC approved the amendment in 2012[36], requiring DWR to file a semiannual status update of the CDFW Section 7 ESA consultation with NMFS and USFWS until a Biological Opinion is issued (FERC 2012c). As of June 1, 2016 CDFW was still consulting with the USFWS and NMFS under Section 7 of the ESA in developing a Biological Opinion on the impacts of stocking rainbow trout on federally listed species including arroyo toad populations in the Pyramid reach (DWR 2016c).

4.5.4.8 Tributaries to Elderberry Forebay

Little information exists regarding fish species residing in Salt Creek, Castaic Creek, or Fish Canyon upstream of Elderberry Forebay and its tributaries. Power Associates state that "no fish of any kind have been observed within Castaic Creek channel above the margin of Elderberry Forebay, and the proposed project would not affect a native or introduced population of arroyo chub (LADWP 2003)."

4.5.4.9 Elderberry Forebay

Licensees were unable to find any information regarding fish species residing in Elderberry Forebay.

[36] Order Amending October 28, 2009 Order Amending Article 52 and Exhibit S (138 FERC ¶62,105; 2426-196) issued on February 10, 2012.

4.5.5 Amphibians and Semi-Aquatic Reptiles

Aquatic resources include amphibians, snakes, and turtles that are closely associated with aquatic environments (Table 4.5-7). Western spadefoot, two-striped garter snake, South Coast garter snake, and southern western pond turtle are special-status species discussed in Section 4.5.1. American bullfrog is a non-native species discussed in Section 4.5.2. As described in Section 4.5.1, FYLF likely no longer occurs in the Project vicinity and is not discussed further.

Western toad (*Anaxyrus boreas*), Baja California chorus frog (or treefrog) (*Pseudacris hypochondriaca*) (treated in older literature as Pacific chorus frog or treefrog, *P. regilla*), and California chorus frog (or treefrog) (*P. cadaverina*) are common amphibians documented to occur in the Project vicinity and Project area. All three species have been observed using sedimentation basins in the storm bypass channel above Elderberry Forebay. Western toad, California chorus frog, and American bullfrog larvae have been observed in Pyramid reach during annual sensitive species surveys (Environmental Science Associates 2010a, 2011, 2012, 2013, 2014a, 2015a).

4.5.6 Aquatic Mollusks

Licensees referred to the CNDDB to determine if there were any recorded sightings of aquatic mollusk species in the Project area. A query of the CNDDB was conducted within USGS 7.5 minute quadrangles located immediately surrounding the existing Project boundary. No occurrences were recorded in the nine quadrangle search (CDFW 2015).

Licensees referred to the California Environmental Data Exchange Network (CEDEN) to find data regarding mollusks within and surrounding the existing Project boundary. A county-based query was run emphasizing select map stations with relevance to the Project location. Data from four map stations in the Project area were examined: (1) Random Site 83 – Piru Creek; (2) Piru Creek 01136; (3) Piru Creek 07024; (4) Piru Creek 1.3 miles upstream from Fish Creek; and (5) Castaic Creek. The results of the query included 13 samples identified by family as Corbiculidae, Hydrobiidae, Lymnaeidae, Physidae and Planorbidae. The samples were further broken down into genus and included *Corbicula, Helisoma, Physa* and *Potamopyrgus* (CEDEN 2012).

Table 4.5-7. Aquatic Amphibians and Semi-aquatic Reptiles that are known to Occur or May Potentially Occur in the Vicinity of the Project

Species	Habitat Associations
Western spadefoot [SSC] (*Spea hammondii*)	Formerly widespread species, but likely extirpated from large parts of its historical range in the Central Valley, coastal plain, and foothills by intensive agricultural and urban development, and loss of vernal pool habitat. Occurs in grasslands, oak woodlands, and occasionally chaparral. Breeds in vernal pools and other ponds that dry seasonally (rarely in permanent ponds), and occasionally in intermittent streams. Survives dry seasons by burrowing deep into loose soil. Species is currently under review by USFWS to determine whether ESA listing is warranted. See Section 4.5.1.
Arroyo toad [FE, SSC] (*Anaxyrus* [*Bufo*] *californicus*)	See Section 4.8.2.2.
Western toad (*Anaxyrus* [*Bufo*] *boreas*)	Widespread species, breeding in ponds, lakes, and reservoir edges, and slow-moving or still sections of streams across a wide range of elevations and habitats, including woodlands, grasslands, and meadows. May be highly terrestrial outside of the breeding season, with females traveling farther from breeding sites than males, and often inhabiting existing burrows during periods of extreme temperatures. No conservation concerns have been documented for this species in California.
Baja California chorus frog (treefrog) (*Pseudacris hypochondriaca*)	The most common amphibian within its range, and as ecologically adaptable as its more northern-ranging sibling species, Sierra chorus frog (*P. sierra*) and Pacific chorus frog (*P. regilla*), from which it was separated by Recuero et al. (2007). Occurs over a wide range of elevations, and breeds in ponds, lakes and reservoir edges, ditches, slow-moving or still sections of streams, and opportunistically in small rainwater pools. Outside of the breeding season may be heard far from water.
California chorus frog (treefrog) (*Pseudacris cadaverina*)	Locally common species found from San Luis Obispo County south to Baja California, Mexico along coastal and desert slope drainages and in desert oases. Known from near sea level to 7,500 feet elevation. Breeds in pools in rocky, seasonally intermittent and perennial streams, with larvae metamorphosing in June to August. Although not aquatic outside of the breeding season, adults and juveniles usually remain close to stream courses during surface activity season, and may retreat to rock crevices and rodent burrows during the driest periods.
California red-legged frog [FT, SSC] (*Rana draytonii*)	See Section 4.8.2.4.

Table 4.5-7. Aquatic Amphibians, Semi-aquatic Reptiles, and Turtles that are known to Occur or May Potentially Occur in the Vicinity of the Project (continued)

Species	Habitat Associations
American bullfrog (*Lithobates* [*Rana*] *catesbianus*)	Introduced and now widespread species, well established in slow-moving streams, stock ponds, lakes, and reservoirs to at least 5,000 feet elevation. Highly aquatic and usually associated with permanent bodies of water with ample aquatic and emergent vegetation, but has successfully invaded rivers and reservoirs where vegetation is sparse. Larvae often overwinter before metamorphosis. The presence of bullfrogs may be associated with declines of other native frogs. See Section 4.5.2.
"South coast garter snake" SSC (*Thamnophis sirtalis infernalis*)	Taxonomically indistinct red-sided garter snakes of the coastal plain from Ventura to San Diego Counties are treated by CDFW as SSC. Closely associated with marsh and adjacent upland habitat near permanent water and dense, riparian vegetation. May be an aquatic-feeding specialist. See Section 4.5.1.
Two-striped garter snake SSC (*Thamnophis hammondii*)	Occurs in coastal southern California to Baja California, from near sea level to 8,000 feet elevation. Common in suitable habitats, but has declined or disappeared in urbanized areas. Closely associated with areas of permanent water, especially in and along rocky streams. See Section 4.5.1.
Southern western pond turtle (*Actinemys* [*Emys*] *pallida* SSC)	Occurs in a wide variety of aquatic habitats across a broad range of elevations, particularly permanent ponds, lakes, side channels, backwaters, and pools of streams, but is uncommon in high-gradient streams. Often overwinters in forested habitats and oviposits in summer at upland sites as much as 1,200 feet from aquatic habitats. See Section 4.5.1.

Sources: Lannoo 2005; Jones et al. 2006; Stebbins and McGinnis 2012; California Herps 2015
Key:
ESA = Endangered Species Act
FE = federal endangered
FT = federal threatened
SSC = California State species of special concern

4.5.7 Aquatic Benthic Macroinvertebrates

Licensees consulted the CEDEN to find data regarding benthic macroinvertebrates (BMI) in the Project vicinity. A county based query was run emphasizing select map stations with relevance to the Project vicinity. Data from four map stations in Pyramid reach were examined: (1) Random Site 83 – Piru Creek; (2) Piru Creek 01136; (3) Piru Creek 07024; and (4) Piru Creek 1.3 miles upstream from Fish Creek and one map station on Castaic Creek was examined. Orders and families of aquatic macroinvertebrates that were found at the five sampling locations are described in Table 4.5-8 (CEDEN 2012).

Table 4.5-8. Orders and Families of Aquatic Macroinvertebrates that were Identified at the Five Research Locations in the Project Area

Order	Families
Amphipoda	Corophiidae, Gammaridae, Hyalellidae
Basommatophora	Lymnaeidae, Physidae, Planorbidae
Coleoptera	Dryopidae, Elmidae, Haliplidae, Psephenidae
Cyclopoida	---
Diptera	Ceratopogonidae, Chironomidae, Dixidae, Empididae, Ephydridae, Psychodidae, Simuliidae, Stratiomyidae, Tipulidae
Ephemeroptera	Baetidae, Ephemerellidae, Leptohyphidae
Hemiptera	Naucoridae
Hoplonemertea	Tetrastemmatidae
Hypsogastropoda	Hydrobiidae
Lepidoptera	Pyralidae
Lumbriculida	Lumbriculidae
Megaloptera	Corydalidae
Odonata	Calopterygidae, Coenagrionidae, Gomphidae, Lestidae, Libellulidae
Podocopida	Cyprididae
Trichoptera	Brachycentridae, Glossosomatidae, Helicopsychidae, Hydropsychidae, Hydroptilidae, Philopotamidae, Polycentropodidae
Tricladida	Planariidae
Trombidiformes	Hygrobatidae, Lebertiidae, Sperchontidae, Torrenticolidae
Tubificida	Naididae, Tubificidae, Enchytraeidae
Veneroida	Corbiculidae

Source: CEDEN 2012

The nearest documented field survey to the Project area for BMI occurred in 2008 in the Santa Clara River. The Wishtoyo Foundation prepared the *Santa Clara River Watershed Amphibian and Benthic Macroinvertebrate Bioassessment Project* for the

Santa Clara River Trustee Council. The benthic macroinvertebrate assessments resulted in the identification of 30 families of insects, and 4 non-insect taxa (SCRTR 2008).

4.5.8 Algae and Cyanobacteria

In recent years, Pyramid Lake has experienced an increasing number of cyanobacteria blooms that produced microcystins (DWR 2015f). DWR began monitoring for cyanotoxins in Pyramid Lake in 2013. The cyanotoxin microcystin was detected during sampling events in 2013, 2014, and 2015 (DWR 2015f). Cyanobacteria species that dominated microcystin-producing algal blooms in the lake include *Microcystis spp., Woronichinia naegeliana, Gloeotrichia sp., Limnoraphis birgei, Aphanizomenon spp., Dolichospermum sp.,* and *Planktothrix sp.*

Licensees accessed the CEDEN to find data regarding algae. A County-based query was run highlighting select map stations with relevance to the Project area. Data from four map stations in Pyramid reach were examined: (1) Random Site 83 – Piru Creek; (2) Piru Creek 01136; (3) Piru Creek 07024; and (4) Piru Creek 1.3 miles upstream from Fish Creek and one map station on Castaic Creek was examined.

The orders of photosynthetic organisms and diatoms that were reported from the five sites were Achnanthales, Bacillariales, Chroococcales, Cladophorales, Cymbellales, Fragilariales, Hydroida, Naviculales, Pseudanabaenales, Sphaeropleales, Surirellales, Synechococcales, Thalassiophysales, Thalassiosirales, and Triceratiales (CEDEN 2012).

4.6 WILDLIFE AND BOTANICAL RESOURCES

This Section provides information regarding existing botanical and wildlife resources. For the purpose of this PAD, botanical and wildlife resources include upland vegetation communities and plant species, and terrestrial wildlife. Besides this general introductory information, this Section consists of eight main sub-sections: Section 4.6.1 describes the general distribution of vegetation based on existing vegetation mapping data in the Project area; Section 4.6.2 provides vegetation descriptions for areas along Pyramid reach; Section 4.6.3 lists special-status botanical species; and Section 4.6.4 identifies non-native invasive plants (NNIP), known or with potential to occur in the Project area. For the purposes of botanical resources, the focus is the area within and immediately adjacent to the existing Project boundary, and along Pyramid reach. Sections 4.6.5 and 4.6.6 list and describe special-status wildlife species and designated special ecological areas, respectively. Section 4.6.7 describes commercially valuable wildlife species that may occur in the Project vicinity, including their potential temporal and spatial distribution. Section 4.6.8 describes existing, relevant and reasonably available information regarding wildlife species occurrences, including but not limited to special-status species, near above-ground Project facilities.

4.6.1 Vegetation Mapping

USFS Classification and Assessment with Landsat of Visible Ecological Groupings (CalVeg) data (USFS 2014) are available for the Project area. CalVeg data classify and describe existing vegetation according to a hierarchical classification system. The data are created using automated, systematic procedures; remote sensing classification; photo editing; and field based observations. CalVeg data have a minimum mapping unit of 2.5 acres, with the exception of lakes and conifer plantations, which have no minimum mapping unit. Where areas smaller than 2.5 acres occur in the data, these represent data which have been subsequently edited and finalized by USFS. Smaller units also occur in the Project-specific data because the Project boundary may include only a small part of a mapped habitat polygon.

Digital CalVeg data files from USFS also provide mapping using the California Wildlife Habitat Relationships (WHR) classification system (Mayer and Laudenslayer, Jr. 1988). The following discussion describes WHR mapped habitats within the proposed Project boundary. Table 4.6-1 provides the area of each WHR habitat type mapped within the proposed Project boundary, along with the corresponding CalVeg classifications (individual WHR habitat types may encompass more than one CalVeg vegetation type).

The Project falls largely within the South Coast and Montane CalVeg zone (i.e., Zone 7), extending into the South Interior CalVeg Zone (Zone 8) in the Quail Lake area. The area within the proposed Project boundary encompasses 4,512 acres, of which about 2,507 acres are in various vegetated, non-vegetated, or developed habitats and the rest is open water. Fifteen WHR habitat types occur within the proposed Project boundary. Mixed Chaparral and Coastal Shrub are the dominant habitat types, each comprising 12 percent of the proposed Project boundary. The acreages of WHR habitat types within the proposed Project boundary are summarized in Table 4.6-1 and are shown in Figures 4.6-1 and 4.6-2. The area summarized in the table encompasses the entire proposed Project boundary, including buried features, such as the Peace Valley Pipeline and Angeles Tunnel.

Table 4.6-1. California Wildlife Habitat Relationship and CalVeg Classification Acreages Within the Proposed Project Boundary

California Wildlife Habitat Relationship Type	Classification and Assessment with Landsat of Visible Ecological Groupings (CalVeg) Classification	Acreage[1]	Percentage of Study Area
Tree-Dominated Habitats			
Pinyon-Juniper	Singleleaf Pinyon Pine	5	<1
Montane Hardwood	Bigcone Douglas-Fir, Canyon Live Oak	<1	<1
Coastal Oak Woodland	Coast Live Oak	3	<1
Montane Riparian	Fremont Cottonwood, Willow (Shrub)	39	<1
Valley Foothill Riparian	Riparian Mixed Hardwood, Willow, Willow (Shrub)	54	1
Shrub-Dominated Habitats			
Sagebrush	Basin Sagebrush, Rabbitbrush	286	6
Mixed Chaparral	Birchleaf Mountain Mahogany, Buckwheat, Lower Montane Mixed Chaparral, Scrub Oak, Sumac Shrub, Tucker / Muller Scrub Oak	563	12
Chamise-Redshank Chaparral	Chamise	130	3
Coastal Scrub	California Sagebrush, Soft Scrub Mixed Chaparral	545	12
Desert Wash	Riversidean Alluvial Scrub	63	1
Herbaceous-Dominated Habitats			
Annual Grassland	Annual Grasses and Forbs	208	5
Wet Meadow	Wet Meadows	53	1
Freshwater Emergent Wetland	Tule – Cattail	39	<1
Developed Habitats			
Urban	Non-Native/Ornamental Conifer, Urban/Developed (General)	293	6
Lacustrine			
Open water	Open water	2,005	44
Non-vegetated Habitats			
Barren	Barren, Urban-related Bare Soil	226	5
	Total:	4,512	100

Source: U.S. Forest Service (USFS) 2014
Note:
[1]Acreages include underground features.
Key:
< = less than

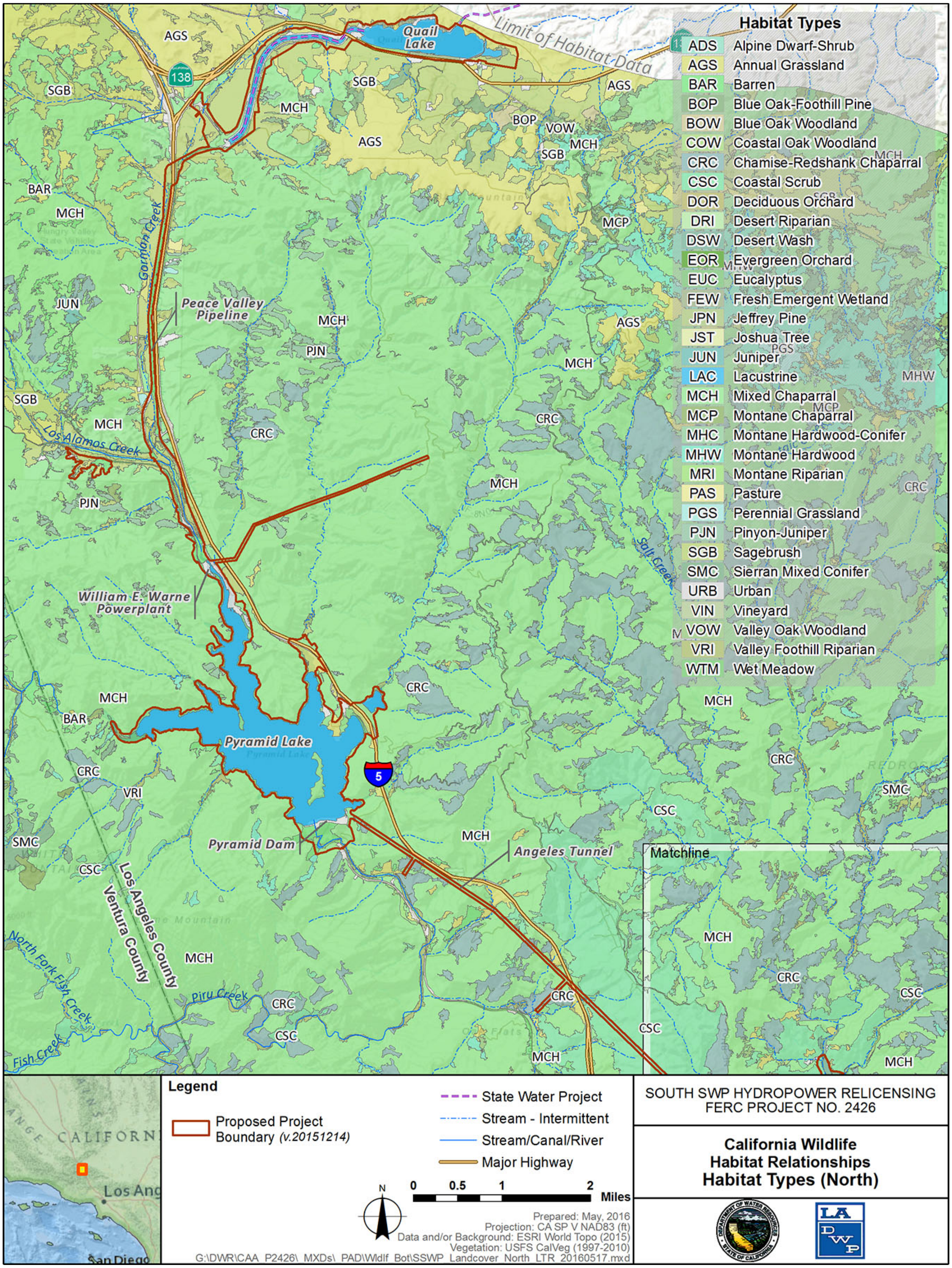


Figure 4.6-1. California Wildlife Habitat Relationship Habitat Types (North)

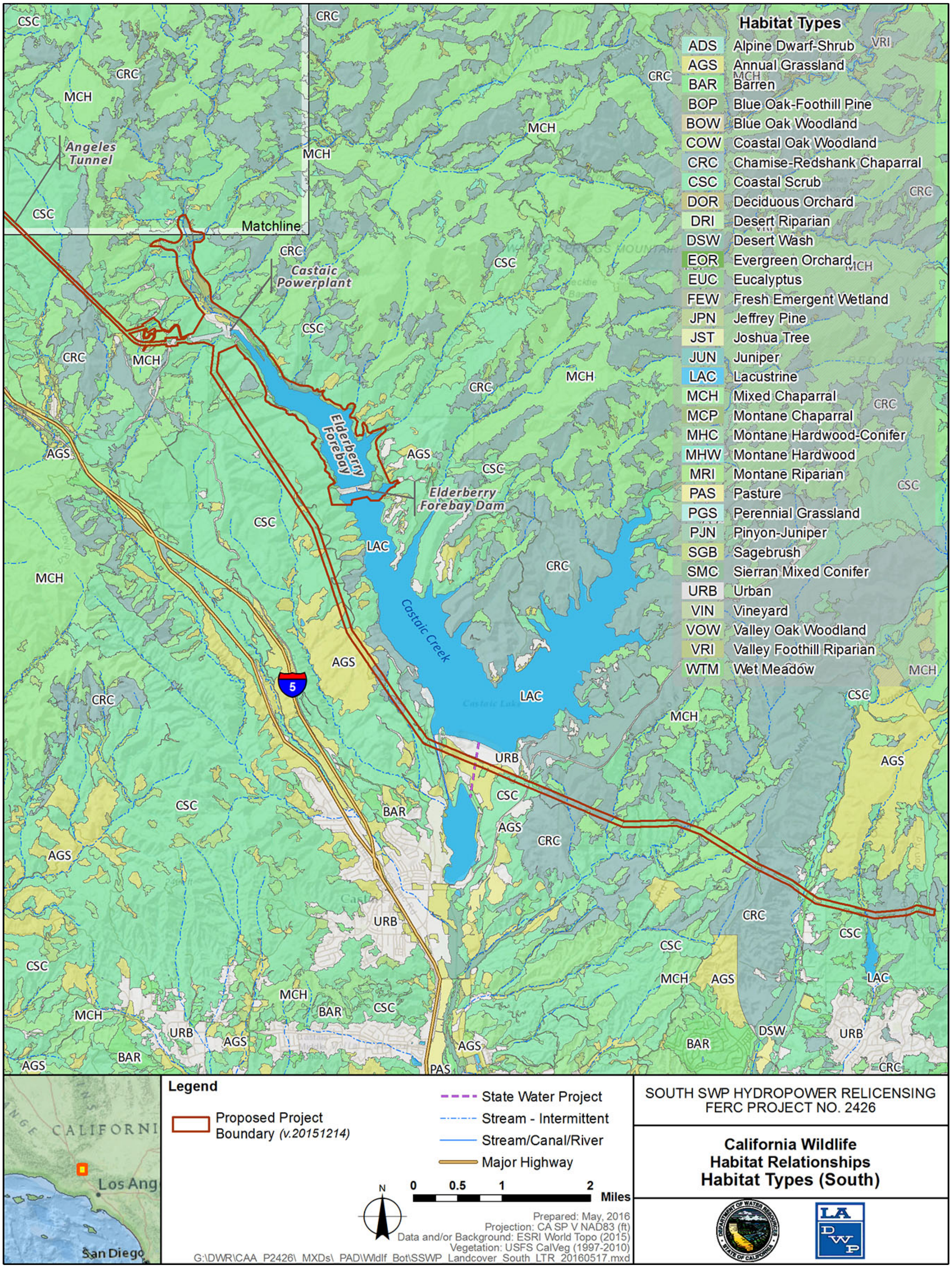


Figure 4.6-2. California Wildlife Habitat Relationship Habitat Types (South)

The following WHR habitat types are mapped by CalVeg (USFS 2014) within the proposed Project boundary (Figure 4.6-1 and Figure 4.6-2). The descriptions of WHR habitat type structure and species composition are derived from generalized information in Mayer and Laudenslayer (1988) and Holland and Keil (1995), with Project area-specific information provided at the end of each habitat type description if found in literature review.

4.6.1.1 Tree-Dominated Habitats

Pinyon-Juniper

Pinyon-Juniper habitat types generally occur on steep, rocky slopes. They are typically open (less than 50 percent canopy cover) habitats composed of relatively low-growing bushy trees and shrubs, including Parry pinyon (*Pinus quadrifolia*), juniper (*Juniperus* spp.), oak (*Quercus* spp.), and Mojave yucca (*Yucca schidigera*). Higher elevation sites may be denser and can include ponderosa pine (*Pinus ponderosa*) and Jeffrey pine (*Pinus jeffreyi*). Shrubs can include sagebrush (*Artemisia* spp.), blackbrush (*Coleogyne ramosissima*), broom snakeweed (*Gutierrezia sarothrae*), narrowleaf goldenbush (*Ericameria linearifolia*), Parry's beargrass (*Nolina parryi*), curl-leaf mountain mahogany (*Cercocarpus ledifolius*), antelope bitterbrush (*Purshia tridentate*), Parry's rabbitbrush (*Ericameria parryi*), chamise (*Adenostoma fasciculatum*), and redshank (*Adenostoma sparsifolium*). Grasses and forbs associated with this habitat type include western wheatgrass (*Pascopyrum smithii*), blue grama (*Bouteloua gracilis*), and Indian ricegrass (*Achnatherum hymenoides*).

In the Project area vegetation mapping the WHR, Pinyon-Juniper habitats occurs along the Peace Valley Pipeline corridor, at the north end of Pyramid Lake, and in small patches along the Warne Transmission Line.

Montane Hardwood

Montane Hardwood habitat types have a hardwood overstory of varying density, with sparser shrub and herbaceous layers. Trees at middle and higher elevations can include Jeffrey pine, ponderosa pine, sugar pine (*Pinus lambertiana*), incense cedar, white fir (*Abies concolor*), bigcone Douglas-fir, California black oak (*Quercus kelloggii*), and Coulter pine (*Pinus coulteri*); lower elevation species include white alder (*Alnus rhombifolia*), California live oak (or coast live oak) (*Quercus agrifolia*), bigleaf maple (*Acer macrophyllum*), California laurel (*Umbellularia californica*), bigcone Douglas-fir (*Pseudotsuga macrocarpa*), and occasionally valley oak (*Quercus lobata*), California foothill pine (*Pinus sabiniana*), and blue oak (*Quercus douglasii*). Understory shrubs can include manzanita (*Arctostaphylos* spp.), poison oak (*Toxicodendron diversilobum*), California coffeeberry (*Frangula californica*), gooseberries (*Ribes* spp.), and ceanothus (*Ceanothus* spp.).

In the Project area vegetation mapping WHR, Montane Hardwood habitat occurs in a few patches in canyons upstream of Pyramid Lake along Piru Creek and near Pyramid Dam.

Coastal Oak Woodland

Coastal Oak Woodland habitat types are highly variable, typically including deciduous and evergreen hardwoods, generally oaks, occasionally with some conifers. Density and structure can vary between sparse, open areas, to dense, multilayer canopies. California live oak is often dominant and can co-occur in mesic (moderately moist) sites with California laurel, Pacific madrone (*Arbutus menziesii*), tanoak (*Notholithocarpus densiflorus*), and canyon live oak (*Quercus chrysolepis*). In drier areas, valley oak, blue oak, and California foothill pine may be found with California live oak. Understory species can include California blackberry (*Rubus ursinus*), creeping snowberry (*Symphoricarpos mollis*), toyon (*Heteromeles arbutifolia*), and herbaceous plants such as western bracken fern (*Pteridium aquilinum*), California polypody (*Polypodium californicum*), fiestaflower (*Pholistoma* spp.), and springbeauty (*Claytonia* spp.).

In the Project area vegetation mapping, WHR Coastal Oak Woodland habitat occurs only in one small, isolated area near the eastern terminus of the Castaic Transmission Line.

Montane Riparian

Montane Riparian habitat types are found in areas of montane lakes, ponds, seeps, bogs and meadows, rivers, streams, and springs. The composition of Montane Riparian varies in species and structure; it typically occurs in narrow patches of dense trees with a sparse understory, but shrubs may be more common at higher elevations. Overstory species may include white alder, Fremont cottonwood (*Populus fremontii*), Goodding's willow (*Salix gooddingii*), arroyo willow (*S. lasiolepis*), red willow (*S. laevigata*), narrowleaf willow (*S. exigua*), and California sycamore (*Platanus racemosa*). Understory species, when present, include willows (*Salix* spp.), mule-fat (*Baccharis salicifolia*), stinging nettle (*Urtica dioica* ssp. *holosericea*), poison hemlock (*Conium maculatum*), and Douglas' sagewort (*Artemisia douglasiana*).

In the Project area vegetation mapping, WHR Montane Riparian habitat occurs in a few locations from the south bank of Quail Lake, at the confluence of Canada de Los Alamos and Gorman Creek along the Peace Valley Pipeline, and just below Pyramid Dam.

Environmental Science Associates (2014a) reported that small patches of riparian forest/scrub occur sporadically along the perimeter of Quail Lake, particularly in the southeastern corner near the access road. These areas were dominated by arroyo willow, with an understory of other willow species and mule-fat. Fremont cottonwood were scattered sparsely along the perimeter of the lake (Environmental Science Associates 2014a). Although Environmental Science Associates did not assign a WHR habitat type to these areas, the species described are similar to those that occur in Montane Riparian habitat.

Around Pyramid Lake, Environmental Science Associates (2014a) reported that riparian forest occurs sporadically along the perimeter of Pyramid Lake at the confluence of intermittent and ephemeral streams. Fremont cottonwood dominated creek margins upstream of the lake water's edge, and arroyo willow occurred along creeks at or below the lake shoreline. Understory species included other willow species and mule-fat. Although Environmental Science Associates did not assign a WHR habitat type to these areas, the species described are similar to those that occur in Montane Riparian habitat types. These areas transitioned into broadleaf cattail (*Typha latifolia*) marsh at the edge of Pyramid Lake.

Valley Foothill Riparian

Valley Foothill Riparian habitat occurs in valleys and foothills in areas of low velocity stream flows and gentle topography. This habitat type is generally dense and multilayered, with primarily deciduous trees, including Fremont cottonwood, California sycamore, and valley oak in the canopy. Subcanopy trees include white alder, boxelder (*Acer negundo*), and Oregon ash (*Fraxinus latifolia*). Shrub species include roses (*Rosa* spp.), California blackberry (*Rubus ursinus*), blue elderberry (*Sambucus nigra ssp. caerulea*), poison oak, common buttonbush (*Cephalanthus occidentalis*), and willows (*Salix* spp.). A variety of herbaceous species occur in the understory, including sedges (*Carex* spp.), rushes (*Juncus* spp.), grasses, springbeauty, Douglas' sagewort, poison hemlock, and stinging nettle. Vines, typically California wild grape (*Vitis californica*), also occur.

In the Project area vegetation mapping, WHR Valley Foothill Riparian habitat occurs in small patches primarily around Pyramid Lake and along Castaic Creek upstream of Elderberry Forebay.

POWER Engineers reported on vegetation in the three sedimentation basins adjacent to Elderberry Forebay during 2013 arroyo toad surveys. Species composition and density varied in the three basins, with narrowleaf willow, tamarisk (*Tamarix* spp.), broadleaf cattail, mule-fat, and Fremont cottonwood observed (POWER 2013).

4.6.1.2 Shrub-Dominated Habitats

Sagebrush

Sagebrush habitat can be found at a wide range of middle and high elevations. Sagebrush community structure is typically open stands of sagebrush of similar heights, often monotypic stands of big sagebrush (*Artemisia tridentata*), but also often along with other species of sagebrush (*Artemisia* spp.), yellow rabbitbrush (*Chrysothamnus viscidiflorus*), horsebrush (*Tetradymia* spp.), gooseberries, western chokecherry (*Prunus virginiana* var. *demissa*), curl-leaf mountain mahogany, and antelope bitterbrush. Less disturbed sites may have an understory of perennial grasses and forbs.

In the Project area vegetation mapping, WHR Sagebrush habitat occurs in various locations from Quail Creek south to the southern end of Elderberry Forebay.

Environmental Science Associates (2014a) described upland vegetation on the north side of Quail Lake as rubber rabbitbrush (*Ericameria nauseosa*) scrub, but notes that it is separated from the lake by an asphalt road.

Mixed Chaparral

Mixed Chaparral habitat generally occurs below 5,000 feet on steep slopes and ridges with relatively thin, well-drained soils. Mature Mixed Chaparral areas have dense (greater than 80 percent) canopy cover typically between 3 and 13 feet tall. Species typically include inland scrub oak (*Quercus berberidifolia*), ceanothus, and manzanita. Chamise, birchleaf mountain mahogany (*Cercocarpus montanus* var. *glaber*), ashy silktassel (*Garrya flavescens*), toyon, hairy yerba santa (*Eriodictyon trichocalyx*), California buckeye (*Aesculus californica*), poison oak, sumac (*Rhus* spp.), California coffeeberry, hollyleaf cherry (*Prunus ilicifolia*), and chaparral pea (*Pickeringia montana*) can also occur. Mixed and Chamise-Redshank Chaparral intergrade with Mixed Chaparral on low to middle elevation slopes at elevations below woodland and forest types. Compared to Chamise-Redshank Chaparral, Mixed Chaparral generally occupies more mesic sites at higher elevations or on north-facing slopes.

Project area vegetation mapping identifies WHR Mixed Chaparral habitat throughout the area, primarily around Pyramid Lake and also along the Warne Transmission Line.

Environmental Science Associates (2014a) reported that two species, chamise and Tucker oak (*Quercus john-tuckeri*), dominated the Mixed Chaparral habitat around Pyramid Lake, with bigpod ceanothus (*Ceanothus megacarpus* var. *megacarpus*), mountain mahogany (*Cercocarpus* spp.), and chaparral yucca (*Hesperoyucca whipplei)* interspersed.

Chamise-Redshank Chaparral

Chamise-Redshank Chaparral habitat occurs on steep slopes and ridges in areas with thin soils and little accumulated organic matter. Chamise-Redshank Chaparral generally occurs below and intergrades with Mixed Chaparral (see above). Vegetative structure is similar to Mixed Chaparral, but species differ, with stands often being composed almost entirely of chamise or redshank. Other species that can occur include toyon, sugar sumac (*Rhus ovata*), poison oak, redshank, California coffeeberry, ceanothus, manzanita, scrub oak, and laurel sumac (*Malosma laurina*). In southern California, white sage (*Salvia apiana*), black sage (*Salvia mellifera*), and Eastern Mojave buckwheat (*Eriogonum fasciculatum*) can be found in this habitat type at lower elevations and on recently disturbed sites.

In the Project area vegetation mapping, WHR Chamise-Redshank Chaparral habitat occurs in small patches on the south end of Pyramid Lake, along the Angeles Tunnel, and along the Castaic Transmission Line.

Coastal Scrub

Coastal Scrub can be found in drier areas than other shrub habitats and commonly occurs on steep, south-facing slopes in sandy, mudstone, or shale soils. The southern sage scrub form of Coastal Scrub found in southern California is made up of a very dense shrub layer up to 7 feet tall. Southern sage scrub species can include black sage, purple sage (*Salvia dorii*), Eastern Mojave buckwheat, golden-yarrow (*Eriophyllum confertiflorum*), goldenbush (*Isocoma* spp.), orange bush monkeyflower (*Diplaucus aurantiacus*), California brittlebush (*Encelia californica*), and chaparral yucca.

In the Project area vegetation mapping, WHR Coastal Scrub habitat occurs on the southern end of Pyramid Lake, along the Angeles Tunnel, and in many areas on the perimeter of Elderberry Forebay. It also comprises the majority of the habitat along the Castaic Transmission Line.

Environmental Science Associates (2014a) reported that two species dominated this habitat type on the perimeter of Pyramid Lake: Eastern Mojave buckwheat and purple sage. Other shrubs observed included big sagebrush, chaparral yucca, white sage, and black sage.

Desert Wash

Desert Wash habitats occur in association with canyons, arroyos, washes, and other areas that are at least seasonally wet, from the southeastern Mojave Desert south through the Sonoran Desert into Mexico. Elevation ranges between about 2,500 feet and 6,560 feet. Canopy species are generally taller and denser than in adjacent desert habitats and may include blue paloverde (*Parkinsonia florida*), yellow paloverde (*P. microphylla*), desert ironwood (*Olneya tesota*), smoketree (*Psorothamnus spinosus*), catclaw acacia (*Senegalia greggii)*, honey mesquite (*Prosopis glandulosa*), screwbean mesquite (*P. pubescens*), and tamarisk. Subcanopy species can include desertbroom (*Baccharis sarothroides*), arrowweed (*Pluchea sericea*), sweetbush (*Bebbia juncea*), desert willow (*Chilopsis linearis*), burrobrush (*Hymenoclea salsola*), creosote bush (*Larrea tridentata*), and water jacket (*Lycium andersonii*). Understory species may include brittlebush (*Encelia farinosa*), prickypear (*Opuntia* spp.), snakeweed (*Gutierrezia* spp.), goldenbush, saltbush (*Atriplex* spp.), and a variety of forbs and grasses.

In the Project area WHR, Desert Wash habitat occurs along Castaic Creek above Elderberry Forebay and upper areas of the Elderberry Forebay.

4.6.1.3 Herbaceous-Dominated Habitats

Annual Grassland

Annual Grasslands occurs in a variety of locations throughout the State and replaces much of what were historically native perennial grasslands. These areas are now composed of a variety of predominantly non-native annual grasses, including oats (*Avena* spp.), soft brome (*Bromus hordeaceus*), ripgut brome (*Bromus diandrus*), compact brome (*Bromus madritensis*), barley (*Hordeum* spp.), and annual fescue (*Vulpia myuros*). A variety of native and non-native forbs also occur, including longbeak stork's bill (*Erodium botrys*), redstem stork's bill (*Erodium cicutarium*), dove weed (*Croton setiger*), clover (*Trifolium* spp.), burclover (*Medicago polymorpha*), and popcorn flower (*Plagiobothrys* spp.).

In the Project area WHR, Annual Grassland habitat occurs in various areas, primarily on the margins of Quail Lake, Pyramid Lake, and Elderberry Forebay. Annual Grassland also occurs along the Castaic Transmission Line.

Environmental Science Associates (2014a) confirmed that Annual Grassland dominates the southern perimeter of Quail Lake, made up primarily of non-native bromes (*Bromus* spp.) and wild oat (*Avena fatua*).

Wet Meadow

Wet Meadow occurs where soils are saturated most of the growing season. Trees and shrubs are typically absent in Wet Meadow. Herbaceous species vary considerably, but may include bentgrasses (*Agrostis* spp.), sedges, hairgrasses (*Danthonia* spp.), rushes, willows, and bulrushes (*Scirpus* spp.). Wet Meadow often intergrades with Fresh Emergent Wetland.

In the Project area WHR, Wet Meadow habitat occurs in small patches along Piru Creek upstream of Pyramid Lake and at the north end of Elderberry Forebay.

Freshwater Emergent Wetland

Fresh Emergent Wetland habitats occur in areas that are saturated or periodically flooded. They occur in a variety of locations, including grasslands, riparian areas, and the margins of rivers or lakes. Freshwater Emergent Wetland can support a variety of herbaceous species, including bigleaf sedge (*Carex amplifolia*), arctic rush (*Juncus arcticus*), and flatsedge (*Cyperus* spp.). Broadleaf cattail, California bulrush (*Schoenoplectus californicus*), river bulrush (*Bolboschoenus fluviatilis*), and arrowhead (*Sagittaria* spp.) may occur on wetter sites.

In the Project area WHR, Wet Meadow habitat occurs along the margins of Quail Lake. In 2014, Environmental Science Associates performed field reconnaissance surveys along the perimeters of Quail Lake and Pyramid Lake to evaluate the potential results from the application of copper sulfate to control aquatic weeds and algal blooms (Environmental Science Associates 2014a). On both lakes, Environmental Science Associates observed broadleaf cattail marsh throughout the perimeter where shallow fringes of emergent vegetation were able to establish. Along Quail Lake, the wetlands were dominated by broadleaf cattail interspersed with common reed and rushes. Although Fresh Emergent Wetlands were not mapped in the vicinity of Pyramid Lake in WHR data obtained from CalVeg, Environmental Science Associates observed broadleaf cattail marsh throughout the perimeter of both Quail Lake and Pyramid Lake where shallow fringes of emergent vegetation were able to establish. Plant species diversity on the perimeter of both lakes was presumed to be low due to constant inundation.

4.6.1.4 Developed Habitats

Urban

Vegetated Urban habitats include a wide variety of native and non-native species and are classified into five types of vegetative structure by WHR: tree grove, street strip, shade tree/lawn, lawn, and shrub cover. Tree groves occur in city parks, green belts, and cemeteries, and have a continuous canopy that varies in height, tree spacing, crown shape, and understory conditions. Street tree strips vary in spacing with both continuous and discontinuous canopies. Understories are typically grass or ground cover. Shade trees in lawns, which are typical in residential areas, have a structure similar to natural savannas. Lawns are the most structurally simple Urban vegetation type, with only one uniform layer. Shrub cover is less common than other Urban vegetation types, and includes hedges. WHR Urban habitat occurs in small patches throughout the Project area.

4.6.1.5 Non-Vegetated Habitats

Barren

Barren habitats are those that are generally devoid of vegetation and include rock outcrops, mudflats, beaches, pavement, boat ramps, and buildings.

Within the Project area, WHR Barren habitat occurs along the Peace Valley Pipeline, in various locations on the margins of reservoirs, and along the Castaic Transmission Line.

4.6.2 Description of Vegetation Along Pyramid Reach

Pyramid reach does not fall within the proposed Project boundary; therefore, WHR habitat types were not determined. A qualitative description of riparian vegetation immediately adjacent to Piru Creek, which has potential to be affected by Project operations, is provided below based on review of previously documented survey data. Environmental Science Associates reported additional riparian vegetation in the approximately 5.5 mile section of Pyramid reach near Lake Piru during 2014 arroyo toad surveys. Surveyors noted that riparian plant communities in this area are dynamic, primarily due to the intensity of winter stream flows. In 2014, Environmental Science Associates observed widespread vegetation encroachment on the riparian channel, with mule-fat, willow, Fremont cottonwood, white alder, and broadleaf cattail being dominant on stream banks. The non-native tamarisk was reported to be expanding in this area, but was primarily confined to isolated locations on gravel bars. Dominant species in the riparian floodplain were willows and mule-fat, and occasionally poison oak and Spanish broom (Environmental Science Associates 2014b). Mule-fat scrub was found on lower and upper flood terraces in drier areas. Sycamore and alder were observed upstream and downstream from Blue Point Campground (approximately 0.5 mile north of Lake

Piru). At Frenchman's Flat (approximately 1.5 miles downstream of Pyramid Lake) and upstream from Blue Point Campground, large Fremont cottonwoods made up the overstory along with California live oak, white alder, and California sycamore. Understory species included arroyo willow and bush senecio (*Senecio flaccidus* var. *douglasii*) (Environmental Science Associates 2014b).

Areas of freshwater marsh were also found south of Frenchman's Flat. Freshwater marsh was also reported near Blue Point Campground (approximately 8 miles south of Pyramid Dam). Vegetation included broadleaf cattail, bulrushes, sedges, and rushes, and was dominated by non-natives, including annual rabbitsfoot grass (*Polypogon monspeliensis*), water speedwell (*Veronica* sp.), and watercress (*Nasturtium officinale*) (Environmental Science Associates 2014b).

4.6.3 Special-Status Plant Species

For the purpose of this PAD, a special-status plant is defined as a vascular plant that meets one or more of the following criteria: (1) FSS; (2) BLM; (3) listed under CESA as an endangered, threatened, or rare plant; (4) State-listed rare or a State candidate for listing species under the Native Species Plant Protection Act of 1977 (CDFW 2015); or (5) listed by the California Native Plant Society (CNPS) on its Inventory of Rare and Endangered Plants, including species that are rated as CNPS 1A through 4B (CNPS 2015). A list of all special-status plant species evaluated for potential occurrence in the project boundary are included in Table G-2 in Appendix G.

Licensees compiled a list of special-status plants that are known or have potential to occur within the proposed Project boundary from queries of the CNDDB (2015) and the CNPS Inventory of Rare and Endangered Plants database (CNPS 2015) based on searches at the level of USGS 7.5-minute topographic quadrangles. These are summarized in Appendix G. Queries included all quadrangles that intersect the proposed Project boundary (i.e., Lebec, La Liebre Ranch, Black Mountain, Liebre Mountain, Whitaker Peak, Warm Springs Mountain, and Newhall) and the quadrangle that includes Pyramid reach (i.e., Cobblestone Mountain).

Two special-status plant species were mapped by CNDDB as occurring within or near the proposed Project boundary: Peirson's morning glory (*Calystegia peirsonii*) was mapped in Castaic Creek above the Castaic Powerplant, and slender mariposa-lily (*Calochortus clavatus* var. *gracilis*) was mapped at the southwestern end of Elderberry Forebay (CNDDB 2015). Based on 2014 surveys of the perimeter of Quail Lake and Pyramid Lake, Environmental Science Associates (2014a) concluded that the following special-status plant species have potential to occur:

Pyramid Lake

- Horn's milkvetch (*Astragalus hornii* ssp. *hornii*)
- Monkey-flower savory (*Clinopodium mimuloides*)

- Mojave tarplant (*Deinandra mohavensis*)
- Los Angeles sunflower (*Helianthus nuttallii* ssp. *parishii*)
- California satintail (*Imperata brevifolia*)
- Ocellated Humboldt lily (*Lilium humboldtii* ssp. *ocellatum*)
- San Bernardino aster (*Symphyotrichum defoliatum*)

Quail Lake

- Late-flowered mariposa-lily (*Calochortus fimbriatus*)
- Palmer's mariposa-lily (*Calochortus palmeri* var. *palmeri)*
- San Bernardino aster (*Symphyotrichum defoliatum*)

4.6.4 Non-Native Invasive Plants

For the purpose of this PAD, NNIP are defined as A-, B-, or C- listed species by the California Department of Food and Agriculture (CDFA), species identified as invasive by Cal-IPC, and species included on the LPNF or ANF's weed lists (USFS 2005; USFS 2015). A list of all non-native invasive plant species with known or potential occurrence in the Project boundary is included in Table G-3 in Appendix G.

A list of NNIP that are known or suspected to occur in the Project area was compiled by reviewing CalWeedMapper spatial data (Cal-IPC 2015). Queries included all quadrangles that intersect the proposed Project boundary and the quadrangles intersecting the Pyramid reach. The results of the query are provided along with their Cal-IPC (2015) and CDFA (2010) ratings in Appendix G.

Review of literature found some references to NNIP in or near the Project Area, but no comprehensive surveys have been completed, and reporting information only addresses portions of the proposed Project boundary.

Along Pyramid reach, Environmental Science Associates reported that tamarisk occurs in isolated pockets and gravel bars and appears to be expanding, and that Spanish broom (*Spartium junceum*) occurs uncommonly in willow scrub. NNIP were reported to be common in grasslands along the creek, including shortpod mustard (*Hirschfeldia incana*), tocalote (*Centaurea melitensis*), and Russian thistle (*Salsola tragus*). Black mustard (*Brassica nigra*) occurs in alluvial terraces adjacent to Piru Creek. (Environmental Science Associates 2014b).

POWER Engineers (2013) reported tamarisk and tree tobacco in the check basins above Castaic Powerplant. LADWP removes invasive plants species in this area by mechanical means, or by hand when feasible. Following removal, stumps that cannot be removed are treated with Roundup® or other herbicide containing glyphosate.

LADWP stores herbicides in a stainless steel tank that is trailer-mounted or placed on a flatbed truck and then transported to treatment areas. Applicators apply herbicides using a hose attached to the tank, which remains secured on the trailer/flatbed so that no spilling occurs. Crews use backpack tanks where target areas are too steep for truck access. LADWP applies pesticide only when there is a low chance of precipitation in the 7 day forecast and when treatment areas are dry. Herbicide applicators are LADWP personnel, contractors, or subcontractors who have either a QAC or License issued by the State of California Department of Pesticide Regulation. These individuals are trained to ensure that herbicides are applied at rates consistent with label requirements and in a manner that avoids potential adverse effects.

4.6.5 Special-Status Wildlife Species

For the purpose of this PAD, a special-status wildlife species meets at least one of the following criteria: (1) listed under CESA as threatened, endangered, or candidate; (2) FP; (3) SSC; (4) FSS-S; (5) BLMS; or (6) formerly listed by the USFWS as a Bird of Conservation Concern (BCC) or protected under the Bald and Golden Eagle Protection Act. A list of all special-status wildlife species occurring or potentially occurring in the project boundary is included in Table G-4 in Appendix G.

Licensees developed the list of special-status wildlife species known, or with the potential to occur in the Project vicinity based on multiple sources of information. These sources included the Special Animals List maintained by the CDFW CNDDB (CDFW 2015), which gives State-listed taxa, as well as species listed by other agencies as described above. Licensees also queried the WHR database (CDFW 2015) for a preliminary list of potentially occurring species using existing vegetation mapping data in the Project area. Because WHR results are derived from county species lists and do not differentiate sub-species or populations categorized as special-status from more widely occurring species, the list was further refined by reviewing WHR range maps for each special-status taxa and other sources as needed, including WHR and other life history accounts and range maps (e.g., Bolster 1998; Zeiner et al. 1988-1990, and updates; Shuford and Gardali 2008; IUCN Red List of threatened Species 2015; California Herps 2015).

On the basis of these analyses, Licensees identified 56 wildlife special-status species, of which 25 species are listed on multiple agency lists that could potentially be affected by the Project. The list (Table G-4 in Appendix G) includes 1 terrestrial amphibian (salamander), 8 reptiles, 29 birds, and 18 mammals. Two species are listed under the CESA: southern rubber boa (*Charina umbratica*) (threatened) and bald eagle (*Haliaeetus leucocephalus*) (endangered). Six of the identified species are listed as FP: northern goshawk (*Accipiter gentilis*), white-tailed kite (*Elanus leucurus*), golden eagle (*Aquila chrysaetos*), American peregrine falcon (*Falco peregrinus anatum*), bald eagle, and ringtail (*Bassariscus astutus*). Forty-three of the identified species are SSC, 12 are FSS, 17 are BLMS, and 14 are on the BCC list. Table G-4 in Appendix G also summarizes information regarding expected habitat associations and potential seasonal occurrence.

Existing records for special-status wildlife species were identified from sources located during Licensees' gathering of existing, relevant and reasonably available information and by a query of the CNDDB (CDFW 2015) based on a search of the USGS 7.5-minute topographic quadrangles in which the proposed Project boundary is located (i.e., La Liebre Ranch, Lebec, Black Mountain, Liebre Mountain, Whittaker Peak, Warm Springs Mountain, and Newhall), and the adjacent quadrangles (Burnt Peak, Cobblestone Mountain, Piru, Val Verde, Green Valley, and Mint Canyon), covering approximately 774 square miles. The broad search area was used because of the limitations of the CNDDB. The CNDDB is a statewide inventory, managed by CDFW, and is continually updated with the locations and conditions of the State's rare and declining species. However, it is limited by where surveys have been performed and contains only those records that have been submitted to CDFW. The results of the queries are discussed in 4.6.5, along with other information on wildlife occurrences, and are summarized in Appendix G.

4.6.6 Designated Special Ecological Areas

The proposed Project boundary includes or abuts one designated special ecological area, a USFS Critical Biological Land Use Zone for arroyo toad on Piru Creek. Critical Biological Land Use Zones are areas managed by the USFS for the protection of rare species. Human activities and land modifications are restricted, but not excluded, to prevent any impacts to the protected species within the land use zone (USFS 2006).

No other designated special ecological areas (e.g., Protected Activity Centers, Habitat Conservation Plans, Home Range Core Areas and Area of Critical Environmental Concern) occur within or adjacent to the proposed Project boundary. While not a designated special ecological area, some migratory birds use the Project's reservoirs as a resting place on their flights between breeding grounds and wintering grounds (Golightly et al. 2005). Additional areas considered sensitive, such as CDFW's high priority natural community elements or vegetation types may also exist within the Project boundary, but are not specifically delineated areas by resource agencies.

4.6.7 Commercially Valuable Wildlife Species

A commercially valuable wildlife species is any species listed as a "harvest species" by CDFW. Per the CDFW, harvest species are game birds (FGC § 3500); game mammals (FGC § 3950), fur-bearing mammals and non-game animals as designated in the CCR (CDFW 2015). The WHR identified 59 harvest wildlife species found in Los Angeles County associated with the WHR vegetation types mapped from the Project area (Table G-5, Appendix G). A species' inclusion on this list does not imply that it occurs in the Project area. The list includes 37 species of birds, primarily migratory waterfowl (i.e., 26 species of ducks, geese, and coots) and upland game birds (i.e., 6 gallinaceous species, such as quails and pheasant), and 22 species of mammals, ranging from rabbits and squirrels to mule deer (*Odocoileus hemionus*). There are 10 non-native species on the list, including game birds propagated for hunting (e.g., wild turkey [*Meleagris gallopavo*]) and species that may have established populations from escaped individuals (e.g., spotted dove [*Streptopelia chinensis*] and fallow deer [*Dama*

dama]). Designated harvest species may be legally hunted under CDFW license regulations in California; however, hunting is not permitted within the Project boundary.

Six subspecies of mule deer occur in California. The subspecies occupying the Project area is the California mule deer (*O. hemionus californicus*), the second most abundant subspecies in the state (Higley 2002). CDFW estimated the population of deer in California at 443,289 individuals in 2014 (CDFW 2015). Deer populations have been relatively steady since 2007, following a general decline from a record high in the 1960s, which has been attributed to loss and degradation of habitat (Higley 2002, CDFW 2015). In 1976, CDFW prepared a deer management plan with the goal of restoring deer populations to previous levels (CDFW 1976). The plan included habitat and population management goals for deer populations by "herd" units. The previous plan did not result in restoration of populations to the goal levels due to the magnitude of landscape changes required to provide suitable habitat and shifts in landscape management priorities since the plans were prepared (CDFW 2015).

In 2015, CDFW prepared the California Deer Conservation and Management Plan to update the 1976 plan and to focus on conservation and management at a larger scale, outlining a landscape-level approach to deer planning within 10 Deer Conservation Unit's (DCU). The objectives for each DCU are to characterize the current scientific, environmental, sociological, and economic conditions of the DCUs as they relate to deer management; describe population estimates and monitoring measures; and to identify key habitat areas and strategies for restoration/enhancement.

The proposed Project boundary falls within the Transverse and Peninsular Ranges DCU. This DCU includes 9,426,348 acres of land that is approximately half publicly owned (52 percent) and half privately owned (48 percent). Mule deer in this area are primarily resident, but occasionally move from high to low elevations in winter, especially during years of heavy snow (CDFW 2015). CDFW anticipated that plan development for this DCU would occur by November 2015, with implementation planned for March 2016. DWR was not able to obtain updates on the current schedule.

4.6.8 Wildlife Occurrences

4.6.8.1 Amphibians[37]

Most amphibians are addressed in Section 4.5 as aquatic resources; however, completely terrestrial salamanders without free-living larval stages are treated here as terrestrial resources. Common, forest- and chaparral-dwelling terrestrial salamanders include Monterey ensatina (*Ensatina eschscholtzii eschscholtzii*), garden slender salamander (*Batrachoseps major*), black-bellied salamander (*B.*

[37] Photo credit: Arboreal salamander by Bill Bouton [CC BY-SA 2.0], via Wikimedia Commons

nigriventris), and arboreal salamander (*Aneides lugubris*). These are species generally associated with surface cover (e.g., under rocks, downed wood, bark slabs, or moist leaf litter) and subterranean retreats, including earthworm and termite tunnels and burrows. Licensees found no records or reports of terrestrial salamanders in the Project area. The CNDDB (CDFW 2015) includes three records of yellow-blotched ensatina (*E. eschscholtzii croceator*) (SSC and FSS) from the Tehachapi Mountains. Although included here as potentially occurring in the Project area, this taxon is believed to occur only in the Tehachapi Mountains south to Frazier and Alamo Mountains, an area north to northwest of the Project area, and apparently separated from the distribution of Monterey ensatina (Stebbins 1949; California Herps 2015).

4.6.8.2 Reptiles[38]

Licensees found four documents that present information regarding terrestrial reptiles in the Project area, mostly for localized evaluations or opportunistic sightings, including lists of species likely to occur, although not documented. Species observed in one or more areas include side-blotched lizard (*Uta stansburiana*), western fence lizard (*Sceloporus occidentalis*), yellow-backed spiny lizard (*S. uniformis*) (formerly considered as a subspecies of desert spiny lizard [*S. magister*]), southern alligator lizard (*Elgaria multicarinata*), western whiptail (*Aspidoscelis tigris*), striped racer (*Masticophis lateralis*), common kingsnake (*Lampropeltis getulus*), western blind snake (*Leptotyphlops humilis*), and Pacific rattlesnake (*Crotalus oreganus*) (Aspen Environmental Group 1984, 2007; POWER 2013; Environmental Science Associates 2015a). Undoubtedly, numerous other common species also occur (e.g., racer [*Coluber constrictor*] and gopher snake [*Pituophis catenifer*]), particularly species associated with open forests, scrub and shrub-dominated habitats, and riparian habitats; however, some of these are fossorial or nocturnal species unlikely to be detected without special survey efforts.

There are CNDDB records for two species of special-status lizards and one species of special-status terrestrial snake in the Project vicinity (CDFW 2015), which are summarized in Appendix G. Of these species, coast horned lizard was most widely reported, including records near Quail Lake, Pyramid Lake, and Pyramid reach, and can be presumed to occur at or near the Project in locations where the appropriate soil and cover characteristics occur. There are two records for California legless lizards, one for “silvery legless lizard” near the Santa Clara River south of the Project and the other from within about 2 miles of Quail Lake, which could represent Southern California legless lizard (*Anniella stebbinsi*), Northern California legless lizard (*Anniella pulchra*) or intergrades of the two species. Legless lizards are mostly fossorial species associated with loose, sandy or loamy soil and therefore predicting distribution requires more information than available from general vegetation mapping. Other special-status

[38] Photo credit: Coast horned lizard by Joshua Tree National Park [CC BY 2.0], via Wikimedia Commons

reptiles that may occur include San Bernardino ring-necked snake (*Diadophis punctatus modestus*) and northern three-lined rosy boa (*Lichanura orcuttii* [*trivirgata*]), for which there is a record at San Francisquito Canyon. The Project is within the known range of coast patched-nosed snake (*Salvadora hexalepis virgultea*), which is evidently associated with shrub-dominated habitats where there are mammal burrows and abundant lizard populations. Desert night lizard (*Xantusia vigilis*) is included as potentially occurring, although this species may require the presence of Joshua trees, and thus may be limited to transitional habitats on the northern edge of the Project area. The presence of southern rubber boa is also uncertain, because the Project may be outside of the species' range and taxonomic controversy. Rubber boas are known to occur in the Tehachapi Mountains south to Frazier and Alamo Mountains, an area north to northwest of the Project in Kern County, and these snakes may represent northern rubber boa (*Charina bottae*) or intergrades of the two species (Stebbins and McGinnis 2012; California Herps 2015). Southern rubber boa is not FSS.

4.6.8.3 Birds[39]

Habitats within the Project area support a wide variety of migratory and resident bird species. Although information is fragmentary and localized evaluations do not provide a comprehensive account of species, Pyramid Lake, Elderberry Forebay, and Quail Lake provide open water habitats highly attractive to migratory waterfowl and shorebirds. Species associated with emergent wetlands and riparian habitats are also known to frequent the margins of these water bodies, the lake tributaries, and Piru Creek downstream of Pyramid Dam. Other species are characteristic of chaparral and other upland shrub-dominated habitats, open forests, and transitional habitats on the northern edge of the Project boundary.

In addition to large numbers of migrating American coots (*Fulica americana*), documented water-birds at the lakes include greater scaup (*Aythya marila*), bufflehead (*Bucephala albeola*), ruddy duck (*Oxyura jamaicensis*), pied-billed grebe (*Podilymbus podiceps*), and double-crested cormorant (*Phalacrocorax auritus*). Jones and Stokes (2002) detected 68 species of birds in Pyramid reach and 58 species along Liebre Gulch, a tributary to Pyramid Lake. Yellow warbler (*Setophaga petechia*) (SSC) was found in both areas. Broadleaf cattail and bulrush stands on the fringe of Quail Lake have provided nesting habitat for the special-status tricolored blackbird (*Agelaius tricolor*), a colonial nesting species; however, the species was not found at the site in a 2014 survey (CDFW 2015). On September 18, 2015, USFWS published a 90-day finding (80 FR 56423) on a petition to list this taxon as endangered or threatened, concluding that the petition presented substantial information showing specific locations where listing may be warranted and beginning a 12-month review.

[39] Photo credit: Tricolored blackbird by Dave Menke, USFWS [public domain], via www.public-domain-image.com

There are also CNDDB records of nine special-status birds in the Project vicinity (summarized in Appendix G), most with at least one record within about 2 miles of the Project boundary (CDFW 2015): ferruginous hawk (*Buteo regalis*), golden eagle, white-tailed kite, prairie falcon (*Falco mexicanus*), burrowing owl (*Athene cunicularia*), loggerhead shrike (*Lanius ludovicianus*), yellow warbler, Bell's sage sparrow (*Artemisiospiza belli belli*), and tricolored blackbird. Of these, records for burrowing owl and loggerhead shrike are the most numerous and widely distributed, including records of both species within 2 miles of Elderberry Forebay. The only record for white-tailed kite was from south of the Project adjacent to the Santa Clara River. Records for prairie falcon (exact location suppressed) are from three USFS topographic quadrangles on which the Project is located (i.e., Black Mountain, Liebre Mountain, and Whittaker Peak). With the exception of yellow warbler, which occurs in shrubby riparian habitat, the documented special-status birds are upland species. Records for most bird species in the CNDDB are limited to nesting records, although this restriction does not apply to golden eagle, bald eagle, burrowing owl, California spotted owl (*Strix occidentalis occidentalis*), vermillion flycatcher (*Pyrocephalus rubinus*), purple martin (*Progne subis*), LeConte's thrasher (*Toxostoma lecontei*), vesper sparrow (*Pooecetes gramineus affinis*), or Bell's sage sparrow.

The Final EIS/EIR for Barren Ridge Renewal Transmission Project (USFS, BLM, and LADWP 2012) stated that northern goshawk was not detected or considered likely in any part of that project, which substantially overlaps the Project area. Protocol surveys for California spotted owl also did not detect that species. Aspen Environmental Group (2007) reported observations of three special-status birds in areas investigated for the Castaic Powerplant Sediment Removal Project: golden eagle, bald eagle, and Bell's sage sparrow. There are no reported bald eagle nests in the Project area.

Based on this available information, special-status bird species most likely to occur in the Project area include wintering bald eagle, golden eagle, burrowing owl, loggerhead shrike, yellow warbler, Bell's sage sparrow, and possibly tricolored blackbird, if this species continues to occur at Quail Lake.

4.6.8.4 Mammals[40]

Mammals documented during evaluations for the Castaic Powerplant Sediment Removal Project included deer mouse (*Peromyscus* sp.), California vole (*Microtus californicus*), southern grasshopper mouse (SSC), "Pacific" kangaroo rat (*Dipodomys agilis* or *D. simulans*), dusky-footed woodrat (*Neotoma fuscipes*), Botta's pocket gopher (*Thomomys bottae*), California ground squirrel (*Otospermophilus beecheyi*), desert cottontail (*Sylvilagus audubonii*), raccoon (*Procyon lotor*), bobcat (*Lynx rufus*), gray fox (*Urocyon cinereoargenteus*), coyote (*Canis latrans*), and mule deer (Aspen Consulting Group 2007; POWER 2010). A separate evaluation downstream of Pyramid Dam (Aspen Environmental Group 2003) documented big brown bat (*Eptesicus fuscus*) and western pipistrelle (*Pipistrellus hesperus*), and assumed the following other species to be common in riparian areas along Piru Creek: California ground squirrel, brush rabbit (*Sylvilagus bachmanii*), raccoon, striped skunk (*Mephitis mephitis*), coyote, and mule deer.

There are records for eight species of special-status mammals in the CNDDB in the Project vicinity (CDFW 2015), which are summarized in Appendix G. The most numerous records (11) are for Tehachapi pocket mouse (*Perognathus alticolus inexpectatus*), which are distributed primarily north to northwest of the Project, suggesting this species may occur in the vicinity of Quail Lake and the northern end of the Peace Valley Pipeline. The one record for San Joaquin pocket mouse (*Perognathus inornatus*) from the Hungry Valley State Vehicular Recreation Area (SVRA) west of the Peace Valley Pipeline may also suggest a similar or more limited distribution. The remaining CNDDB records, many of which are not recent, are all for special-status bats: Townsend's big-eared bat (*Corynorhinus townsendii*), western mastiff bat (*Eumops perotis*), pallid bat (*Antrozous pallidus*), spotted bat (*Euderma maculatum*), Yuma myotis (*Myotis yumaensis*), and fringed myotis (*M. thysanodes*). Studies for the Barren Ridge Renewal Transmission Project (USFS, BLM, and LADWP 2012) included acoustic monitoring for bats in August 2008 and an evaluation of habitats for potential occurrence of FSS bats. The Biological Evaluation concluded that pallid bat, Townsend's big-eared bat, and western red bat (*Lasiurus blossevillii*) were likely to occur, although none of those species were detected.

Based on this available information, special-status mammals most likely to occur in the Project area include Tehachapi white-eared pocket mouse, southern grasshopper mouse, and special-status bats.

[40] Yuma myotis by Daniel Neal [CC BY 2.0 (http://creativecommons.org/licenses/by/2.0)], via Wikimedia Commons

4.7 WETLANDS, RIPARIAN, AND LITTORAL HABITATS

This Section provides information regarding existing wetlands, riparian and littoral habitats. Besides this general introductory information, this Section includes three main sub-sections: Section 4.7.1 describes wetlands, including wetlands identified by USFWS in its National Wetlands Inventory (NWI) maps that may be affected by the Project; Section 4.7.2 discusses riparian habitats that may be affected by the Project; and Section 4.7.3 describes littoral habitats that may be affected by the Project. Each of the sections addresses these habitats associated with Project reservoirs and impoundments within the proposed Project boundary, and along Pyramid reach.

Wetlands, riparian areas, and littoral habitats occur within the proposed Project boundary adjacent to Project impoundments and conveyances, but no formal mapping or delineation of these habitats have been conducted in the Project area.

Waters of the United States are those that are regulated under the CWA, and include waters which are currently used, were used in the past, or may be susceptible to use in interstate or foreign commerce; their tributaries; and adjacent waters, including wetlands, ponds, lakes, impoundments and similar waters (40 CFR § 230.3). For rivers and streams, including those that are non-vegetated, the limit of jurisdiction is determined by the ordinary high water mark (OHWM), which is typically delineated in the field by evaluating field indicators. Evaluation of hydrological data also can provide additional information to assist in determination of the OHWM. Riparian areas that are not located within Waters of the United States are not regulated under the CWA.

There are also a number of man-made water features in the Project area. Man-made water bodies may or may not be considered jurisdictional under the CWA. The jurisdictional determination of these features is typically made by considering wetland characteristics and hydrological connections to other waterways or wetlands. The United States Army Corps of Engineers (USACE) ultimately makes the final determination of jurisdictional status.

4.7.1 <u>Wetlands</u>

Wetlands are areas that meet the criteria for soils, hydrology, and vegetation as defined in the USACE Wetland Delineation Manual (USACE 1987). These areas are inundated or saturated by surface or groundwater at a duration and frequency sufficient to support vegetation typically adapted for saturated soil conditions. Wetland areas include marshes, shallow swamps, lakeshores, wet meadows, and riparian areas, and often occur along or adjacent to perennial or intermittent water bodies.

The USFWS' NWI data (USFWS 2010d) were the only data identified for wetlands mapping within the proposed Project boundary (Figures 4.7-1 through 4.7-5). NWI mapping provides preliminary data on potential location and type of wetlands. These data are based on aerial imagery, which is not typically ground-truthed, and likely do not capture some areas where wetlands may occur, such as in and adjacent to riparian areas. Additionally, NWI provides no information about vegetation, condition of the wetland, whether an area meets the USACE definition of wetland, or whether it would be considered jurisdictional.

No comprehensive wetland surveys or delineations have been performed in the Project area; however, the following paragraphs describe recent field surveys by Environmental Science Associates evaluating vegetation in portions within the Project boundary.

In 2014, Environmental Science Associates performed field reconnaissance surveys along the perimeters of Quail Lake and Pyramid Lake to evaluate the potential effects of the proposed application of copper-based herbicides to control aquatic weeds and algal blooms (Environmental Science Associates 2014a). On both lakes, Environmental Science Associates observed broadleaf cattail marsh along the perimeter of the lake where shallow fringes of emergent vegetation were able to establish. At Quail Lake, the wetlands were dominated by broadleaf cattail interspersed with common reed and rushes. At Pyramid Lake, this plant community was dominated by broadleaf cattail, with common reed occurring occasionally in patches. Plant species diversity on the perimeter of both lakes was presumed to be low due to constant inundation. These areas would be classified as Palustrine wetlands under the Cowardin system (Cowardin et al. 1979) but were not mapped in NWI data (see NWI Mapped Habitats section below).

Environmental Science Associates (2014b) reported on vegetation observed along the approximately 5.5 mile section of Pyramid reach upstream of Lake Piru during 2014 arroyo toad surveys. Areas of freshwater marsh were found south of Frenchman's Flat (approximately 1.5 miles downstream of Pyramid Lake). This area is mapped as Palustrine--Scrub-Shrub--Seasonally Flooded by NWI (see NWI Mapped Habitats below). Freshwater marsh was also reported near Blue Point Campground (approximately 8 miles south of Pyramid Dam). NWI maps only Riverine wetlands in this area. Vegetation included broadleaf cattail, bulrushes, sedges, and rushes, and was dominated by non-natives, including annual rabbitsfoot grass, water speedwell, and watercress (Environmental Science Associates 2014b).

4.7.1.1 NWI Mapped Habitats

NWI areas are described using the Cowardin classification (Cowardin et al. 1979), a hierarchical system that defines wetlands and deepwater habitats according to System, Subsystem, Class, Subclass and Modifiers. Mapped features are not always described using all categories, but typically are classified by System and Class, at a minimum.

Three Cowardin classifications were mapped by NWI within the proposed Project boundary: Palustrine, Lacustrine, and Riverine. Palustrine wetlands include all non-tidal wetlands dominated by trees, shrubs, emergent plants, mosses or lichens. Lacustrine areas include wetlands and deepwater habitats that (1) are located in a topographic depression or a dammed river channel; (2) are lacking in trees, shrubs, persistent emergent plants, emergent mosses or lichens with greater than 30 percent areal coverage; and (3) are greater than 20 acres in area. Riverine include habitats contained in natural or artificial channels with periodically or continuously flowing water, or which form a connecting link between two bodies of standing water. Lacustrine and Riverine habitats are generally not considered wetland areas, but they are included here for completeness in evaluating NWI data. Table 4.7-1 summarized Cowardin classifications for the NWI features mapped within the proposed Project boundary and Pyramid reach.

NWI wetland and other water types and specific features mapped within the proposed Project boundary and Pyramid reach are described below and depicted in Figures 4.7-1 through 4.7-6.

Table 4.7-1. Cowardin Classifications for Features Within the Project Boundary and Along Pyramid Reach

Cowardin Classifier	Abbreviation	Description
System		
Palustrine	P	Non-tidal wetlands dominated by trees, shrubs, emergent plants, mosses or lichens
Lacustrine	L	Wetlands and deepwater habitats that (1) are located in a topographic depression or a dammed river channel; (2) are lacking in trees, shrubs, persistent emergent plants, emergent mosses or lichens with greater than 30 percent areal coverage; and (3) are greater than 20 acres in area
Riverine	R	Habitats contained in natural or artificial channels with periodically or continuously flowing water, or which form a connecting link between two bodies of standing water
Subsystem--Riverine		
Lower Perennial	2	Characterized by a low gradient and slow water velocity, some water flows throughout the year. The substrate consists mainly of sand and mud, and the floodplain is well developed.
Upper Perennial	3	Characterized by a high gradient and fast water velocity. Some water flows throughout the year. This substrate consists of rock, cobbles, or gravel with occasional patches of sand. There is very little floodplain development.
Intermittent	4	Describes channels that contain flowing water only part of the year, but may contain isolated pools when the flow stops
Subsystem--Lacustrine		
Limnetic	1	Extends outward from Littoral boundary and includes all deep-water habitats within the Lacustrine System
Littoral	2	Extends from shoreward boundary to 2 meters (6.6 feet) below annual low water or to the maximum extent of nonpersistent emergents, if these grow at depths greater than 2 meters
Class		
Unconsolidated Bottom	UB	Wetlands and deepwater habitats with at least 25 percent cover of particles smaller than stones (less than 6 to 7 cm) and a vegetative cover less than 30 percent
Unconsolidated Shore	US	Wetlands and deepwater habitats characterized by substrates lacking vegetation, except for pioneer plants that become established during brief periods when growing conditions are favorable
Forested	FO	Wetlands characterized by woody vegetation with height 6 m or taller

Table 4.7-1. Cowardin Classifications for Features Within the Project Boundary and along Pyramid Reach (continued)

Cowardin Classifier	Abbreviation	Description
Emergent	EM	Wetlands characterized by erect, rooted, herbaceous hydrophytes (plants adapted to growing in wet conditions), excluding mosses and lichens. This vegetation is present for the majority of the growing season in most years, and most emergent wetlands are dominated by perennial plants.
Scrub-shrub	SS	Includes areas dominated by woody vegetation less than 6 m (20 feet) tall. The species include true shrubs, young trees (saplings), and trees or shrubs that are small or stunted because of environmental conditions.
Subclass		
Persistent	1	Dominated by species that normally remain standing at least until the beginning of the next growing season
Modifiers		
Temporarily Flooded	A	Areas in which surface water is present for brief periods during growing season, but the water table usually lies well below the soil surface for most of the growing season. Plants that grow both in uplands and wetlands may be characteristic of this water regime.
Seasonally Flooded	C	Areas in which surface water is present for extended periods especially early in the growing season, but is absent by the end of the growing season in most years. The water table after flooding ceases is variable, extending from saturated to the surface to a water table well below the ground surface.
Intermittently Exposed	G	Areas in which surface water is present throughout the year, except in years of extreme drought
Permanently Flooded	H	Areas in which water covers the land surface throughout the year in all years
Artificially Flooded	K	Areas in which the amount and duration of flooding is controlled by means of pumps or siphons in combination with dikes or dams
Other Special Modifiers		
Excavated	x	Areas that occur in a basin or channel that have been dug, gouged, blasted, or suctioned through artificial means
Diked/ Impounded	h	Areas that have been created or modified by a man-made barrier or dam which obstructs the inflow or outflow of water

Source: USFS 2014

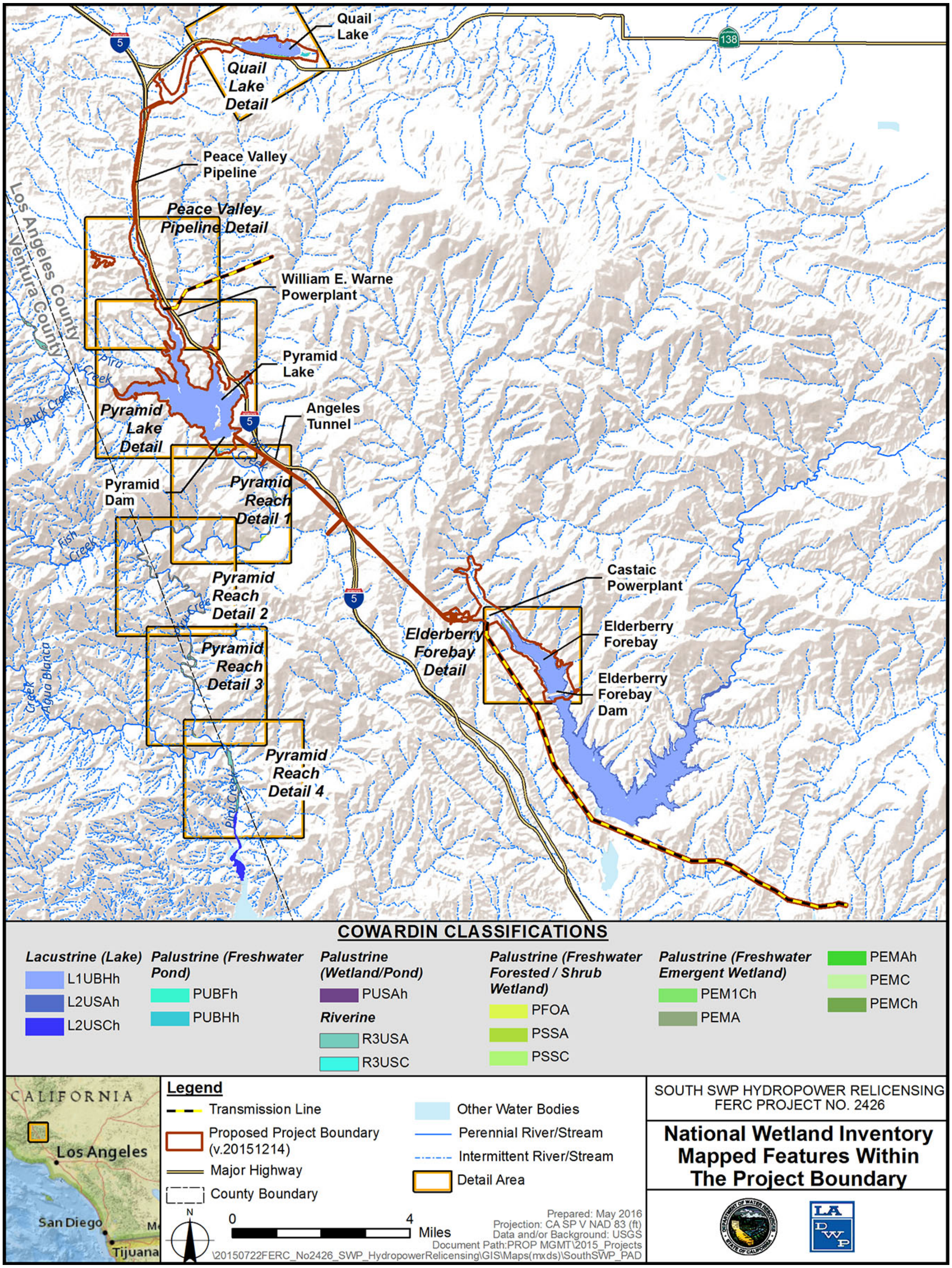


Figure 4.7-1. National Wetland Inventory – Key Map

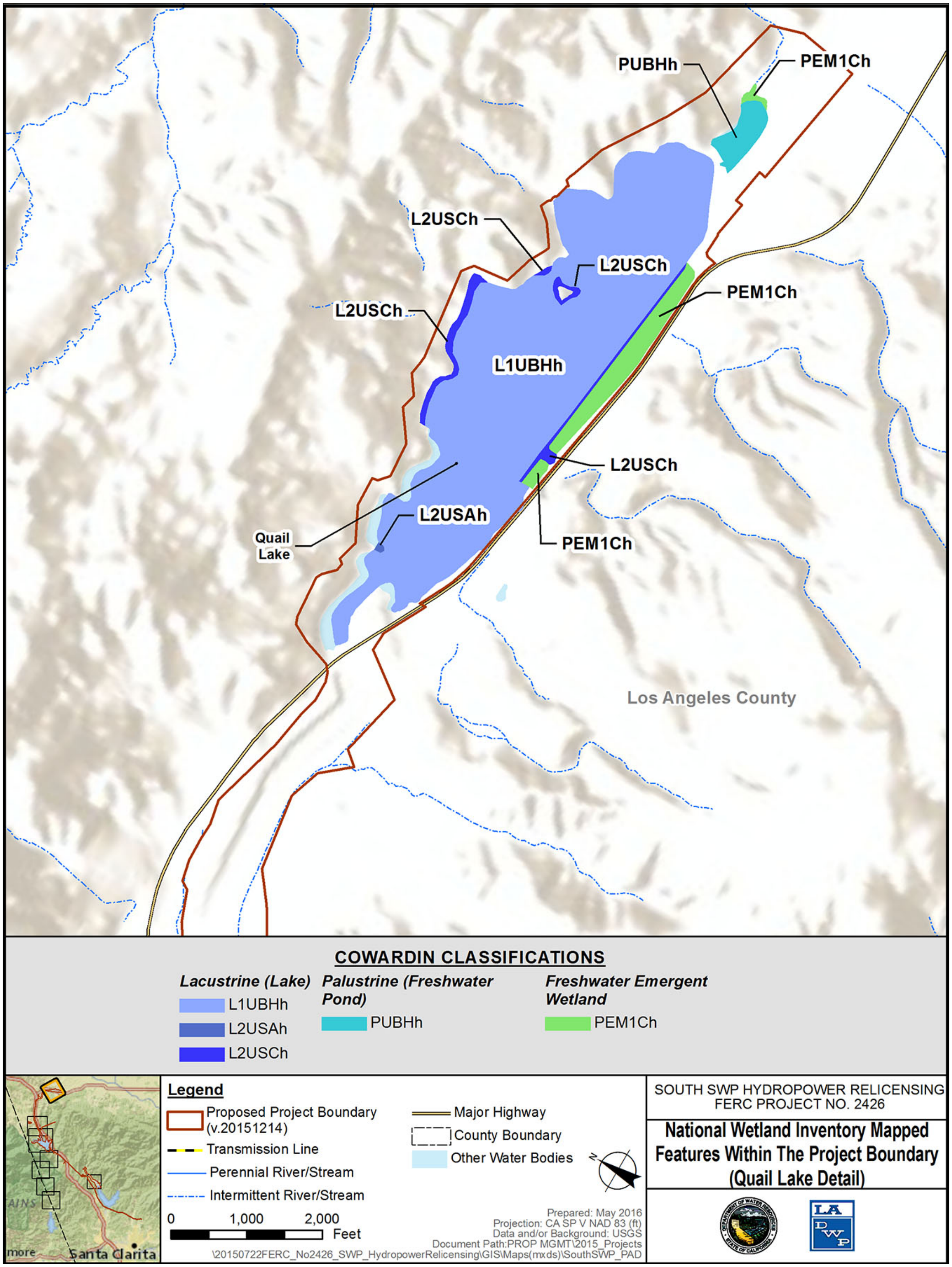


Figure 4.7-2. National Wetland Inventory Mapped Features Within the Project Boundary – Quail Lake Detail

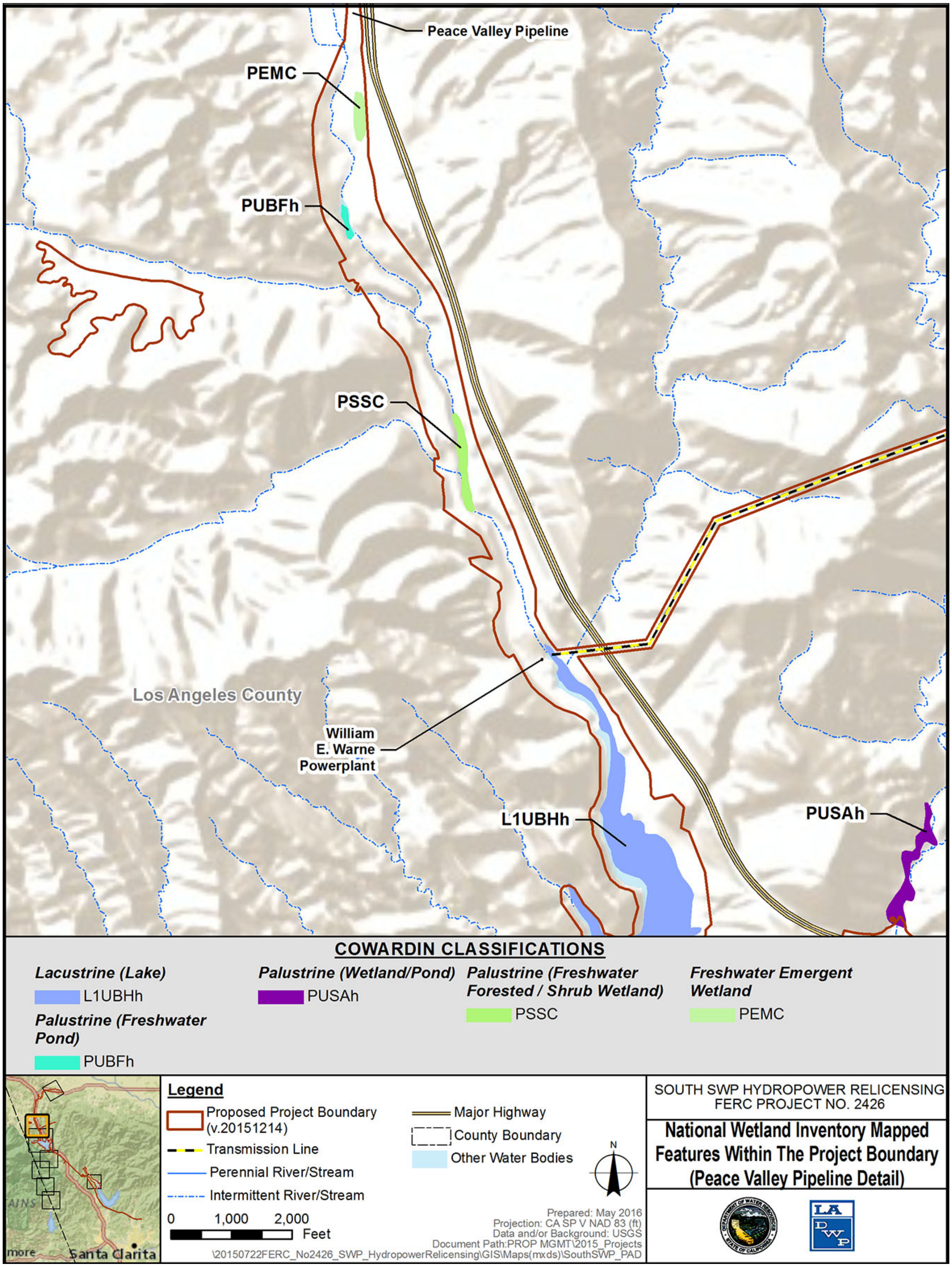


Figure 4.7-3. National Wetland Inventory Mapped Features Within the Project Boundary – Peace Valley Pipeline Detail

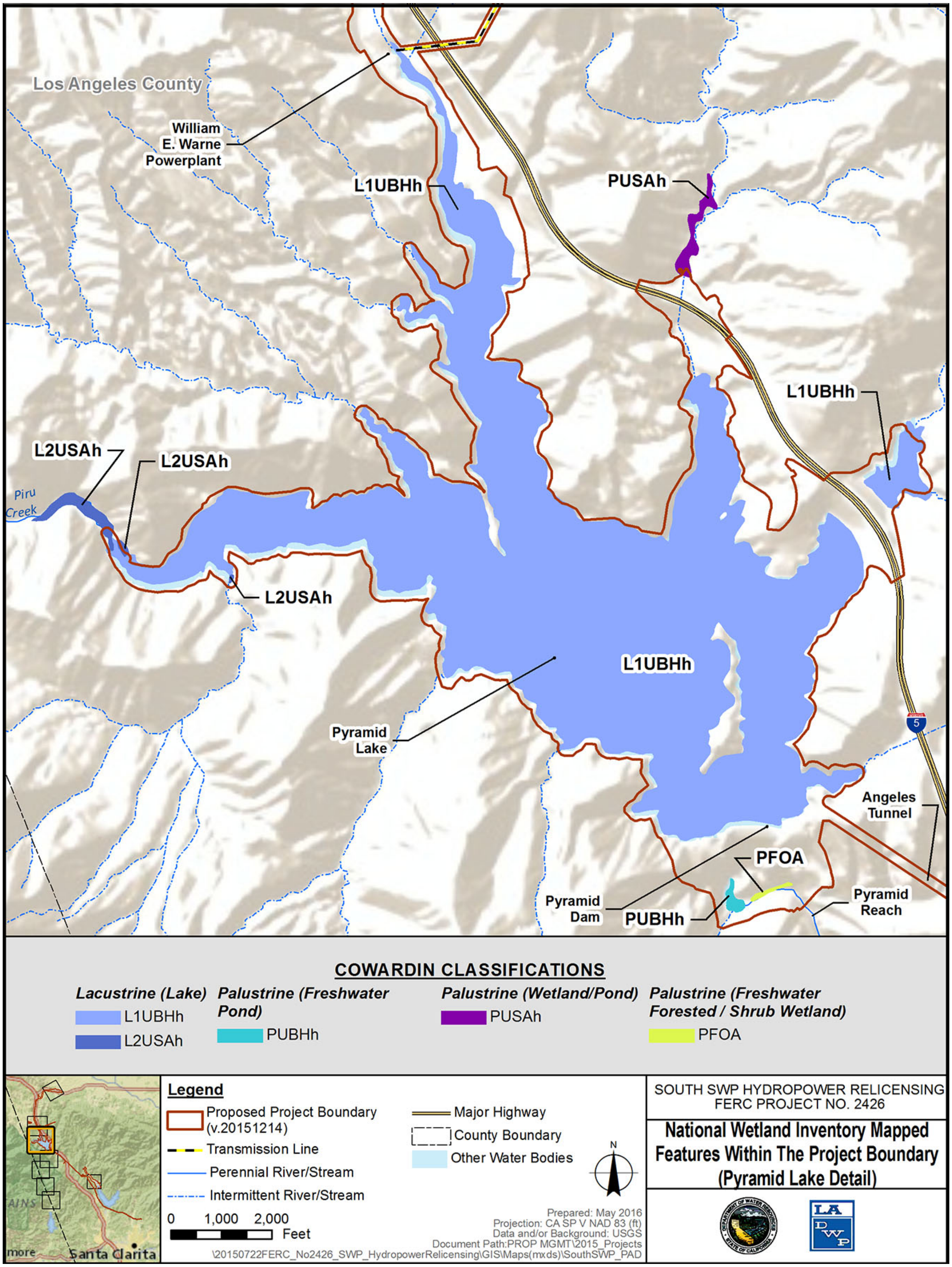


Figure 4.7-4. National Wetland Inventory Mapped Features Within the Project Boundary – Pyramid Lake Detail

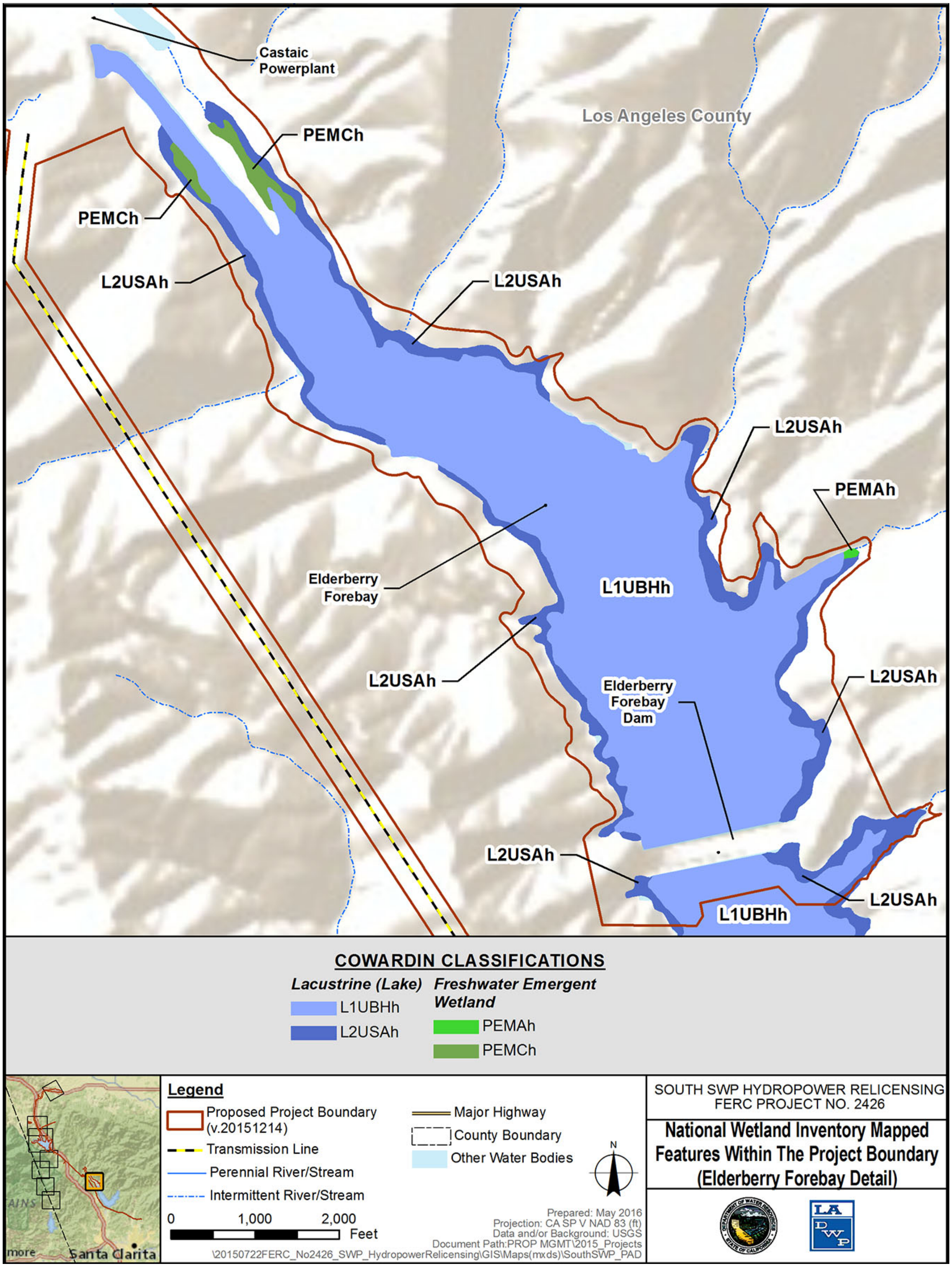


Figure 4.7-5. National Wetland Inventory Mapped Features Within the Project Boundary – Elderberry Forebay Detail

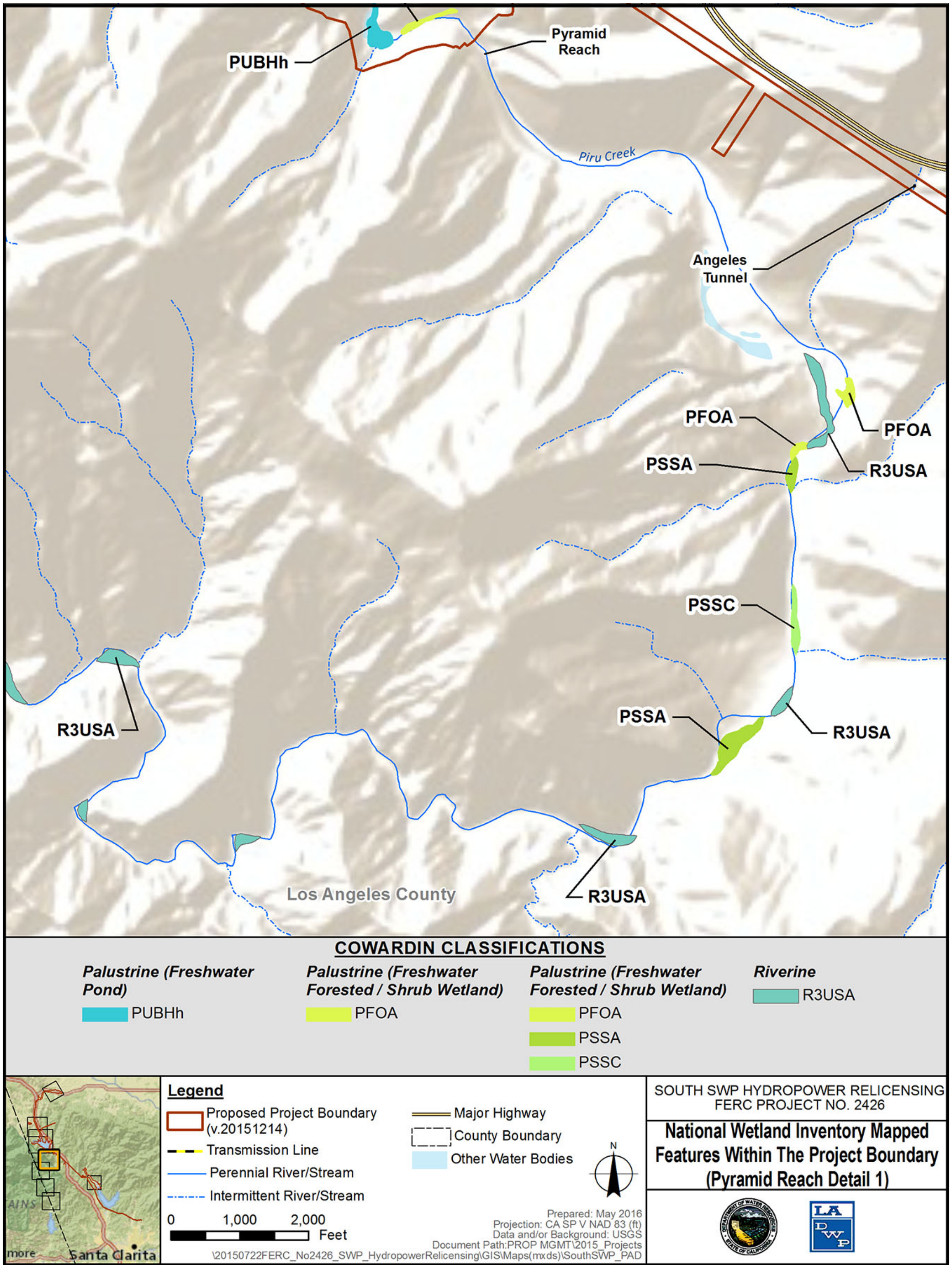


Figure 4.7-6. National Wetland Inventory Mapped Features Within the Project Boundary – Pyramid Reach Detail 1

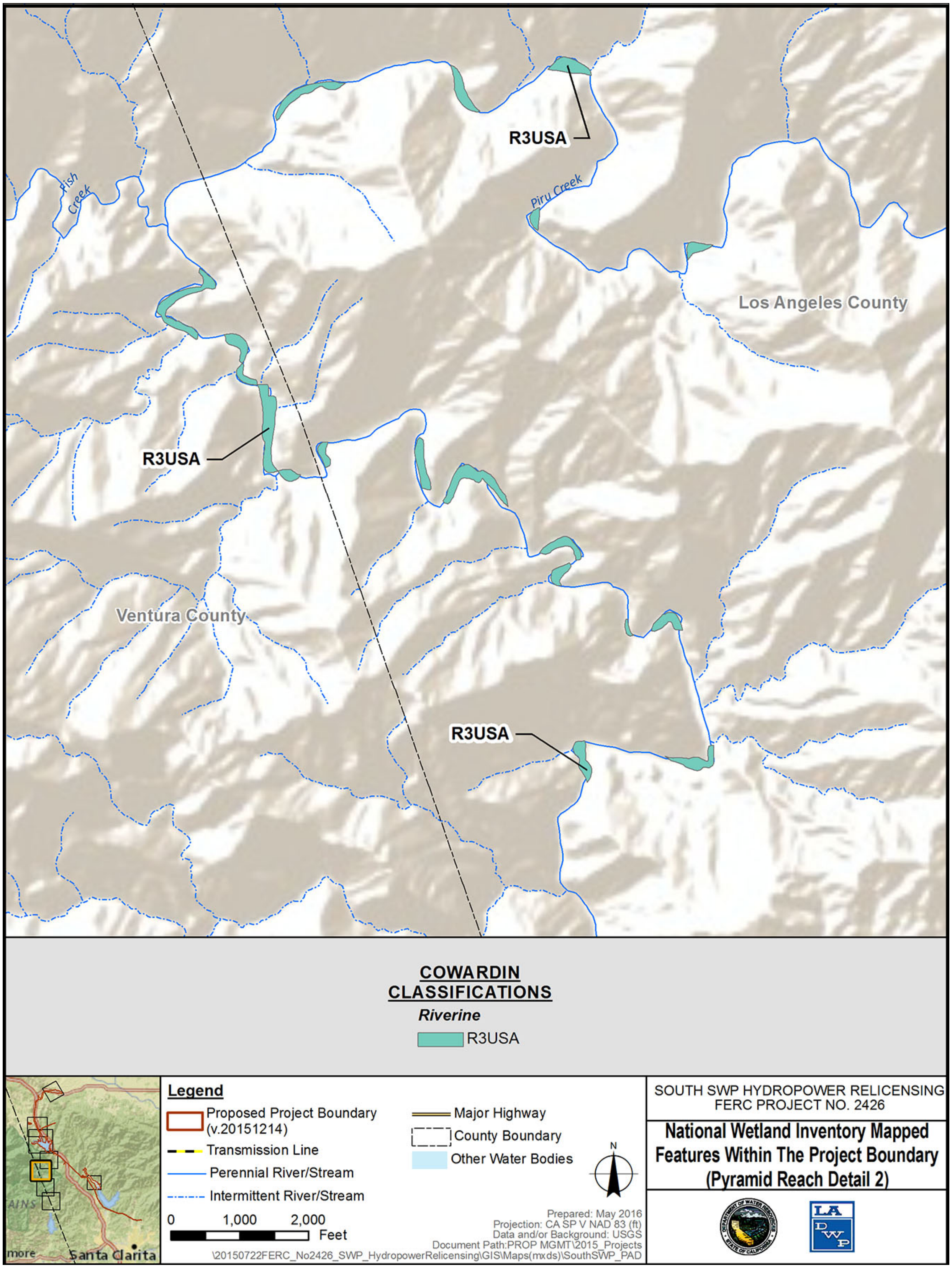


Figure 4.7-7. National Wetland Inventory Mapped Features Within the Project Boundary – Pyramid Reach Detail 2

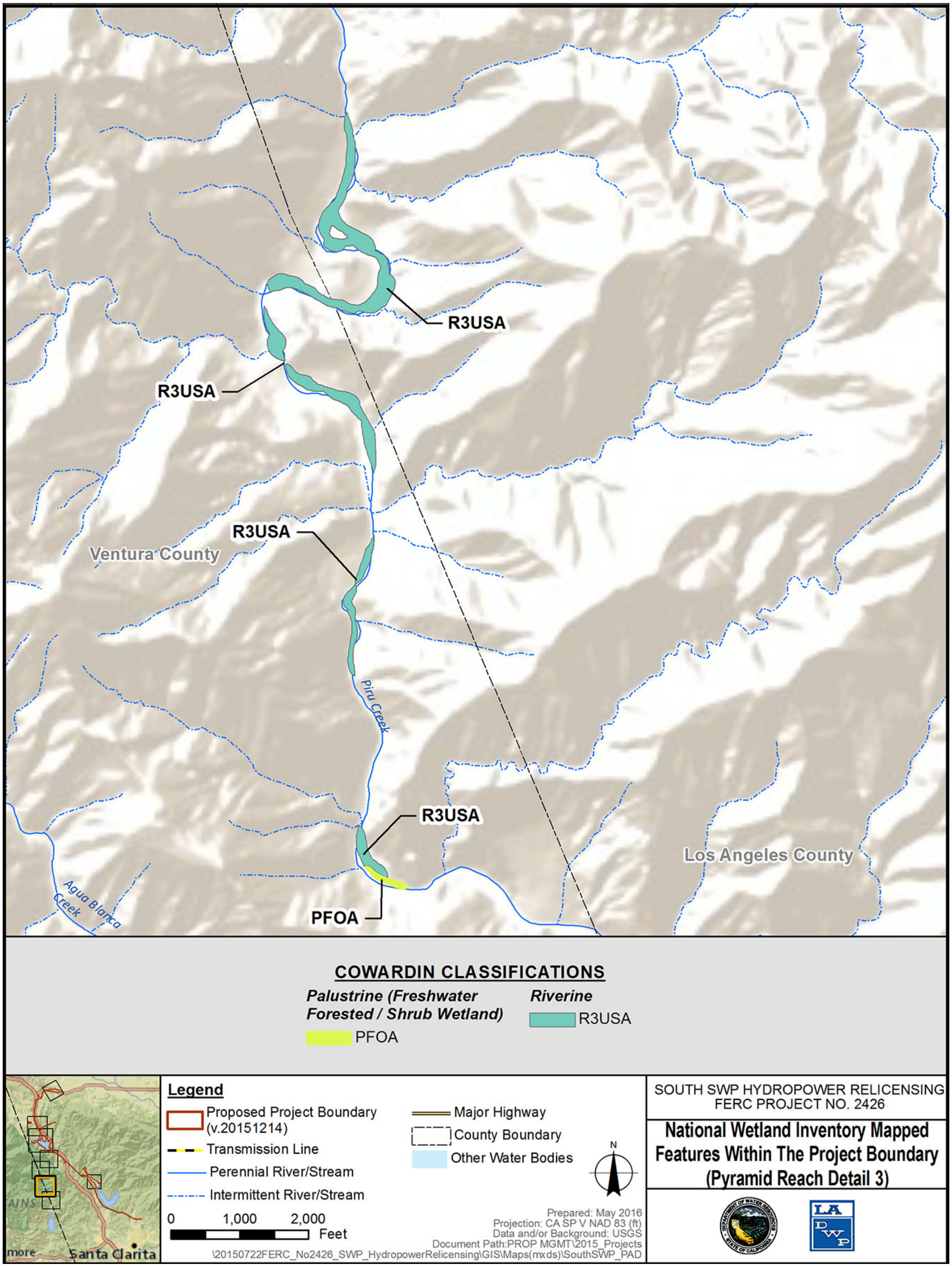


Figure 4.7-8. National Wetland Inventory Mapped Features Within the Project Boundary – Pyramid Reach Detail 3

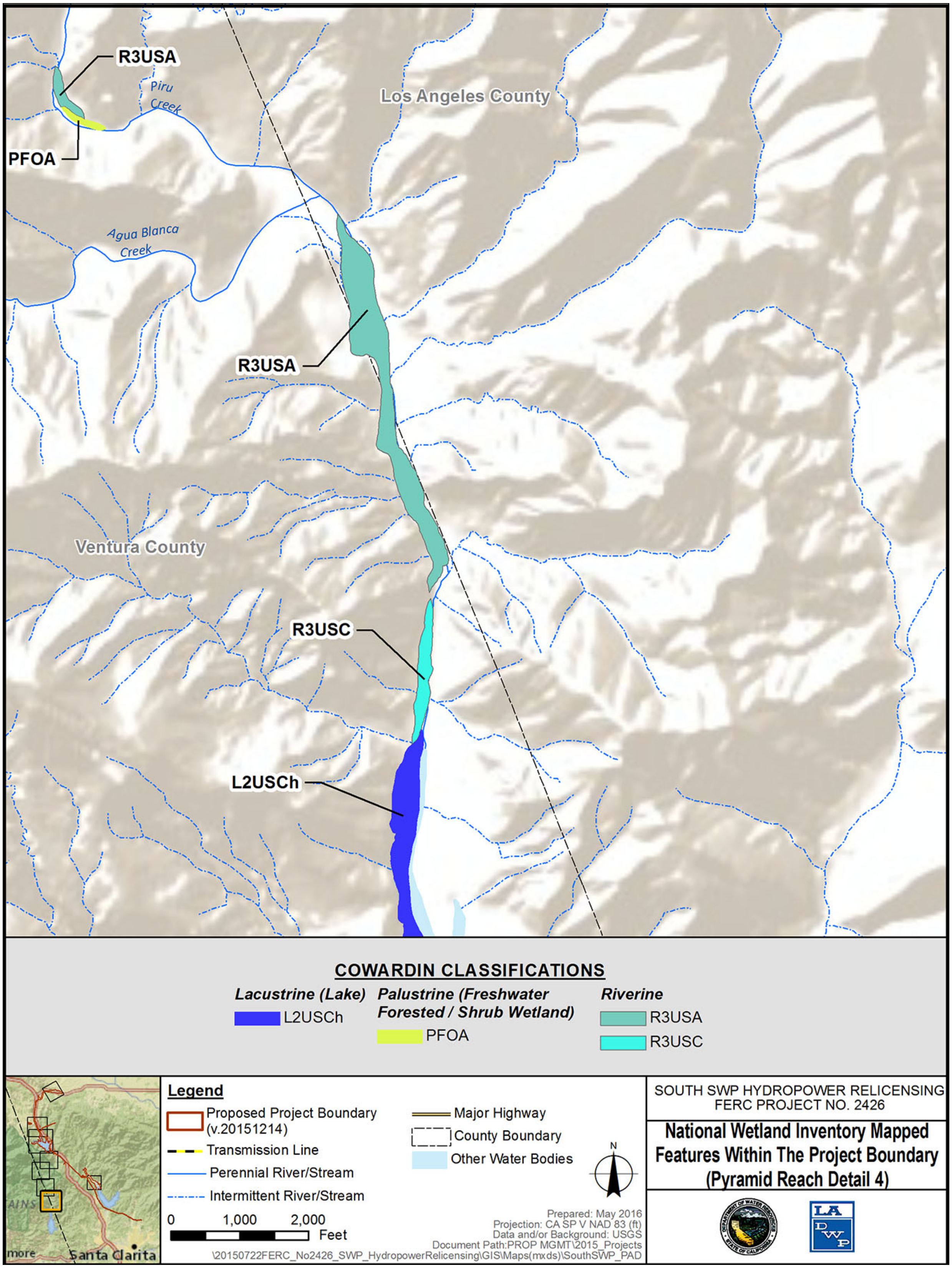


Figure 4.7-9. National Wetland Inventory Mapped Features Within the Project Boundary – Pyramid Reach Detail 4

Palustrine

Two Palustrine--Emergent--Persistent--Seasonally Flooded--Diked/Impounded areas are mapped on the margins of Quail Lake, and one Palustrine--Unconsolidated Bottom--Permanently Flooded--Diked/Impounded area is mapped east of Quail Lake (the impoundment east of the unimproved road on the east end of Quail Lake).

A number of Palustrine areas are mapped along the Peace Valley Pipeline, including at Gorman Creek. These are:

- Palustrine--Emergent--Temporarily Flooded
- Palustrine--Forested--Temporarily Flooded
- Palustrine--Emergent--Seasonally Flooded
- Palustrine--Unconsolidated Bottom--Semipermanently Flooded--Diked/Impounded
- Palustrine--Scrub-Shrub--Seasonally Flooded

Palustrine areas are mapped in several places along the margin of Pyramid Lake. Specifically:

- One Palustrine--Unconsolidated Shore--Temporarily Flooded--Diked/Impounded area upstream of Pyramid Lake on the east side of Interstate 5 along West Fork Liebre Gulch
- One Palustrine--Unconsolidated Bottom--Permanently Flooded--Diked/Impounded area and one Palustrine--Forested--Temporarily Flooded area along Pyramid reach

Palustrine areas are also mapped along Pyramid reach. These are:

- Palustrine--Forested--Temporarily Flooded
- Palustrine--Scrub-Shrub--Temporarily Flooded
- Palustrine--Scrub-Shrub--Seasonally Flooded
- Palustrine--Unconsolidated Bottom--Semipermanently Flooded

Palustrine areas are mapped in several locations on the margins of Elderberry Forebay within the proposed Project boundary, specifically:

- Palustrine--Emergent--Temporarily Flooded--Diked/Impounded
- Palustrine--Emergent--Seasonally Flooded--Diked/Impounded

Lacustrine

Quail Lake, Pyramid Lake, and Elderberry Forebay are mapped as Lacustrine--Limnetic--Unconsolidated Bottom--Permanently Flooded--Diked/Impounded areas, as are areas at the confluence of Piru Creek's inflow to Pyramid Lake and at Liebre Gulch east of Pyramid Lake and Interstate 5.

Other mapped Lacustrine areas within the Project boundary are:

- Lacustrine--Littoral--Unconsolidated Shore--Temporarily Flooded: One area at the impounded area on the margins of Quail Lake, one area at the confluence of Piru Creek's inflow to Pyramid Lake, and several areas on the margins of Elderberry Forebay

Riverine

Downstream of Quail Lake, open water areas of the Lower Quail Canal are mapped as Riverine--Lower Perennial--Unconsolidated Bottom--Artificially Flooded and one Riverine--Intermittent--Temporarily Flooded area is mapped downstream of this along the Peace Valley Pipeline.

Pyramid reach is mapped by NWI primarily as a Riverine--Upper Perennial--Unconsolidated Shore--Seasonally Flooded area for most of its length, and as a Riverine--Upper Perennial--Unconsolidated Shore--Seasonally Flooded area at its interface with Lake Piru.

4.7.2 Riparian Habitat

Riparian areas are vegetated zones that form a transition between permanently saturated areas and upland areas and that typically exhibit vegetation and physical characteristics associated with permanent sources of surface or groundwater (USACE 1987). These areas may or may not meet all three USACE criteria for wetlands.

In the Project area, no comprehensive mapping of riparian vegetation has been completed. The following sections describe information on riparian habitat conditions in the Project area obtained from DWR's literature review. No information was found regarding riparian vegetation around Quail Lake downstream to Pyramid Lake. Limited information was identified for areas of Pyramid reach and in Castaic Creek upstream of Elderberry Forebay, and is summarized below.

4.7.2.1 Quail Lake

Environmental Science Associates (2014a) reported that riparian forest/scrub was observed sporadically along the perimeter of Quail Lake, particularly in the southeastern corner near the access road. These areas were dominated by arroyo willow, with an understory of other willow species and mule-fat. Fremont cottonwood were scattered sparsely along the perimeter of the lake. The small patch of riparian forest/scrub in the southeast corner of the lake would be described as Southern Willow Scrub based on the Holland (1986) classification, which is used in CNDDB (Environmental Science Associates 2014a).

4.7.2.2 Pyramid Lake

Environmental Science Associates (2014a) reported that riparian forest occurs sporadically along the perimeter of Pyramid Lake at the confluence with creeks. Dominant trees observed included Fremont cottonwood along drainages upstream of the lake water's edge, and arroyo willow along drainages at or below the lake shoreline. Understory species included other willow species and mule-fat. These areas transitioned into broadleaf cattail marsh at the edge of Pyramid Lake. The riparian areas would be classified by the CDFW under the Holland (1986) system as Southern Cottonwood Willow Riparian Forest, where cottonwood is the dominant species, and as Southern Willow Scrub where willow is dominant. (Environmental Science Associates 2014a).

4.7.2.3 Pyramid Reach (Piru Creek downstream of Pyramid Lake)

Environmental Science Associates reported on vegetation along the Pyramid reach located between Ruby Canyon and Blue Point Campground and along Agua Blanca Creek upstream of Lake Piru during 2014 arroyo toad surveys. Surveyors noted that riparian plant communities in this area are dynamic, primarily due to the intensity of winter stream flows. In 2014, Environmental Science Associates observed widespread vegetation encroachment on the riparian channel, with mule-fat, willow, Fremont cottonwood, white alder, and broadleaf cattail being dominant on stream banks. The non-native tamarisk was reported to be expanding in this area, but was primarily confined to isolated locations on gravel bars. Southern willow scrub was reported to be the dominant plant community in the riparian floodplain, with dominant species being willows and mule-fat, and occasionally poison oak and Spanish broom (Environmental Science Associates 2014b). Mule-fat scrub was found on lower and upper flood terraces in drier areas. Narrow creek gorges that experience frequent flooding supported alluvial scrub, consisting of scale broom (*Lepidospartum squamatum*), mule-fat, California buckwheat, California sagebrush, and California brickelbrush (*Brickella californica*), scattered trees, hairy yerba santa, shortpod mustard, black mustard, and non-native grasses. Southern Sycamore Alder Riparian Woodland (as identified under the Holland 1986 system) was observed upstream and downstream from Blue Point Campground (approximately 0.5 mile north of Lake Piru). At Frenchman's Flat (approximately 1.5 miles downstream of Pyramid Lake) and upstream from Blue Point Campground, Southern Cottonwood Riparian Forest (as identified under the Holland 1986 system) was observed, with large Fremont cottonwoods in the overstory, and less frequently coast live oak, white alder, and California sycamore. Understory species include arroyo willow and bush senecio (*Senecio flaccidus* var. *douglasii*) (Environmental Science Associates 2014b).

4.7.2.4 Castaic Creek Upstream of Elderberry Forebay

In 2005, Frank Hovore & Associates described riparian habitat during 2005 arroyo toad surveys along Castaic Creek in the check dam basins upstream of Elderberry Forebay. Record high rainfall occurred in the winter of 2004/2005 that resulted in heavy erosional flows from surrounding uplands into Castaic Creek, particularly from canyons that had been recently disturbed by fire or human activity. Large mud and debris flows altered channel morphology by downcutting the channel bottom in the upper portions of the basins and depositing silt and gravel fans in the middle and lower portions. During this period, mature riparian vegetation was scoured from the banks in many areas.

POWER Engineers reported on vegetation in the three check basins during 2013 arroyo toad surveys. In Basin 1 (furthest upstream), the upper third contained a dense cover of sandbar willow and tamarisk, the middle section was dominated by sandbar willow, and the southern end was dominated by sparse sandbar willow and broadleaf cattail. The margins of Basin 1 were dominated by Mediterranean tamarisk and tree tobacco, with some additional sandbar willow. The northern half of Basin 2 supported very dense broadleaf cattail cover, and the lower half contained a relatively even mixture of mule-fat and cottonwood saplings, with the lower 25-30 feet being primarily tamarisk. With the exception of some broadleaf cattail clusters, the lower half of the basin is generally sparsely vegetated. The margins of Basin 2 supported emergent vegetation, with the southeast end containing a row of mature cottonwoods above the basin along the access road. Vegetation in the northern half of Basin 3 (the furthest downstream basin) was primarily made up of broadleaf cattails and willows. The southern two-thirds of Basin 3 was almost completely dominated by tamarisk (POWER 2013).

4.7.3 <u>Littoral Habitats</u>

In the Cowardin et al. (1979) classification, the Lacustrine System has two Subsystems: littoral (shallow water) and limnetic (deep water). Littoral areas per Cowardin et al. (1979), are those with standing water of depths less than 6.6 feet. These areas typically support aquatic bed or emergent vegetation and would likely meet wetland criteria. Unvegetated littoral areas (Unconsolidated Bottom, per Cowardin, et al. [1979]) also occur; these areas would not meet all three USACE wetland criteria, and would therefore not be considered jurisdictional wetlands.

Littoral habitats occur throughout the proposed Project boundary on the margins of Quail Lake, Pyramid Lake, and Elderberry Forebay; however, these areas have not been formally delineated or described.

4.8 FEDERAL ENDANGERED SPECIES ACT LISTED AND CANDIDATE SPECIES

This Section provides information regarding species listed as FE, FT, and Federal candidate (FC) under review, or proposed for listing under the ESA known from or with the potential to occur in the Project area. Besides this general introductory information, this section is divided into two main sub-sections: Section 4.8.1 details Licensees' efforts to identify ESA-listed species potentially affected by the Project; and Section 4.8.2 describes for each ESA-listed species, a brief life history, its status, and any known occurrences and abundance within the Project vicinity.

4.8.1 Identification of ESA-Listed Species

The list of ESA-listed species known or with the potential to occur in the Project vicinity was developed by querying the USFWS' Information for Planning and Conservation (IPaC) to generate an unofficial list of federally listed and proposed endangered, threatened, and candidate species that should be considered as part of any future effects analysis for the Project (Table G-6, Appendix G) (USFWS 2015b). In addition, Licensees accessed existing species records through CNPS's online Inventory of Rare and Endangered Vascular Plants of California (CNPS 2015); and the CDFW CNDDB (CDFW 2015a). Plant species records were also reviewed on the CalFlora website. The database queries were each based on a search of the USGS 7.5-minute topographic quadrangles in which the existing Project boundary is located (i.e., La Liebre, Lebec, Black Mountain, Liebre Mountain, Whittaker Peak, Warm Springs Mountain, and Newhall), and the adjacent quadrangles (i.e., Burnt Peak, Cobblestone Mountain, Piru, Val Verde, Green Valley, and Mint Canyon), covering approximately 744 square miles. This is an area much larger than that potentially affected by the Project, but is intended to ensure a comprehensive initial list.

The results of these queries included 23 species listed by IPaC and 1 anadromous fish species (Appendix G). Licensees then researched the known distribution, habitat associations, and requirements of these species to exclude from further consideration those species known to be endemic to restricted geographic areas and habitat types not found in the Project area, the results of which are summarized in Appendix G. Eight species listed by IPaC for which there were no known occurrences in the Project vicinity and for which the Project vicinity is not within the species known native range were excluded. These species were Riverside fairy shrimp (*Streptocephalus woottoni*), blunt-nosed leopard lizard (*Gambelia sila*), Mojave desert tortoise (*Gopherus agassizii*), western yellow-billed cuckoo (Western Distinct Population Segment [DPS]) (*Coccyzus americanas occidentalis*), San Joaquin kit fox (*Vulpes macrotis mutica*), Conejo dudleya (*Dudleya parva* [*D. abramsii* ssp. *parva*]), Braunton's milk-vetch (*Astragalus brauntonii*), and Lyons penachaeta (*Pentachaeta lyonii*). In addition, Santa Ana sucker (*Catostomus santaanae*), which occurs within the Project vicinity, was excluded from further consideration because the introduced population within the Santa Clara River drainage is not covered by the ESA listing. The Southern California steelhead (*Oncorhynchus mykiss*) DPS was also excluded from further consideration because Santa Felicia Dam blocks all upstream steelhead migration into Piru Creek above Piru Lake.

On the basis of this initial analysis, 15 ESA-listed species are potentially affected by the Project. Table 4.8-1 lists the species.

Table 4.8-1. Identification of ESA-listed, Proposed, or Candidate Species Potentially Affected by the Project

Common Name	Scientific Name	Federal and State Status	Identified by IPaC	Known Occurrences in Project Vicinity	Project Vicinity Within Species Known Native Range	Other Considerations	Conclusion
Vernal Pool Fairy Shrimp	*Branchinecta lynchi*	FT	Yes	Yes	Yes	--	Include
Unarmored Threespine Stickleback	*Gasterosteus aculeatus williamsoni*	FE, SFP	Yes	Yes	Yes	--	Include
Arroyo Toad	*Anaxyrus* [*Bufo*] *californicus*	FE, SSC	Yes	Yes	Yes	--	Include
California Red-legged Frog	*Rana draytonii*	FE, SSC	Yes	Yes	Yes	--	Include
California Condor	*Gymnogyps californianus*	FE, SE	Yes	Yes	Yes	--	Include
Coastal California Gnatcatcher	*Polioptila californica californica*	FT, SSC	Yes	Yes	Yes	--	Include
Least Bell's Vireo	*Vireo bellii pusillus*	FE, SE	Yes	Yes	Yes	--	Include
Southwestern Willow Flycatcher	*Empidonax traillii extimus*	FE, SE	Yes	Yes	Yes	--	Include
Slender-horned Spineflower	*Dodecahema* [*Centrostegia*] *leptoceras*	FE, SE	Yes	Yes	Yes	--	Include
San Fernando Valley Spineflower	*Chorizanthe parryi* var. *fernandina*	FC, SE, FSS	Yes	Yes	Yes	--	Include
Marsh Sandwort	*Arenaria paludicola*	FE, SE	Yes	No	No	Species may be under-reported	Include
Nevin's Barberry	*Berberis nevinii*	FE, SE	Yes	Yes	Uncertain	Native range imprecisely known	Include
Gambel's Watercress	*Nasturtium* [*Rorippa*] *gambelii*	FE, ST	Yes	No	No	Species may be under-reported	Include
Spreading Navarretia	*Navarretia fossalis*	FT	Yes	Yes	Yes	--	Include
California Orcutt Grass	*Orcuttia californica*	FE, SE	Yes	Yes	Yes	--	Include

Source: CNDDB (CDFW 2015a)
Key:
ESA = Endangered Species Act
FC = federal candidate
FE = federal endangered
FSS = Forest Service sensitive
FT = federal threatened
IPaC = United States Fish and Wildlife Service online Information for Planning and Conservation
SE = California State endangered
SFP = California State fully protected
SSC = California State species of special concern
ST = California State threatened

This page left blank intentionally.

4.8.2 Description of ESA-Listed Species

4.8.2.1 Vernal Pool Fairy Shrimp[41]

The vernal pool fairy shrimp (*Branchinecta lynchi*) was listed as threatened on September 19, 1994 (59 FR 48136). Critical habitat was designated for this species on August 5, 2003 (68 FR 46684) with subsequent economic, non-economic and administrative revisions in 2005, 2006, and 2007 (70 FR 11140; 70 FR 46924; 71 FR 7118, 7316). The 2007 FR notice was a court mandated requirement to clarify the economic and non-economic exclusions. A 90-day finding to petition to revise critical habitat was filed in 2011 (76 FR 7528). USFWS issued a Recovery Plan on March 7, 2006, and the results of a five-year review on September 28, 2007. No recovery actions specific to the Project or the Project area are identified in the Recovery Plan or five-year review.

The vernal pool fairy shrimp is a relatively large (0.12 to 1.5 inch) branchiopod (crustaceans of the Class Branchiopoda, Order Anostraca) endemic to vernal pools and other seasonally flooded landscape depressions, both natural and artificially created, including small, clear, sandstone rock pools; ephemeral drainages; road rut pools; roadside ditches; vernal swales; and large, turbid, alkaline, grassland, valley floor pools (Eng et al. 1990; Helm 1998). Occurrences are predominantly within the Central Valley of California from Shasta County to Tulare County, but the species is also found in California in the Coast Ranges and in Riverside County, as well as in the Agate Desert of Jackson County, Oregon. The loss and degradation of habitats are the primary factors responsible for the decline of the species. Critical habitat has been designated in 24 counties in California and in Jackson County, Oregon (71 FR 7118). There is no critical habitat in Los Angeles County.

Fairy shrimp are non-selective filter feeders, consuming detritus, bacteria, algae, protozoans, and other small organisms. Like other vernal pool branchiopods, vernal pool fairy shrimp have a relatively short life span that allows them to hatch, mature to adulthood, and reproduce during the brief time period when vernal pools contain water (USFWS 2005). Vernal pool fairy shrimp mature in 18 days at optimal conditions of 20°C, and reproduce within an average of 39 days (Helm and Vollmar 2002). Populations occur annually between October and March, completing the lifecycle in as little as 9 weeks (Helm 1998). Vernal pool fairy shrimp cysts (i.e., “resting eggs”) survive long periods of desiccation and temperature extremes. Cysts may be ingested and passed undamaged through the digestive tracts of migratory birds and amphibians, providing a means of dispersal, and are also inadvertently carried on the skin and feathers of waterfowl and other animals (USFWS 2005).

[41] Photo credit: Dwight Harvey, USFWS [public domain], via Wikimedia Commons

Although the vernal pool fairy shrimp has been documented at large vernal pools, including one exceeding 25 acres in area, it tends to occur primarily in smaller pools and is most frequently found in pools measuring less than 0.05 acres in area (Eriksen and Belk 1999). Habitats are usually characterized by low to moderate levels of salinity or total dissolved solids (Eriksen and Belk 1999). The vernal pool fairy shrimp occurs over a broad range of elevations mostly from 30 feet to 4,000 feet (Eng et al. 1990). Vernal pool fairy shrimp pools range in water temperature from 4.5°C (Eriksen and Belk 1999) to about 23°C (Helm 1998; Eriksen and Belk 1999).

There are two CNDDB records of vernal pool fairy shrimp in the Project vicinity, both from the Mint Canyon quadrangle in the Santa Clarita area of Los Angeles County (CDFW 2015a). The nearest critical habitat is located about 11 miles west of Pyramid Lake in Ventura County (USFWS 2015a).

4.8.2.2 Unarmored Threespine Stickleback[42]

The unarmored threespine stickleback (*Gasterosteus aculeatus williamsoni*) was listed as endangered on October 13, 1970 (35 FR 16047). Critical habitat was proposed on November 17, 1980 (45 FR 76012); however, no final rule was issued because the USFWS later determined that the designation of critical habitat was not warranted (67 FR 58580). USFWS issued a revised Recovery Plan on December 26, 1985, and on June 15, 2009 published its May 29, 2009 report describing the results of a five-year review. No recovery actions specific to the Project or the Project area are identified in the Recovery Plan or five-year review.

This small fish is native to the Santa Clara, Los Angeles, San Gabriel, and Santa Ana River drainages and a few locations in Santa Barbara County. Most known populations were extirpated prior to listing, often through hybridization or competition with a more common form of threespine stickleback, *G. aculeatus microcephalus* (partially armored threespine stickleback) (USFWS 2009). Populations in the upper reaches of Piru Creek and Castaic Creek were extirpated prior to listing (USFWS 1985). Exposure to predation may also strongly select for individual sticklebacks with lateral plates (i.e., “armor”), gradually eliminating the unarmored form (USFWS 1985). Unarmored threespine sticklebacks are associated with perennial headwater streams, where populations are isolated at most times by intermittent stream courses from armored forms of threespine stickleback and from larger, predatory fishes.

The unarmored threespine stickleback currently occurs in Los Angeles County in the Santa Clara River, primarily in Soledad Canyon upstream of Santa Clarita and intermittently downstream of Soledad Canyon, and in Santa Barbara County in San Antonio Creek. Unarmored threespine sticklebacks have also been found in Castaic Creek downstream of the Interstate 5 Bridge, where occurrences may be intermittent

[42] Photo credit: Barrett Paul, USFWS [public domain], via Wikimedia Commons

(USFWS 2009e). A population may persist in the lowermost reaches of Bouquet Creek, a tributary of the Santa Clara River, although replacement by introduced partially armored threespine sticklebacks has evidently occurred in the upper reaches (Richmond et al. 2014). Recent severe drought has imperiled the Santa Clara River population, prompting emergency translocation of fish to San Francisquito Creek, where the native population may have been extirpated earlier (CDFW 2015a). Threespine sticklebacks isolated in the Baldwin Lake drainage in the San Bernardino Mountains are "low-armored" (Swift et al. 1993) and treated by USFWS (2009e) as *G. aculeatus williamsoni*, although they may be genetically distinct. Existing populations are threatened by competition and genetic introgression with partially armored threespine stickleback, predation by larger fish and other introduced predators, stochastic extinction events, changes to stream hydrology, including depletion from groundwater pumping, and degradation of water quality.

Unarmored threespine sticklebacks spawn in vegetated pools and other sheltered, slow-moving stream sections, mostly in early spring and summer. Eggs are laid in nests constructed and guarded by the males until fry disperse (USFWS 2009e). Fry and early juvenile stages are restricted to shallow, densely vegetated stream edges, whereas larger juveniles and adults are more widely distributed. Individual unarmored threespine sticklebacks are probably short-lived (i.e., usually 1 year or less).

There are eight CNDDB records of unarmored threespine stickleback in the Project vicinity on the following quadrangles: Piru, Val Verde, Mint Canyon, Newhall, Green Valley, and Warm Springs Mountain (CDFW 2015a). These records are from the Santa Clara River, Bouquet Creek, San Francisquito Creek, and within the lowermost mile of Castaic Creek between Highway 126 and Commerce Drive, where one unarmored threespine stickleback was found during a survey for the species in 2005 (CDFW 2015a).

4.8.2.3 Arroyo Toad[43]

The arroyo toad (*Anaxyrus* [*Bufo*] *californicus*) was listed as endangered on December 16, 1994 (59 FR 64859). Critical habitat was designated for this species on February 7, 2001 (66 FR 9414) with revisions on April 13, 2005 (70 FR 19562) and on February 9, 2011 (76 FR 7246). USFWS issued a Recovery Plan on July 24, 1999, and a five-year review on August 17, 2009. On March 27, 2014, USFWS proposed to reclassify arroyo toad as threatened (79 FR 17106); however, USFWS later decided to withdraw its proposed rule on December 23, 2015 because the same types of threats that resulted in the original listing of the toad still exists and new threats were identified (80 FR 79805). USFWS has not yet issued a final rule to withdraw its proposal to declassify the arroyo toad.

[43] Photo credit: USFWS [public domain], via Wikimedia Commons

Historically, arroyo toad populations occurred from Monterey County to Baja California, Mexico, mostly in coastal drainages, but also along inland draining streams (i.e., desert slopes) of the Transverse and Peninsular Ranges south of the Santa Clara River in Los Angeles County (USFWS 2009a). Known extant populations of arroyo toad occur within about 75 percent of the original range (USFWS 2009a), concentrated at elevations from about 975 to 3,250 feet (Sweet and Sullivan 2005).

Critical habitat for arroyo toad has been designated in Santa Barbara, Ventura, Los Angeles, San Bernardino, Riverside, Orange, and San Diego Counties. Critical habitat Unit 5 is located on Piru Creek and Unit 6 is located, in part, on Castaic Creek. Sub-unit 5a is defined by USFWS as the 17-mile reach of Piru Creek upstream of Pyramid Lake, whereas sub-unit 5b is a 15-mile reach of Piru Creek beginning at the confluence of Fish Creek and extending downstream to Lake Piru (76 FR 7246). Both of the sub-units are described in the final rule as having substantial arroyo toad populations (76 FR 7246).

Sub-unit 6a is defined by USFWS as a 7-mile reach of Castaic Creek from Bear Canyon downstream to Elderberry Forebay, and 0.7-mile of Fish Creek from Cienaga Spring to the confluence with Castaic Creek. Sub-unit 6b includes the lowermost 2.6-mile reach of Castaic Creek extending up from the confluence with the Santa Clara River, as well as a 4-mile section of the Santa Clara River between the mouths of Castaic and San Francisquito Creeks (76 FR 7246).

Population loss has been largely attributed to development of coastal areas, flood control projects, and other stream modifications, with declines likely exacerbated by introduced predatory fish and American bullfrog, and the spread of tamarisk (salt cedar) (*Tamarix ramosissima*) in riparian areas (59 FR 64859). Suitable aquatic and riparian habitat is maintained and supported by fluvial processes, including a natural flood regime or conditions similar to a natural regime. Within watersheds, the most robust arroyo toad populations may do best at the lower end of the upstream sections of third to sixth order streams (Sweet 1992, as cited by Sweet and Sullivan 2005). These are streams characterized by sand and gravel substrates, where flows are sufficient to suspend silt and clay. Periodic flooding is important to scour vegetation, redistribute fine sediments, and re-form suitable, shallow pools. However, flood flows during the breeding season disrupt breeding and are a potential source of mortality to eggs and larvae. Existing populations of adult arroyo toads are relatively small compared to historical data (Sweet and Sullivan 2005). Populations in headwater areas upstream of reservoirs may be limited by marginal habitat conditions (Sweet and Sullivan 2005; USFWS 2009a).

The arroyo toad breeds in low-gradient, broad, open streams or low-gradient sections of streams, and is largely terrestrial outside of the breeding season. Breeding habitats are located in overflow pools, old flood channels, and shallow pools and margins with little or no flow. Substrates in breeding areas are usually sand or gravel, with little or no emergent vegetation. Adult males in breeding condition typically call from suitable egg-laying sites almost every night during the breeding season, which can last from February to July, whereas females are present only when they are ready to breed.

Breeding behavior may be interrupted by flooding, but typically resumes when flows are again favorable. Most streams supporting arroyo toads hold surface water for at least 4 to 5 months in most years; however, streams with water for as little as 2 months in spring in most years, the minimum required for at least some of the larvae to complete metamorphosis, are considered suitable (76 FR 7246). Larvae may utilize areas with water velocities of up to 1.3 feet per second (Sweet 1992, as cited by Sweet and Sullivan 2005).

Arroyo toads are active from approximately February or March to July or August and inactive later in the year. Little is known regarding hibernation behavior. Populations studied by Sweet (1992, 1993, both as cited by Sweet and Sullivan 2005) exhibited high mortality during the hibernation period.

Adult females and large males are relatively sedentary during the active season, whereas smaller adult males and juveniles may undertake longer movements along streams. Daytime and dry period retreats are shallow burrows in the riparian zone usually in areas of sandy or other friable soils, with occasional use of existing small mammal burrows. Metamorphosed arroyo toads less than about one-inch body length do not burrow and remain near the stream, often associated with damp substrates (Sweet and Sullivan 2005).

Riparian habitats are important to all post-metamorphic life stages. Favored riparian habitat includes sand bars, alluvial terraces, and sparsely to moderately vegetated streamside benches. Typically, banks are vegetated with willows (*Salix* spp.) and mulefat. Use of upland areas beyond the riparian zone also occurs, although this may vary regionally or by site. Radio-telemetry by Ramirez found that arroyo toads sometimes ventured as much as 650 feet into uplands, but that most tracked toads remained in riparian areas (Aspen Environmental Group 2006). Use of upland areas may occur more often in populations near the coast (Sweet and Sullivan 2005).

Eggs and small larvae may experience high mortality from stranding when water levels drop or displacement when flooding occurs. Other sources of larval mortality include predation by introduced fishes. Juvenile arroyo toads are vulnerable to predation by killdeer (*Charadrius vociferus*), and trampling by recreationists and cattle (Sweet 1992, as cited by Sweet and Sullivan 2005). Adult arroyo toads, especially calling males, may experience heavy predation by introduced American bullfrogs (USFWS 1999a).

There are four CNDDB records for arroyo toad in the Project vicinity. These are from the Black Mountain, Cobblestone Mountain, Whittaker Peak, and Newhall quadrangles (CDFW 2015a). These occurrences are associated with populations on Piru Creek upstream of Pyramid Lake; Piru Creek and its tributary, Agua Blanca Creek downstream of Pyramid Lake; and Castaic Creek up to 2 miles north of Castaic Powerplant. The Newhall quadrangle record represents an individual arroyo toad found near the Santa Clara River. Sandburg (2006) details a long history of surveys for and observations of arroyo toads in Piru Creek, including characterizations of habitat. Arroyo toad surveys were performed for DWR in Pyramid reach in 2005, and annually since 2010 (Sandburg 2006; Environmental Science Associates, 2011, 2012, 2013, 2014a, 2015a). Focused breeding season surveys were also performed for DWR at gage sites in Piru Creek upstream of Pyramid Lake and Castaic Creek upstream of Elderberry Forebay in 1999, with several detections, and immediately downstream of Pyramid Dam, where no arroyo toads were found (FH&A 1999). Arroyo toads also utilize sedimentation basins in the storm bypass channel above Elderberry Forebay in some years, documented by required clearance surveys performed as recently as October 1, 2013 (POWER 2013). Protocol surveys for arroyo toad in San Francisquito Canyon on the ANF indicated the species did not occur (POWER 2012).

The arroyo toad Recovery Plan (USFWS 1999a) identified one recovery action specific to the Project and one specific to the Project area, but not Project operations. Task 1.3.2, to “determine and maintain a compatible pattern of stream flow downstream from Pyramid Lake,” has been implemented by the Licensees after consultation with USFWS and other resource agencies. Task 1.3.3, to “determine and maintain a compatible pattern of stream flow downstream from Castaic Lake,” is not related to the Project, because Project operations do not affect flows into Castaic Creek.

4.8.2.4 California Red-legged Frog[44]

The California red-legged frog (*Rana draytonii*; CRLF) was listed as a threatened species on May 23, 1996, (61 FR 25813). Critical habitat was first designated for this species on March 13, 2001 (66 FR 14626) and was later revised on April 13, 2006 (71 FR 19244) and on March 17, 2010 (75 FR 12816). USFWS issued a Final Recovery Plan on May 28, 2002, and a five-year review was initiated on May 25, 2011 (76 FR 30377). No recovery actions specific to the Project or the Project area are identified in the Recovery Plan.

The historical range of the CRLF extends through Pacific slope drainages from Shasta County, California, to Baja California, Mexico, including the Coast Ranges and the west slope of the Sierra Nevada Range at elevations below 4,000 feet. The current range of this species is greatly reduced, with most remaining populations occurring along the coast from Marin County to Ventura County. Fellers (2005) indicated only two known extant populations in southern California, one in Riverside County on the Santa Rosa Plateau (Schaffer et al. 2004) and the other in Ventura County, both with few documented adults. Critical habitat has been designated in 24 counties, including one unit in Los Angeles County (LOS-1, San Francisquito Creek), two in Ventura County (VEN-1, San Antonio Creek and VEN-3, Upper Las Virgenes Creek), and one straddling both counties (VEN-2, Piru Creek). These three critical habitat units are within the Ventura River – Santa Clara River Core Area of the Northern Transverse Range and Tehachapi Mountain Recovery Unit (USFWS 2002a).

[44] Photo credit: U.S. Army, California National Guard [public domain], via Wikimedia Commons

According to the Recovery Plan (USFWS 2002a), factors associated with declining populations of the CRLF include degradation and loss of its habitat through: (1) agriculture, (2) urbanization, (3) mining, (4) overgrazing, (5) recreation, (6) timber harvesting, (7) the introduction of non-native plants that affect the frog's habitat, (8) impoundments, (9) water diversions, (10) degraded water quality, (11) use of pesticides, and (12) introduced predators (e.g., American bullfrog, crayfish, and non-native predatory fish). Populations may have initially declined because of over-harvesting for food. Because populations have been extirpated from large portions of the species' historical range, the continued survival of isolated populations, some of which are not within dispersal distance of other suitable habitats, is uncertain. Other factors that may limit recovery include contamination from agrochemicals, which may become wind-borne over long distances (Davidson et al. 2001).

CRLF is primarily associated with perennial ponds or pools and slow-moving perennial or seasonal streams or pools within streams where water remains continuously for a minimum of 20 weeks beginning in the spring (i.e., sufficiently long for breeding to occur and larvae to complete development) (Jennings and Hayes 1994; 71 FR 19244). Dense, shrubby riparian vegetation (e.g. willow and bulrush [*Schoenoplectus*] species), and bank overhangs typically occur in breeding habitat. Emergent vegetation, undercut banks, and semi-submerged root wads may provide hiding cover for larvae. Suitable aquatic habitats include natural and manmade ponds, backwaters within streams and creeks, marshes, lagoons, and dune ponds. Deep lacustrine habitats larger than 50 acres do not represent breeding or dispersal habitat (75 FR 12816). At San Francisquito Creek (Los Angeles County), egg laying is estimated to have begun as early as February 5 and eggs hatched as late as March 20 in 3 years when eggs were found (Alvarez et al. 2013). The latter study also found that breeding occurred slightly later at four stream sites compared to four lotic sites, a behavior which may avoid disruption of breeding by high flows during winter. Egg masses are attached to emergent vegetation such as cattails (*Typha* spp.) and bulrushes. Larvae remain in these aquatic habitats until metamorphosis. Increased siltation during the breeding season can cause asphyxiation of eggs and small larvae. Larvae typically metamorphose between July and September, and most likely feed on algae (Jennings and Hayes 1994).

Outside of the breeding season, adults may disperse upstream, downstream, or upslope of breeding habitat to forage and seek sheltering habitat, which may consist of small-mammal burrows, leaf litter, and other moist sites in or near (up to 200 feet from) riparian areas (Jennings and Hayes 1994; 71 FR 19244). During wet periods, long-distance dispersal of 1 mile or more may occur between aquatic habitats, including movement through upland habitats or ephemeral drainages (71 FR 19244). Seeps and springs in open grasslands can function as foraging habitat or refuges for dispersing frogs (USFWS 2005).

Suitable dispersal habitat consists of all upland and wetland habitat that connect two or more patches of suitable aquatic habitat within 1.25 miles of one another. Dispersal habitat must be at least 500 feet wide and free of barriers, such as heavily traveled roads (roads with more than 30 cars per hour), moderate to high-density urban or industrial developments, and large reservoirs (Allen and Tennant 2000).

There are two CNDDB records of CRLF in the Project vicinity, both from San Francisquito Creek on the Warm Springs Mountain quadrangle (CDFW 2015a). These records are both from 2005. Alvarez et al. (2013) describes the site as a headwater stream with areas more than 1.5 meters deep, and vegetated with cattail, willow, and watercress. The numbers of CRLF egg masses reported by Alvarez et al. for 3 years were: 13 in 2003, 41 in 2004, and 8 in 2006. POWER (2012) indicates that CRLF was found at San Francisquito Creek by annual USGS surveys as recently as 2010.

Records for CRLF on Piru Creek include an observation in 1949 about 7.5 miles north of the town of Piru (Sanders 1950, as cited by Sandburg 2006), and Davidson et al. (2001) lists other museum records 4.5, 11, and 12 miles north of the town of Piru, which is located approximately 16 miles south of Pyramid Lake. Hubbert and Murphey (2005) did not detect CRLF in Pyramid reach or its tributary, Agua Blanca Creek, about 16.5 miles downstream of Pyramid Lake during surveys performed for the USGS in 1999 to 2000. USFWS (2002a) indicates the presence of CRLF in Piru Creek, but describes the population as being "in decline due to changes in flow regimes since the construction of Pyramid Dam in 1973 and the introduction of many predatory fish via the California aqueduct." Sandburg (2006) found larval CRLF in 2005 in a 7-foot-deep pool with cattails in Pyramid reach more than 10 miles downstream of Pyramid Lake and in a 3-foot-deep pool in Agua Blanca Creek. Annual sensitive species surveys on Pyramid reach, performed for DWR in concert with annual arroyo toad surveys in 2010 to 2015, have not detected CRLF (Environmental Science Associates 2010a, 2011, 2012, 2013, 2014a, 2015a). The nearest critical habitat units are located more than 4 miles south of Pyramid Lake along Pyramid reach, and approximately 6 miles from Elderberry Forebay along San Francisquito Creek (USFWS 2015b).

4.8.2.5 California Condor[45]

The California condor (*Gymnogyps californianus*) has been listed as an endangered species since 1967 (32 FR 4001). The introduced population in Arizona was categorized as "experimental, non-essential" on October 16, 1996 (61 FR 54044). Critical habitat for California condor was designated in 1976 (41 FR 41914), with a correction in 1977 (42 FR 47840). USFWS issued the most recent revision (third) of the Recovery Plan on April 25, 1996, and the results of the most recent five-year review on June 4, 2013. No recovery actions specific to the Project or the Project area are identified in the Recovery Plan or five-year review.

Historically, the California condor occurred from coastal British Columbia, Canada, to Baja California, Mexico, and as far east as the Cascade and Sierra Nevada Ranges, but the species' range had been reduced by the 1950s to a wishbone-shaped area within

[45] Photo credit: David Clendenen, USFWS [public domain], via Wikimedia Commons

parts of the following 10 California counties: Monterey, San Benito, Fresno, Kings, San Luis Obispo, Santa Barbara, Ventura, Los Angeles, Kern, and Tulare.

At the time of listing and until the 1980s, the California condor was in steep decline and in imminent danger of extinction due to direct persecution, eggshell thinning as a result of secondary poisoning from the pesticide, dichlorodiphenyltrichloroethane (DDT) and its derivative dichlorodiphenyldichloroethylene (DDE), and possibly other factors. Critical habitat has been designated in Santa Barbara, San Luis Obispo, Ventura, Los Angeles, Kern, and Tulare Counties.

Recovery of the California condor required removing surviving birds from the wild, captive breeding and subsequent and continuing release of captive-reared birds. As a result of these efforts, the free-flying population had increased to 268 by the end of 2015 located in southern California, Arizona, and Baja California, Mexico (USFWS 2015b). The wild populations are regularly monitored, including periodic trapping of birds lured by supplemental carrion. Natural reproduction remains insufficient to sustain or grow populations without captive breeding, primarily due to exposure to lead from lead ammunition in carrion (USFWS 2013). Ingestion of “microtrash” (i.e., small pieces of plastic, bottle caps, aluminum can tabs, broken glass, and other indigestible materials) is also a threat to the California condor, particularly nestlings fed microtrash brought back to the nest, causing impaction of the digestive tract and often eventual death. Mortality from collisions with powerlines and electrocution of California condors perched on power-poles sometimes occurs (USFWS 2013).

Available information indicates that California condors nested naturally in cavities on escarpments in steep mountainous or canyon terrain, and also utilized burnt-out hollows of large trees (e.g., old-growth sequoia and coastal redwood), cliff ledges, and rarely the nests of other large birds (USFWS 1996). Nest site selection occurs in winter and a single egg clutch is laid between late January and early April. Eggs hatch within approximately 56 days. Young will fly at approximately 5 to 6 months, but are partially dependent on parents for up to a year. California condors become sexually mature at 5 to 8 years, and are potentially long-lived (USFWS 2013). Adults typically leave roosts 3 to 5 hours after sunrise, waiting for thermals to develop, and return 2 to 5 hours before sunset (San Diego Zoo 2009). California condors forage over open grasslands, foothill oak savannas, and coastal areas where they feed on carrion, including deer, elk, cattle, pronghorn antelope, marine mammals and birds, and fish. Individual California condors have been documented to travel more than 100 miles in a day, assisted by air currents (USFWS 2013).

There are two CNDDB records of California condor in the Project vicinity, from the Sespe-Piru Condor Area (CDFW 2015a), which includes parts of the Piru, Black Mountain, and Cobblestone Mountains, and from near Redrock Mountain east of Pyramid Lake (Liebre Mountain quadrangle). This critical habitat area for California condor, which is less than 1 mile from Pyramid Lake, has been a protected area for the species in the LPNF since 1947. Aspen Environmental Group (2007) indicates California condors are “commonly observed” around Pyramid Lake. POWER (2012) describes Piru Lake as a “known feeding ground.” The nearest active release site for captive-raised condors is the Bitter Creek National Wildlife Refuge in Kern County, more than 30 miles from the Project.

4.8.2.6 Coastal California Gnatcatcher[46]

The coastal California gnatcatcher (*Polioptila californica californica*) was listed as threatened on March 30, 1993 (58 FR 16742). Critical habitat was first designated for this species on October 24, 2000 (65 FR 63680) and revised critical habitat was designated on December 19, 2007 (72 FR 72010). A Recovery Plan has not been published. USFWS issued the results of a five-year review on September 29, 2010. No recovery actions specific to the Project or the Project area are identified in the five-year review. On December 31, 2014, USFWS found that delisting may be warranted, based on evidence that the coastal California gnatcatcher may not be a valid subspecies, and began a 12-month review (79 FR 78775).

The coastal California gnatcatcher is a small, non-migratory songbird, which occurs almost exclusively in certain sub-associations of coastal sage scrub plant communities and occasionally in chaparral (72 FR 72010). Almost all known occurrences (i.e., 99 percent of records) are below 2,000 feet elevation (USFWS 2010b). Historically found in coastal southern California, from Ventura County south to Baja California, Mexico, coastal California gnatcatcher has disappeared from much of its historical range because of widespread loss and fragmentation of habitat due to urban and agricultural development (USFWS 2010b). According to the listing rule, only about 30 pairs were believed to occur in Los Angeles County at the time of listing. Critical habitat has been designated in Ventura, Los Angeles, San Bernardino, Riverside, Orange, and San Diego Counties.

The coastal California gnatcatcher generally breeds from late February through mid-July (USFWS 2010b). Nests are placed in California sagebrush (*Artemisia californica*) or other shrubs about 3 feet above the ground. The average clutch size is four eggs, and the eggs are incubated by both sexes for about 14 days. The nesting period is approximately 16 days. Breeding territories are between 2 and 14 acres (USFWS 2010b).

There are six CNDDB records of this species in the Project vicinity. These are from the Mint Canyon, Val Verde, Newhall, and Lebec quadrangles (CDFW 2015a). Most of the records were for individual gnatcatchers that may not be indicative of breeding occurrences. The nearest critical habitat is outside of Santa Clarita, approximately 15.7 miles from Elderberry Forebay (USFWS 2015b).

[46] Photo credit: USFWS [public domain]

4.8.2.7 Least Bell's Vireo[47]

The least Bell's vireo (*Vireo bellii pusillus*) was listed as endangered on May 2, 1986 (51 FR 16474). Critical habitat was designated for this species on February 2, 1994 (59 FR 4845). USFWS issued a draft Recovery Plan on May 6, 1998, and the results of a five-year review on September 26, 2006. No recovery actions specific to the Project or the Project area are identified in the Recovery Plan or five-year review.

This small, mostly migratory, insectivorous songbird is closely associated with dense, riparian habitat and adjacent chaparral in river valleys from interior northern California to northwestern Baja California, Mexico (USFWS 2006). Populations from the Sacramento and San Joaquin Valleys were considered extirpated at the time of listing, with almost all remaining occurrences concentrated in southern California (USFWS 2006). Critical Habitat has been designated in Santa Barbara, Ventura, Los Angeles, San Bernardino, Riverside, and San Diego Counties.

Nesting occurs in dense riparian habitat dominated by willows. Nests are often placed in openings or near habitat edges in understory shrubs, including wild rose (*Rosa californica*) and mulefat beneath willows and cottonwoods (USFWS 1998a). Wintering habitat includes arroyos with scrub vegetation, hedgerows, and other shrubby areas as far south as southern Baja California, Mexico (USFWS 2006). Clutch size is usually three or four eggs, with incubation by both sexes lasting 14 days. Nestlings fledge at 10 to 12 days. Some pairs may produce multiple broods annually; however, young are rarely fledged from more than two nests (USFWS 1998a).

Loss and degradation of nesting habitat was the primary factor in the species decline, and nest parasitism by brown-headed cowbirds (*Molothrus ater*) threatens existing populations (USFWS 1998a). Since listing, the number of known least Bell's vireo breeding territories has increased ten-fold, which USFWS (2006) attributed to measures to protect and enhance riparian habitat and control brown-headed cowbirds by trapping. In 1998, there were 67 nesting pairs of least Bell's vireo along the Santa Clara River (Kus 2002). The number of breeding pairs detected in the Los Padres National Forest declined from 50 in 1980 to none in 2013 (Los Padres Forest Watch 2015).

There are seven CNDDB records of least Bell's vireo in the Project vicinity. They are from the Val Verde, Newhall, Warms Springs Mountain, and Piru quadrangles, all associated with the Santa Clara River and tributaries, including Castaic Creek, San Francisquito Creek, and Pole Creek (CDFW 2015). These records include observations northwest of Castaic Lagoon in Grasshopper Canyon during surveys in April through July 2005. Jones and Stokes (2002) reported no detections on Pyramid reach and

[47] Photo by USFWS [public domain], via Wikimedia Commons

Liebre Gulch north of Pyramid Lake. The nearest critical habitat is more than 8 miles from Elderberry Forebay along the Santa Clara River (USFWS 2015b).

4.8.2.8 Southwestern Willow Flycatcher[48]

The southwestern willow flycatcher (*Empidonax traillii extimus*) was listed as endangered on February 27, 1995 (60 FR 10695). Critical habitat was first designated for this species on July 22, 1997 (62 FR 39129) and was later revised on October 19, 2005 (70 FR 60886) and on January 3, 2013 (78 FR 344). USFWS issued a Recovery Plan on August 30, 2002, and on September 4, 2014 published its August 15, 2014 report describing the results of a five-year review. No recovery actions specific to the Project or the Project area are identified in the Recovery Plan or five-year review.

This migratory, insectivorous songbird is found during the breeding season in dense, riparian habitat associated with low-gradient streams or lentic habitat from Kern County, California, south to northern Baja California, Mexico, east to southwest Colorado to southwest Texas. Historically, suitable riparian habitat within this mostly arid area often occurred in widely dispersed and isolated patches, which were further reduced by water development projects, agriculture, urbanization, and other factors. Critical habitat has been designated in New Mexico, Colorado, Utah, Nevada, Arizona, and California. In California, critical habitat is located in Santa Barbara, Inyo, Kern, Ventura, Los Angeles, San Bernardino, Riverside, and San Diego Counties.

The southwestern willow flycatcher nests in riparian thickets with the following attributes: canopy height may be as little as 6 feet at high elevation sites dominated by shrubs to as much as 100 feet at lower elevation sites with distinct tree and shrub layers. Foliage is typically dense from the ground to approximately 13 feet high. Nesting habitat usually contains willows or tamarisk (USFWS 2002b). Other characteristic species include boxelder (*Acer negundo*), Russian olive (*Eleagnus angustifolia*), cottonwood (*Populus* spp.), ash (*Fraxinus* spp.), alder (*Alnus* spp.), and buttonbush (*Cephalanthus occidentalis*). Breeding territories may be as small as 0.25 acres, but most are at least 0.5 acres. Wintering habitat is Neotropical, with lowlands of Costa Rica and other parts of Central America probably most important (USFWS 2014).

There are no CNDDB records of southwestern willow flycatcher in the Project vicinity. USFWS (2002b) indicated presence of one southwestern willow flycatcher site (i.e., an area with one or more southwestern willow flycatcher territories) (Santa Clara River – Upper Piru Creek) outside the Project vicinity on the uppermost Pyramid reach. No southwestern willow flycatchers were detected during USGS surveys of Pyramid reach in 2006 (Durst et al. 2008). Habitat suitability assessments and protocol surveys performed by USFS in 2002 for southwestern willow flycatcher along the Pyramid reach

[48] Photo credit: Jim Rorabaugh, USFWS [public domain], via Wikimedia Commons

and Liebre Gulch upstream of Pyramid Lake indicated that suitable habitat existed in these areas; however, there were no detections of breeding southwestern willow flycatchers (USFS 2003). Non-breeding willow flycatchers (sub-species not determined) were detected during the same surveys, likely using these areas for resting and foraging during migration. Because the other subspecies of willow flycatcher are much more common than southwestern willow flycatcher, detection of willow flycatchers during migration may not be significant. Jones and Stokes (2002) reported no breeding detections along Pyramid reach or Liebre Gulch north of Pyramid Lake. Designated critical habitat for southwestern willow flycatcher is located on Pyramid reach more than 3 miles downstream of Pyramid Lake to the confluence of the Santa Clara River and on lowermost Castaic Creek downstream of the Interstate 5 Bridge to the Santa Clara River.

4.8.2.9 Slender-horned Spineflower[49]

The slender-horned spineflower (*Dodecahema leptoceras*) was listed as endangered on September 28, 1987 (52 FR 36265). Critical habitat has not been designated for this species. USFWS issued the results of a five-year review on October 1, 2010. No recovery actions specific to the Project or the Project area are identified in the five-year review.

Slender-horned spineflower is a small, rosette-forming annual of the buckwheat family (Polygonaceae) that is found on floodplain terraces and sandy benches, areas that flood infrequently (52 FR 36265). Germination is likely related to rainfall. Occurrences are associated with alluvial fan scrub vegetation. Slender-horned spineflower is a southwestern California endemic species restricted to northern Los Angeles County, east to San Bernardino County and south to southwestern Riverside County in the foothills of the Transverse and Peninsular Ranges. It has been found at elevations of about 660 to 2,300 feet (USFWS 2010f). At the time of listing, there were only five known extant populations. Current threats include changes in flood regimes from flood-control projects, continuing development, gravel-mining, agriculture, off-road vehicle use, and invasive non-native plants (USFWS 2010f).

There are two CNDDB records of slender-horned spineflower in the Project vicinity, both from the Mint Canyon quadrangle, which are categorized as "possibly extirpated" (CDFW 2015a).

[49] Photo credit: Joe Decruyenaere (DSCN5846) [CC BY-SA 2.0 (http://creativecommons.org/licenses/by-sa/2.0)], via Wikimedia Commons

4.8.2.10 San Fernando Valley Spineflower[50]

The San Fernando Valley spineflower (*Chorizanthe parryi var. fernandina*) has been a Candidate for listing since 1999 (64 FR 57534), and is currently precluded from USFWS' consideration by higher-priority species (79 FR 72450).

The San Fernando Valley spineflower is a diminutive, short-lived annual of the buckwheat family that appears after winter rains and flowers April to June. Prior to rediscovery in 1999, San Fernando Valley spineflower was assumed to be extinct, having not been observed since 1929. The taxon is endemic to sandy to gravelly soils mostly in coastal sage scrub from Lake Elizabeth, Los Angeles County, to Del Mar, San Diego County. Habitats are sparsely vegetated, likely the result of poor soils. Most of the suitable habitat within the known historical range has been eliminated by urban development. Habitat is also degraded by competition and shading from invasive non-native plants. The two known populations occupy a total of less than 45 acres.

There are 12 CNDDB records of San Fernando Valley spineflower in the Project vicinity, all but one of which are from the Newhall Ranch (Val Verde quadrangle), one of the two known populations of the taxon (CDFW 2015a). The other historical (1929) record is from Castaic (Newhall quadrangle) and is categorized as "possibly extirpated."

4.8.2.11 Marsh Sandwort[51]

The marsh sandwort (*Arenaria paludicola*) was listed as endangered on August 3, 1993 (58 FR 41378). No critical habitat has been designated for this species. USFWS issued a Recovery Plan on September 28, 1998, and a five-year review on July 10, 2008. No recovery actions specific to the Project or the Project area are identified in the Recovery Plan or five-year review.

Marsh sandwort is a rhizomatous herb of the pink family (Caryophyllaceae) with long, trailing or clambering stems, which may root at the nodes (USFWS 1998b). Although described as an annual by USFWS (1998b), other sources (USFWS 2008b; CalFlora 2015; eFloras 2015) characterize the species as a perennial. Flowering occurs from May to August with fruiting beginning in June. Information summarized in the five-year review (USFWS 2008b) indicates the species has been documented from only 10 naturally occurring populations in the United States in scattered swamps and freshwater marshes near the Pacific Coast, including one site in Washington State and the rest in southern or central California. The species may also occur in central Mexico and Guatemala (eFloras 2015). Elevations of these sites range from near sea level to 1,480

---

[50] Photo credit: National Park Service [public domain]
[51] Photo credit: Stickpen (Own work) [CC0] [public domain], via Wikimedia Commons

feet; however, USFWS concluded that “primary habitat consists of boggy areas in freshwater marshes and swamps below 560 feet in elevation.” Habitats are also described as “boggy meadows” (eFloras 2015). At the time of listing, only one declining population was known to be extant. Despite subsequent reintroduction attempts, the current known distribution is limited to two sites in San Luis Obispo County, California, one of which represents an introduced population (USFWS 2008b). Recent experimental introductions have proven more successful and provide new insights into the species’ habitat requirements, which may be similar to those of a common native plant, water parsley (*Oenanthe sarmentosa*) (Bontrager et al. 2014). The threats to the species include continuing loss and degradation of suitable habitat that might allow for establishment of new populations, changing hydrology of sites, inbreeding and risk of stochastic extinction events because of small population size, and off-road vehicle use (USFWS 1998b, 2008b).

There are no CNDDB records of marsh sandwort in the Project vicinity. However, based on the wide geographic distribution of historically known occurrences and potential for misidentification (USFWS 1998b), the species may be under-reported, as suggested by Hickman (1993).

4.8.2.12 Nevin’s Barberry[52]

Nevin’s barberry (*Berberis nevinii*) was listed as endangered on October 13, 1998 (63 FR 54956). Critical habitat was designated for this species on February 13, 2008 (73 FR 8412). USFWS issued the results of a five-year review on August 14, 2009. No recovery actions specific to the Project or the Project area are identified in the five-year review.

Nevin’s barberry is an evergreen, perennial shrub of the barberry family (Berberidaceae) that grows 3 to 12 feet tall and flowers in March and April. Individual plants have been reported to live more than 50 years, but may only produce fertile seed sporadically (USFWS 2009b). Endemic to southern California, Nevin’s barberry has been documented at scattered locations, each representing small stands of fewer than 10 plants, in Los Angeles, San Bernardino, and Riverside Counties, and possibly San Diego County, at elevations mostly between 1,400 and 1,700 feet (USFWS 2009b). Most occurrences are concentrated near Vail Lake in southwestern Riverside County, where all designated critical habitat is located.

Habitat includes benches, terraces, canyon floors, and steep banks of drainages; margins of washes; and steep, rocky slopes and ridges. Nevin’s barberry has been found in alluvial scrub, chaparral, coastal sage scrub, oak woodland, and riparian scrub

[52] Photo credit: Stan Shebs [GFDL (http://www.gnu.org/copyleft/fdl.html), CC BY-SA 3.0 (http://creativecommons.org/licenses/by-sa/3.0), via Wikimedia Commons

or woodland (USFWS 2009b). Because Nevin's barberry has been introduced into the horticultural trade, some recent occurrences may not be native.

There are two CNDDB records for Nevin's barberry in the Project vicinity, one from the Warm Springs Mountain quadrangle and one from Newhall quadrangle in San Francisquito Canyon (CDFW 2015a), both of which are considered to be non-native (i.e., naturalized from transplants) (USFWS 2009b).

4.8.2.13 Gambel's Watercress[53]

Gambel's watercress (*Nasturtium* [*Rorippa*] *gambelii*) was listed as endangered on August 3, 1993 (58 FR 41378). No critical habitat has been designated for this species. USFWS issued a Recovery Plan on September 28, 1998, and the results of a five-year review on November 7, 2011. No recovery actions specific to the Project or the Project area are identified in the Recovery Plan or five-year review.

This perennial herb of the mustard family (Brassicaceae) is rhizomatous, sometimes rooting at the nodes, grows up to 6 feet tall, and flowers April to July. Historically, Gambel's watercress occurred at scattered freshwater marshes, mesic areas near streams, and possibly in brackish marshes in southern California from Los Angeles and San Bernardino counties southward to Mexico at elevations from near sea level to 1,480 feet (USFWS 1998b, 2011c). Most of the known populations are now considered extirpated. Only three extant populations were known in the United States at the time the Recovery Plan was published, two in San Luis Obispo County and a third at the Vandenburg Air Force Base in Santa Barbara County. The species has continued to decline since being listed.

USFWS (2011c) indicated that the sites in San Luis Obispo County may no longer support genetically pure Gambel's watercress and that detected watercress were all either hybrids with common watercress (*Nasturtium officinale* [*R. nasturtium-aquaticum*]) or pure common watercress. Pure Gambel's watercress may now occur only at Vandenburg Air Force Base and an introduced population at the Guadalupe-Nipomo Dunes National Wildlife Refuge in San Luis Obispo County. Threats to the species include continuing loss and degradation of habitat, changing hydrology of sites, risk of stochastic extinction events because of small population size, and genetic swamping from common watercress (USFWS 2011c).

There are no CNDDB records for Gambel's watercress in the Project vicinity. However, based on limited ecological data from historical occurrences and potential for misidentification (USFWS 2011c), undiscovered occurrences are possible.

[53] Photo credit: Mark A. Elvin, USFWS [public domain], from (USFWS 2011)

4.8.2.14 Spreading Navarretia[54]

Spreading navarretia (*Navarretia fossalis*) was listed as threatened on October 13, 1998 (63 FR 54975). Critical habitat was first designated for this species on October 18, 2005 (70 FR 60658) and was later revised on October 7, 2010 (75 FR 62192). USFWS issued a Recovery Plan on September 3, 1998, and the results of a five-year review on August 10, 2009. No recovery actions specific to the Project or the Project area are identified in the Recovery Plan or five-year review.

Spreading navarretia is a low, spreading or ascending annual herb of the phlox family (Polemoniaceae) that flowers after pools have dried. Other key aspects of the species biology, including pollination ecology and mechanisms of seed dispersal are not fully understood (USFWS 2009d). The known distribution of this endemic vernal pool species includes parts of southern California south to northwestern Baja California, Mexico, with known sites concentrated in Riverside and San Diego Counties, and fewer sites in Los Angeles County, at elevations between approximately 100 and 2,200 feet. USFWS (2009d) reported 48 extant occurrences in the United States from vernal pools and poorly drained, seasonally flooded alkali playas. CDFW (2015a) described the microhabitat association of this species as "San Diego hardpan and San Diego claypan vernal pools in swales and vernal pools, often surrounded by other habitat types." Critical habitat has been designated in Los Angeles, Riverside, and San Diego Counties. Threats to the species include continuing loss and degradation of habitat from urbanization, agriculture, changing hydrology, trash dumping, vandalism, and off-road vehicle use (USFWS 2009d).

There are two CNDDB records of spreading navarretia in the Project vicinity, both from the Mint Canyon quadrangle at Cruzan Mesa and Plum Canyon (CDFW 2015a). The nearest critical habitat is also located at these two sites, which are approximately 15 miles from the Project.

[54] Photo credit: Joe Decruyenaere [CC BY-SA 2.0 (http://creativecommons.org/licenses/by-sa/2.0)], via Wikimedia Commons

4.8.2.15 California Orcutt Grass[55]

California orcutt grass (*Orcuttia californica*) was listed as endangered on August 3, 1993 (58 FR 41384). No critical habitat has been designated for this species (USFWS 2015b). USFWS issued a Recovery Plan on September 3, 1998, and the results of a five-year review on March 11, 2011. No recovery actions specific to the Project or the Project area are identified in the Recovery Plan or five-year review.

California orcutt grass is a small (i.e., 2 to 8 inches tall), tufted, prostrate annual grass (Poaceae) that flowers April to June and exhibits increasingly upward growing stems as pools dry. The species is endemic to deep vernal pools in southern California, predominantly in Riverside and San Diego Counties, and a few locations in Ventura and Los Angeles Counties. Known occurrences are scattered at elevations from 45 to 2,000 feet. There are three known extant occurrences in Los Angeles County at Cruzan Mesa, near Newhall and Plum Canyon, and two other occurrences have been extirpated. This species is found in the parts of vernal pools that are wet for the longest period of time (USFWS 2011a). Threats to the species include continuing loss and degradation of habitat from urbanization, agriculture, changing hydrology, and off-road vehicle use (USFWS 1998, 2011a).

There are three CNDDB records for California orcutt grass in the Project vicinity, all from the Mint Canyon quadrangle (CDFW 2015a).

4.9 RECREATION AND LAND USE

This Section provides information regarding existing recreation resources and land use. Besides this general introductory information, this Section includes four main sub-sections: Section 4.9.1 describes recreation opportunities associated with the Project and, for each Project developed recreation area, location, number, type and condition of the facilities in the recreation area, as well as annual use levels and facility occupancy rates; Section 4.9.2 lists recreational opportunities and identified recreation needs in the Project region; Section 4.9.3 discusses land use and management in the Project region, and identifies the nearest designated Wild and Scenic River, Wilderness Area, Heritage Site, nationally significant recreation area, and river segment listed in NPS' National Rivers Inventory (NRI). In addition, Federal Emergency Management Agency (FEMA) floodplains are identified. Section 4.9.4 focuses on the land use and management within the proposed Project boundary. Areas covered include: (1) land ownership; (2) land use and management; (3) Project-related land use permits and easements; (4) DWR's vehicular access routes to Project facilities; (5) known Project-related wildfires and Licensees' policies regarding fire prevention and suppression; (6) public safety related to Project facilities; (7) law enforcement in the Project area; (8) restrictions to Project

[55] Photo credit: Russell Huddleston [public domain], via CalPhotos

waters and lands; (9) use of herbicides and pesticides; and (10) Licensees' policies regarding shoreline management.

The Project is located within the boundaries of the ANF and portions of the LPNF administered by the ANF. NFS lands occupy 49.3 percent (i.e., 2,222 acres) of the total lands within the proposed Project boundary. Policies and programs associated with the ANF apply only to NFS lands within the Project area.

Southern California national forest (i.e., ANF, Cleveland, LPNF, and SBNF) visitation has increased over the past two decades because of the area's population growth. Driving for pleasure and viewing scenery have become some of the more popular national forest activities. Visitors expect a certain level of 'naturalness' in the recreation and tourism settings they pursue. Even individuals who have never visited these national forests expect a certain level of 'natural intactness' in these landscapes. This natural beauty contributes to their sense of well-being and quality of life. (USFS 2005d).

Recreation is currently the predominant use of the national forests. For year-round use, these urban national forests rank among the top in the nation. Almost all visitations to southern California national forests are local in origin. These forests are primarily very popular local day-use attractions, often for large, diverse urban groups of extended family and friends engaging in relaxing activities. (USFS 2005d).

While some level of recreation activity occurs almost everywhere on the national forests, the majority is concentrated in a relatively small number of popular areas. These areas are often associated with developed facilities and are easily accessible by road. (Stephenson and Calcarone, 1999; USFS 2005d).

Recreation in southern California is a complex social activity, constantly changing and posing increased challenges for agency managers. Some unique factors that affect the environmental sustainability of recreation management within the southern California national forests are as follows (USFS 2005d):

- The forests offer a unique niche of nature-based, day-use mountain recreation in southern California. Key attractions include scenic vistas, green forests, cool temperatures, lake and stream-based waterplay, picnicking, winter sports, wilderness areas and hundreds of miles of trail systems and motorized backcountry recreation routes. Visitors want to escape the stress of urban life, traffic and smog, and to relax in nearby mountain refuges.

- Intensive, all-season recreation leads to resource and habitat impacts and a struggle for the USFS to maintain environmentally sustainable recreation opportunities. Competition for space, visitor group and community conflicts, and deterioration of facilities and areas occur in many parts of the national forests.

- There is no off-season in southern California. Use is year-round, often spontaneous (for example, snowplay after major winter storms), and the daily site turnover rate is often high at some facilities.

- There is a lack of room to expand recreation facilities at some popular areas due to steep topography and limiting land boundaries.

- Rapid urban development is occurring adjacent to and within national forest boundaries, leading to use pressures (such as "social" trails) and resource impacts. Urban social problems are migrating to this nearby open space, leading to public safety concerns.

- Demographics are rapidly changing. Complex public information strategies are needed, based on urban orientations and many languages, cultures and class diversities.

- Visitor expectations are higher than in some parts of the country. More amenities are expected, such as recreational vehicle utility hook-ups, flush toilets and hot showers.

- Many new recreation activities originate or become popular in southern California and are sometimes first practiced in these national forests. They include mountain biking, hang-gliding, radio-controlled airplanes, geocaching and paintball gaming. Development of these new activities often changes or increases visitors' ability to access and use the national forests.

- There are increased opportunities for recreation and conservation education partnerships between USFS and non-profit organizations, volunteers, and businesses.

- Recreation facilities, areas, and programs on national forests influence local economies by prompting tourism, business and residential sectors.

4.9.1 Project Recreation Facilities

Project recreation resources are focused on Quail Lake and Pyramid Lake. These Project recreation resources and others nearby are described below and photographically documented at the end of this Section, Figures 4.9-12 through 4.9-24.

4.9.1.1 Quail Lake

Recreational facilities at Quail Lake are owned and operated by DWR. A large, graveled parking area with portable restrooms, signage, and trash receptacles is located at the west end of the lake, adjacent to State Route 138 and the outlet structure (Figure 4.9-12). Project lands surrounding Quail Lake are fenced and recreational access to the lake is walk-in only. Natural surface trails lead to the lake from the parking area. A graveled service road which is closed to public vehicles, but open to hikers and fishermen, surrounds the lake (Figure 4.9-13). No boating or swimming are allowed at Quail Lake. Additional information concerning Quail Lake recreational facilities and amenities and other Project recreational facilities and amenities are described in Table 4.9-1.

Table 4.9-1. Project Recreation Facilities

Recreation Area	Developed Facilities
Quail Lake	Access point with gravel parking and typically 1-2 temporary/portable restrooms; shoreline fishing
Pyramid Lake, Emigrant Landing Boat Launch	8-lane boat launch ramp; 2 public boat docks; 1 sheriff boat dock; administrative building; 7 shade ramadas with typically 2 picnic tables per ramada; 2 restrooms with flush toilets; parking for approximately 24-26 single vehicles with trailers; 1 interpretive display; parking for 55-60 single vehicles, typically 2-3 ADA; 2 floating restrooms that are deployed on the lake as needed; typically 5 portable ramadas that are deployed to recreation areas as needed.
Pyramid Lake, Emigrant Landing Swim and Picnic Area	Swim beach; 24 shade ramadas, with typically 2 picnic tables and 1 barbecue per ramada; 2 restrooms with flush toilets; parking for approximately 130-135 single vehicles, approximately 1 ADA
Pyramid Lake, Emigrant Landing, Picnic and Fishing Area No. 1	6 shade ramadas, with typically 2 picnic tables and typically 1 barbecue per ramada; shoreline fishing; restroom with flush toilets; parking for approximately 53-55 single vehicles with trailer; parking for approximately 45-50 single vehicles, typically 2-3 ADA
Pyramid Lake, Emigrant Landing, Picnic and Fishing Area No. 2	16 shade ramadas, with typically 2 picnic tables and typically 1 barbecue per ramada; shoreline fishing; restroom with flush toilets; parking for approximately 70-75 single vehicles with trailers, typically 4-5 ADA
Pyramid Lake, Vista del Lago Visitors Center	18,500 square-foot visitor building; exhibits and displays; parking for 150-160 single vehicles, typically 5 ADA, and 10 busses; potable water within facility
Pyramid Lake, Vaquero Day Use Area	15 shade ramadas with typically 1 picnic table and typically 1 barbecue per site, one ADA site; trash receptacles; 2 restrooms with flush toilets, ADA; parking for 140-150 single vehicles, typically 8 ADA; 2-lane, non-motorized watercraft launch ramp; boat dock; swim beach
Pyramid Lake, Spanish Point Boat-in Picnic Area	12 shade ramadas, typically 1-2 picnic tables and typically 1 barbeque per ramada; restroom with vault toilets; trash receptacles; shoreline fishing
Pyramid Lake, Serrano Boat-in Picnic Area	6 shade ramadas, typically 1-2 picnic tables and typically 1 barbecue per ramada; restroom with vault toilets; trash receptacles; boat dock; shoreline fishing
Pyramid Lake, Bear Trap Boat-in Picnic Area	3 shade ramadas, typically 1 picnic table per ramada; 1 restroom with vault toilet; typically 1-2 barbecues; trash receptacle; boat dock; shoreline fishing
Pyramid Lake, Yellow Bar Boat-in Picnic Area	10 shade ramadas with typically 1-2 picnic tables per site, 3 sites are ADA; restroom with vault toilets, ADA; boat dock; trash receptacle; shoreline fishing

Table 4.9-1. Project Recreation Facilities (continued)

Recreation Area	Developed Facilities
Los Alamos Campground	93 camp sites with typically 1-2 picnic tables and 1 fire ring per site, 4 ADA; 4 restrooms with flush toilets; typically 5 portable ramadas that are deployed to recreation areas as needed; trailer dump station; potable water; trash receptacles.
Los Alamos Group Campground	3 group sites with maximum occupancy of 40 people and parking for typically 8-10 vehicles per site; each site includes a large shade ramada, typically containing 4-5 picnic tables, fire pits, and trash receptacles; restroom with flush toilets

Source: DWR 2016b
Key:
ADA = Americans with Disabilities Act of 1990 (U.S.)

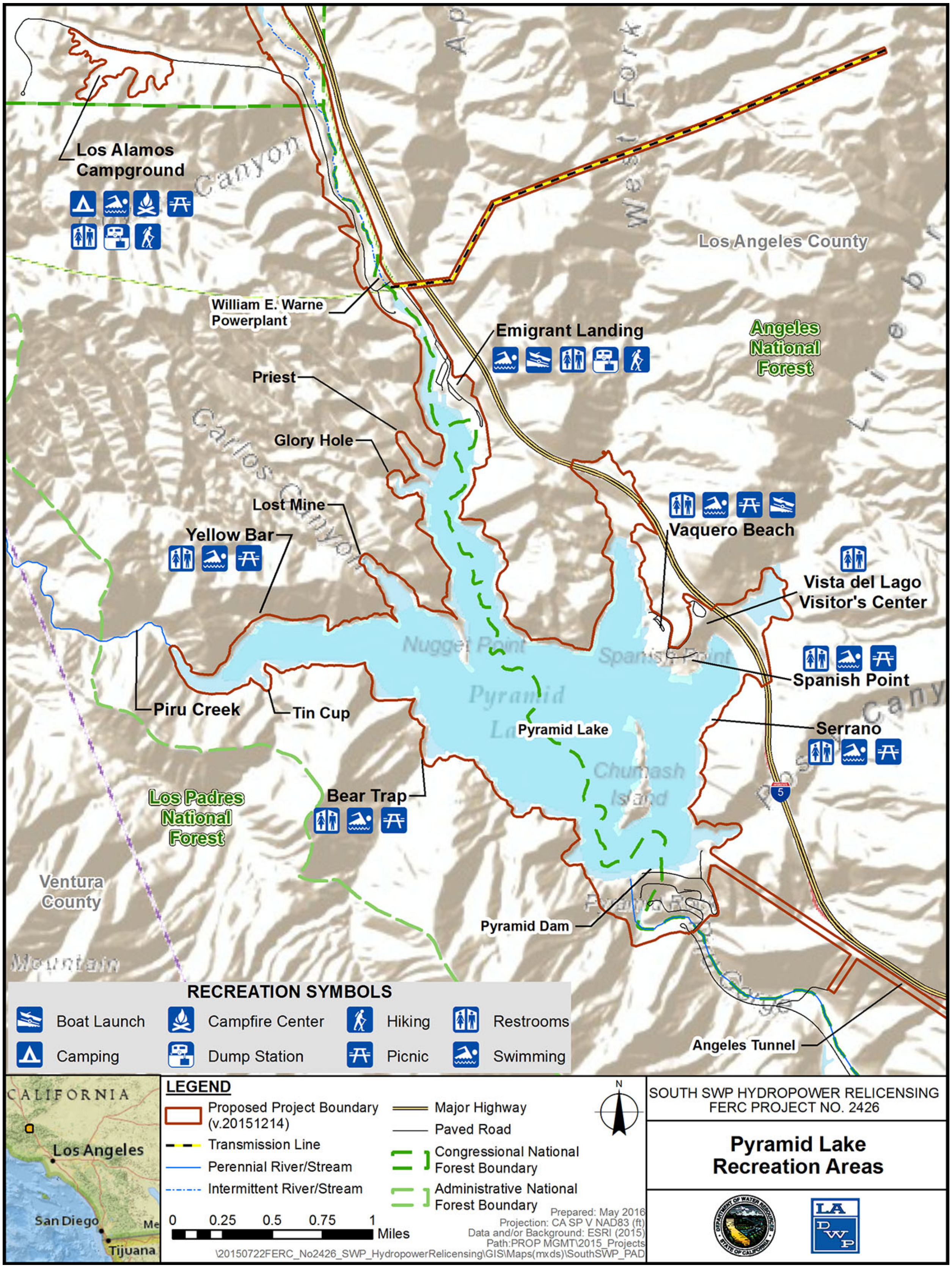


Figure 4.9-1. Pyramid Lake Recreation Area

4.9.1.2 Pyramid Lake

Impounded by Pyramid Dam, Pyramid Lake is popular with boaters and fishermen. In addition, the lake, its surrounding shorelines, and adjacent areas are popular with swimmers, hikers, and picnickers, particularly during the summer months. As shown in Figure 4.9-1 and described in Table 4.9-1, recreation facilities on and around Pyramid Lake include: a campground, boat-in sites, a visitor center, picnic areas, boat launches and public docks, and swim beaches.

Pyramid Lake boating is regulated by the Los Angeles County Sheriff's Department from offices located at Emigrant Landing Marina. Boating speed limits differ in parts of the lake. In the canyons where non-motorized crafts such as canoes and rafts are popular, power boats are restricted to low speeds (5 miles per hour [mph], no wake). Higher speeds for waterskiing are allowed on the lake's main body. The direction of boat travel on the lake is counterclockwise.

Each day, the Los Angeles County Sheriff's office sets a maximum number of boats that can be safely launched on Pyramid Lake at any one time. These limits are typically 75 jet skis and 150 boats, although these limits vary based on a number of conditions. Once these lake limits are hit, which can occur very early on busy weekends, boats and jet skis will only be allowed to enter Emigrants Landing when one leaves. As outlined in the USFS Recreation on Pyramid Lake online flyer, the boating regulations are as follows:

- Ride inside the boat, never on the bow or sides.
- Carry at least one life preserver for each person on board, and one United States Coast Guard approved throwable cushion. Always wear a life preserver when around water if you can't swim.
- Reduce speeds to 5 mph when within 50 feet of the shore or in areas restricted to 5 mph by buoys.
- Display a red flag whenever a skier is down or a towrope is in the water.
- Wear an approved flotation device whenever skiing.
- Jet skis and boats should provide a safety zone for each other.
- All internal combustion engines must be equipped with adequate mufflers and spark arresters.
- Boats must have current registration and vessel numbers displayed properly.
- All inboards must have a fire extinguisher on board (USFS 2015).

Pyramid Lake is primarily a warm-water fishery consisting of largemouth bass, smallmouth bass, channel catfish, striped bass, bluegill, white catfish and black crappie.

A cold-water fishery is maintained by stocking hatchery-raised rainbow trout. A valid fishing license is required and all CDFW regulations (www.wildlife.ca.gov/regulations) apply and are enforced (USFS 2015b).

Pyramid Lake Project recreational facilities include:

- Emigrant Landing Day Use Area
- VDL Visitors Center
- Vaquero Day Use Area
- Spanish Point Boat-in Picnic Area
- Serrano Boat-in Picnic Area
- Bear Trap Boat-in Picnic Area
- Yellow Bar Boat-in Picnic Area
- Los Alamos Campground

Effective January 1, 2011, DWR assumed responsibility from USFS for routine operation and maintenance of certain recreation sites, and management of public recreation activities at sites and on Pyramid Lake, at the Pyramid Lake Recreation Area in accordance with Amendment No. 2 to the MOU between USFS and DWR.

The Emigrant Landing Day Use Area is located at the north end of Pyramid Lake, just south (downstream) of the Warne Powerplant. This area includes an entry station, four parking areas, a fishing platform (Figure 4.9-14), shade ramadas, restrooms (Figure 4.9-15), a boat launch (Figure 4.9-16) one administrative and two public boat docks (Figure 4.9-17), Los Angeles County Sheriff's office (non-Project facility), boat rental and other concessions, a swim beach (Figure 4.9-18) and picnic tables/grills (Figure 4.9-19). Recreation facility fee collection at this location, daily operations, and routine maintenance activities are carried out by a concessionaire under contract to DWR.

The 18,500 square-foot VDL Visitors Center (Figure 4.9-20) is located on the east side of Pyramid Lake, immediately adjacent to and easily accessible from Interstate 5. The visitors center overlooks Pyramid Lake and has a surrounding outdoor balcony. Educational exhibits (Figure 4.9-21 and Figure 4.9-22) about California's water, the SWP, ancient civilizations and natural habitats in the area, and water treatment operations are contained inside the visitor center. A large theater, reception desk, offices, restrooms, and parking for cars and buses are also included. VDL offers free admission and is open daily from 9 a.m. to 5 p.m., except Thanksgiving, Christmas, and New Year's Day.

The Vaquero Day Use Area is located just southwest of the VDL Visitors Center. This area, which is easily accessible from Interstate 5, includes a parking area, picnic tables and grills, shade ramadas, comfort stations, a boat launch, and a swim beach.

Located just south of the VDL Visitors Center, but reachable to the general public only by boat, is Spanish Point. This picnic area includes tables, grills, shade ramadas, and a restroom.

The Serrano area is located south of Spanish Point, along the east shore of Pyramid Lake. Accessible by the general public only by boat, this area includes picnic tables, grills, shade ramadas, a restroom, and a boat dock.

Located along the southwest shore of Pyramid Lake and reachable only by boat is the Bear Trap picnic area. In addition to picnic tables, this area includes grills, shade ramadas, a restroom, and a boat dock.

Located just northwest of Bear Trap is the Yellow Bar Boat-in Picnic Area. This area includes picnic tables, shade ramadas, a comfort station, a boat dock, and a beach.

The Los Alamos Campground (Figure 4.9-23 and Figure 4.9-24) is located approximately 2 miles northwest of the Warne Powerplant and accessible via Hard Luck Road. While not within the existing Project boundary, this campground is a Project recreation facility. Los Alamos Campground offers family campsites, group campsites, restrooms, potable water, a trailer dump station, and an entrance kiosk and the facility is located on NFS lands that are outside Los Padres National Forest boundaries. Fee collection, daily operations, and routine maintenance activities are carried out by a recreation concessionaire under contract with DWR.

4.9.1.3 Dispersed Recreation Within Project Boundary

Dispersed recreation within the proposed Project boundary takes place predominately at and around Quail Lake and Pyramid Lake.

Along Quail Lake shoreline fishing, bird watching and hiking take place, however, no water contact uses are allowed. Along the Pyramid Lake shoreline, boaters may access the undeveloped and dispersed recreational use areas at: Priest, Glory Hole, Lost Mine, Piru Creek, and Tin Cup (see Figure 4.9-1).

No recreation takes place within the existing or proposed Project boundary surrounding the Warne Powerplant and surrounding the Castaic Powerplant and Elderberry Forebay. The water level regularly fluctuates in Elderberry Forebay by up to 25 feet due to operation of the Castaic Powerplant; therefore it is closed for public safety. These facilities are fenced, gated, and signed “no trespassing.”

While roads are located along the west (Los Angeles City Water and Power Road) and east (Goodell Fire Road/Castaic Canyon Road - 6N13) of the Elderberry Forebay, public vehicular access on these roadways is prohibited. Pedestrian use is possible on the east shoreline road but is very infrequent.

4.9.1.4 Project Recreation Facilities Use

Pyramid Lake Creel Surveys

Pyramid Lake creel surveys are conducted as a license requirement under the existing Exhibit S. Licensees conducted a series of creel surveys at Pyramid Lake, one spanning from March 2014 to July 2014 and the other from October 2014 to July 2015. These creel surveys were based on roving survey methods with sampling days selected by stratified random sampling weekend and weekday days. Both surveys were conducted on average of 10 days a month, with seven weekday surveys and 3 weekend day surveys The roving survey consisted of angler interviews at shoreline areas where fishing effort was observed and accessible. Boat anglers were interviewed when they returned to the launch ramp. On average, three hours per survey day were required to conduct the angler interviews. In general, the majority of visible shoreline anglers were interviewed during the three-hour period. (Environmental Science Associates 2014c, DWR 2015b).

Anglers were asked questions pertaining to demographics and satisfaction with their fishing experience. The March/July 2014 and October 2014/July 2015 surveys revealed that 94 percent and 92 percent, respectively, of anglers were male. Age demographics of the March/July 2014 and October 2014/July 2015 surveys showed that 71 percent and 57 percent, respectively, of anglers were between the ages of 16 and 55 years old, with 22 percent and 37 percent, respectively, of anglers older than 55 years old, and 7 percent and 6 percent of anglers younger than 16 years old. In March/July 2014, 52 percent traveled 20-50 miles to fish at Pyramid Lake, while only 42 percent of anglers traveled this distance during the October 2014/July 2015 survey. Anglers traveling less than 20 miles to Pyramid Lake were 9 percent for March/July 2014 and 7 percent for October 2014/July 2015. Those who traveled more than 50 miles to get to Pyramid Lake were 51 percent in October 2014/July 2015 and only 39 percent in March/July 2014. (ESA 2014, 2015). Anglers were also asked questions about their satisfaction with the fishing experience, the number of fish caught, and the size of fish caught. On a scale of one to four (1=poor; 2=fair; 3=good; 4=excellent), the rating for number of fish caught was below fair for March/July 2014 and October 2014/July 2015 surveys (1.89 and 1.69, respectively). Also ranked below fair was size of fish with 1.88 and 1.72 for March/July 2014 and October 2014/July 2015, respectively. Although both number and size of fish ranked below 2.0 for these surveys, anglers rated their overall fishing experience as between fair and good with ratings if 2.58 and 2.28 for March/July 2014 and October 2014/July 2015, respectively. (Environmental Science Associates 2014c, 2015c).

Additional information concerning Pyramid Lake creel surveys is contained in Section 4.5, Fish and Other Aquatic Resources.

2014 Recreation User Counts and Capacity Utilization

In preparation for its 2015 FERC Form 80 (Recreation Report) filing, DWR conducted a user count and capacity utilization study for Project recreation facilities in 2014. DWR found that capacity utilization ranged from a low of 3 percent for Quail Lake “access points – shoreline fishing” to a high of 79 percent for Pyramid Lake “picnic areas” (Table

4.9-2). In no cases were use figures at or above maximum capacity, which suggests that existing facilities and use areas are adequately accommodating the existing recreational demand.

Table 4.9-2. Project Recreation Capacity, Use, and Capacity Utilization

Amenity Type	Capacity (daily)	Use (average, daily non-peak weekend)	Capacity Utilization (percent)
Quail Lake Access Points – Shoreline Fishing	120	4	3
Pyramid Lake Boat Launch Areas – Emigrant and Vaquero	225	161	72
Pyramid Lake – Reservoir Fishing	160	50	31
Pyramid Lake – Swim Areas	200	150	75
Pyramid Lake – Picnic Areas	1,236	974	75
Pyramid Lake – Visitors Center	552	427	77
Pyramid Lake - Campsites	93	34	37*
Pyramid Lake – Group Campsites	120	30	25**
Pyramid Lake - Marina	39	9	23

Source: DWR 2016b
**By sites*
***By persons*

4.9.2 Recreation Opportunities and Needs in the Project Region

4.9.2.1 Statewide Comprehensive Outdoor Recreation Plan

The California State Comprehensive Outdoor Recreation Plan (SCORP) serves as a Statewide master plan for State and local parks and outdoor recreational open space areas. The SCORP also offers policy guidance to all outdoor recreation providers, including Federal, State, Local, and Special District Agencies throughout California.

The current (2015) SCORP is summarized below, along with the following key supporting documents: SOPA 2012 and Outdoor Recreation in California's Regions 2013.

California State Parks' 2015 SCORP reflects the current and projected changes in California's population, trends and economy. This edition of the SCORP provides a strategy for Statewide outdoor recreation leadership and action to meet the State's identified outdoor recreation needs. This SCORP establishes the following actions to address California's park and recreation needs:

Statewide Actions

1. Inform decision-makers and communities of the importance of parks.

2. Improve the use, safety, and condition of existing parks.
3. Use Geographic Imaging System (GIS) mapping technology to identify park deficient communities and neighborhoods.
4. Increase park access for Californians including residents in underserved communities.
5. Share and distribute success stories to advance park and recreation services.

The Survey on Public Opinions and Attitudes (SOPA) on Outdoor Recreation in California 2012 (DPR 2014) continues a process in place for over 25 years, to utilize applied research as a critical component of developing the SCORP. An understanding of the outdoor recreation demands, patterns, preferences, and behaviors of California residents is essential to develop policies, programs, services, access, and projections of future use.

The 2012 survey study included an adult telephone survey, adult online/mail-back survey, and online/mail-back youth survey to provide a comprehensive perspective of the outdoor recreation opinions and attitudes of Californians. Consistent with earlier studies, the 2012 adult surveys measured participation, latent demand, willingness to pay, importance and use of facilities, motivation, and opinions regarding privatization of services. The 2012 adult surveys, as in the 2008 survey, include measurement of physical activity in parks and constraints to physical activity. A new area of study for the current survey is an analysis of quality of life relating to parks and communities. Comparisons on several variables by region and differences and similarities between Hispanics and non-Hispanics have been continued as a focus of investigation.

The survey findings from the 2012 adult surveys are provided below and include:

Park Visitation and Activity Participation

- Nearly all respondents (91.6 percent) had visited a park within the past 12 months. The majority (71.5 percent) had visited a park within the past month.
- In the past 12 months a majority of respondents visited highly developed parks and recreation areas, developed nature-oriented parks and recreation areas, historic or cultural buildings, sites, or areas, and natural and undeveloped areas.
- About three quarters of Californians traveled to parks with family (52.5 percent) and friends (23.5 percent), while almost one-third went to parks with both family and friends.
- More than two-thirds of Californians reported spending the same (33.2 percent) or more time (35.2 percent) in outdoor recreation activities compared to 5 years ago.

- Californians who spend less time in outdoor activities then they did 5 years ago, do so because of time/work (25.7 percent), age (22.7 percent), and health/disability (16.4 percent).

- The majority of respondents participated in moderate (40.6 percent) to light levels (37.8 percent) of physical activity during park visits and spent less than 3 hours of time (46.1 percent) physically active in parks.

- During the past 12 months Californians mostly participated in picnicking (70.4 percent) walking (63.8 percent), beach activities (52.8 percent), shopping at farmers' markets (49.5 percent), and swimming in a pool (48.2 percent).

- The respondents would like to participate more often in picnicking (55.1 percent), walking (37.4 percent), camping (35.1 percent), and beach activities (34.6 percent).

- Park companions under the age of 18 mostly play (54.8 percent) and participate in sports (27.7 percent) when at parks.

- More than half of respondents utilized community facilities/buildings (65.4 percent), unpaved multiuse trails (60.2 percent), and picnic table/pavilion (56.6 percent) during their last park visit.

- Over a third (34.7 percent) of respondents reported utilizing an unpaved trail for hiking, biking, or horseback riding at least once or twice a month or more during the last 12 months. At the same time, 31 percent of respondents reported never using an unpaved trail.

- Few (7.9 percent) of the respondents reported engaging in off-road motor vehicle use once a month or more. A total of 18.2 percent of respondents reported using an off road vehicle in the last 12 months.

- The most prevalent reasons the respondents participate in their favorite outdoor recreation activities included: to have fun, relax, view scenic beauty, be with family and friends, and keep fit and healthy.

Preferences and Priorities

- The most important facilities were wilderness type areas with no vehicles or development, play areas for children, areas for environmental and outdoor education, large group picnic sites, recreation facilities at lakes/rivers/reservoirs, and single-use trails.

- More than 60 percent of Californians surveyed thought more emphasis should be placed on protecting natural resources, maintaining park and recreation areas, protecting historic resources, and cleaning up pollution of oceans, lakes, rivers, and streams in park and recreation areas. About one third of respondents felt less emphasis should be placed on providing opportunities for motorized vehicle operation on dirt trails and roads.

- Most respondents strongly agreed or agreed fees should be spent on the area where they are collected, recreation programs improve health, rules and regulations need enforcement, the availability of recreation areas and facilities attract tourists, and recreation programs help reduce crime and juvenile delinquency.

Satisfaction with Park Facilities

- Most respondents (72.8 percent) reported being satisfied or very satisfied with current facilities or outdoor recreation areas' conditions. Approximately 26 percent of the respondents answered that parks were better than 5 years ago and 26 percent answered that they were not as good as 5 years ago.

Park Fees

- The respondents were more willing to pay between $11 to $50 to picnic and camp than other activities.

Privatization Preferences

- The respondents more strongly supported privatization of food and beverage and rental services, sponsorships of events, and general maintenance. Respondents were less supportive of privatizing total operations, law enforcement, and educational activities.

Constraints to Park Use

- Fear of gang activity, use of alcohol and drugs, and poor maintenance were the biggest factors limiting the respondents' ability to engage in physical activities in parks.

Travel Times

- A majority of respondents (55.2 percent) reported spending between 5 and 10 minutes walking to the place they most often go for recreation. Meanwhile, a majority of respondents (54.5 percent) reported spending between 11 and 60 minutes driving there.

Quality of Life and Communities

- Californians rated clean air and water, prevention of crime, feeling safe, and having enough good jobs for residents as the most important factors for their personal quality of life. Respondents were not as satisfied with these factors in their community.

- Residents rated preservation of natural areas, the beauty of their community, and preservation of wildlife habitats as the community conditions most increased by parks and recreation in their community. Residents did not rate traffic control, a stable political environment, fair prices for goods and services, and good public transportation as being increased or decreased by parks and recreation. (DPR 2014)

As described in Outdoor Recreation in California's Regions 2013 (DPR 2013), California's diverse geography, demography, and economy present both opportunities and challenges to the State's outdoor recreation providers. A regional approach, which recognizes regional differences and divides regions along county lines, can aid both State and local planning efforts.

The Project, which is located entirely within Los Angeles County, is located in the "Los Angeles" Planning Region. This region also includes Ventura County.

The number of acres of protected land per resident in the Los Angeles Planning Region is the second lowest among regions. Accessibility to protected land (measured by the percentage of residents living within 1/4 mile of such land) is slightly lower than the Statewide average. The number of miles of highway in the National Scenic Byways Program per 100 square miles is slightly higher than the Statewide average. The region has numerous trails in the California Recreational Trails System. Recreation facilities such as picnic/barbeque areas are generally lower than the proportion of the region's population percentage of about 31 percent.

About 87 percent of protected land in the Los Angeles Planning Region is federally protected land, slightly higher than the Statewide average (86 percent). Percentages of nonprofit (3.4 percent) and local (9 percent) protected land are also slightly higher than Statewide averages (2.5 percent and 6 percent, respectively), but the percentage of State protected land (1 percent) is lower than the Statewide average (6 percent).

Serving residents' needs and improving access to recreation were ranked as "highest priority" in the Los Angeles Planning Region. Specifically, funding outdoor recreation opportunities that meet the activity preferences of Hispanic participants was encouraged. Also encouraged was funding incorporated area recreation facilities, such as ball fields, basketball courts, campgrounds, community centers, playgrounds, skate parks, and tennis/racquet courts.

4.9.2.2 Los Angeles County

As described in the County of Los Angeles General Plan, Conservation and Open Space Element (Los Angeles County Department of Regional Planning 1980), national forests and Santa Catalina Island are the largest recreational areas in the County. A system of regional parks has been developed through County and City efforts. A local park system complements the regional park system and is designed to meet neighborhood and community outdoor recreation needs.

The Los Angeles County Park System has a total of 169 parks and recreational facilities. These facilities are owned, operated, and maintained by the County and total 69,595 acres. An additional 541 acres have been dedicated, but have not yet been developed as parkland. (Los Angeles County Department of Regional Planning 2014).

Antelope Valley

The Antelope Valley Area Plan (Los Angeles County Department of Regional Planning 2015a) is a component of the Los Angeles County General Plan. The Project's Quail Lake, Lower Quail Lake Canal, Peace Valley Pipeline, and most of Pyramid Lake are included in the Antelope Valley Planning Area (AVPA). Currently, there is a total of 3,870 acres of regional parkland (not including Quail Lake or Pyramid Lake) in the AVPA and adjacent cities. For every 1,000 residents, there are approximately 10 acres of regional parkland. Based on the Adopted General Plan's goal, there is a 1,573-acre surplus of regional parkland under existing conditions. The current ratio of local parkland is 0.54 acres of local parkland for every 1,000 residents in the AVPA. Based on the Adopted General Plan and Proposed Area Plan's desired ratio of 4 acres of local parkland per 1,000 residents, there is currently a 324-acre deficit of local parkland. Although there is an existing local park deficiency, there are a number of other recreation and open space assets that serve to reduce the demand for local park facilities. The considerable amount of regional parkland (see Figure 4.9-2), State parks, trails, and private recreational facilities available to the residents of the AVPA substantially reduces the demand for local park facilities.

Parks and Recreation Goal PS 8 from the AVPA Plan states that residents are to enjoy access to parks and recreational facilities. (Los Angeles County Department of Regional Planning 2015a).

Parks and Recreation Goal PS 9 from the AVPA Plan states safe spaces for the recreational use of off-road vehicles and other motorized sporting vehicles are to be provided (Los Angeles County Department of Regional Planning 2015a).

Hungry Valley State Vehicular Recreation Area

Located just west of the Project's Peace Valley Pipeline (outside of the proposed Project boundary, see Figure 4.9-2) is the Hungry Valley State Vehicular Recreation Area (SVRA). The Hungry Valley SVRA is the third largest unit of California State Park's Off-Highway Motor Vehicle Recreation Division. Located in the Tejon Pass north of Los Angeles and along the Interstate 5 corridor, Hungry Valley offers close to 20,000 acres and more than 130 miles of scenic trails for motorcycle, All-Terrain Vehicles (ATV), including side by side ATVs, and 4x4 recreation vehicles. All levels of OHV operator skills may be challenged by the wide variety of terrain and trails at Hungry Valley SVRA.

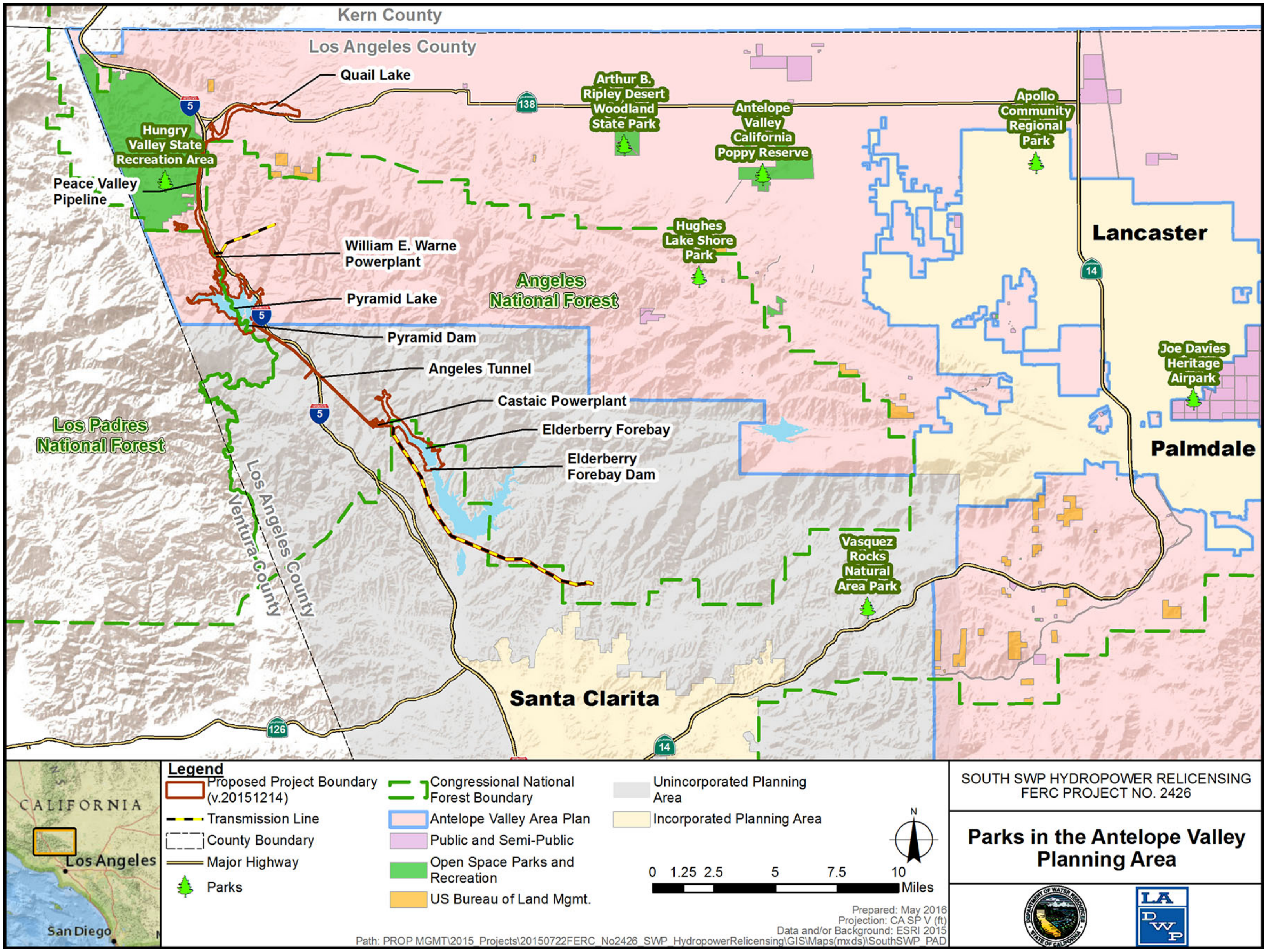


Figure 4.9-2. Parks in the Antelope Valley Area Planning Area

Elevations at Hungry Valley range from 3,000 to nearly 6,000 feet. Occasional snowfalls occur during the winter. Summers are most often hot, dry and dusty. The most pleasant times of the year for OHV use are during the spring and fall months when the temperatures are mild and occasional rain showers make for good traction and reduced dust. Nighttime temperatures often drop below freezing in the spring and fall, as well as during the winter. The wide variety of trails at Hungry Valley SVRA provides excitement for both beginner and experienced off-roaders. For experienced OHV users challenging trails can be found in the hills and sand washes of the back-country section of the SVRA. Beginners can enjoy the scenery and relative ease of the trails in the Native Grasslands Management Area. Trails in the adjoining LPNF are recommended for experienced riders only.

Providing for long-term, sustained OHV recreation opportunity is a top priority in SVRA Management. Provisions in California law require actions to stabilize soils and to provide for healthy wildlife populations in OHV recreation areas. DPR staff protects the natural and cultural resources that make the park so special. In order to ensure protection of the environment, DPR staff has established extensive and comprehensive wildlife, habitat, and soil monitoring programs. While visiting the park, users may encounter protective barriers such as fences, gates, straw bales, signs, or trail reroutes designed to protect natural and cultural resources.

Santa Clarita Valley

The southern portion of the Project's Pyramid Lake, Pyramid Dam, Angeles Tunnel, Castaic Powerplant, Elderberry Forebay, Elderberry Forebay Dam, and Castaic Transmission Line are included in the Santa Clarita Valley Area Plan Area (Los Angeles County Department of Regional Planning 2012). The Santa Clarita Valley Area Plan is a component of the Los Angeles County General Plan and is intended to provide focused goals, policies, and maps to guide the regulation of development within the unincorporated portions of the Santa Clarita Valley.

Los Angeles County owns and operates 13 parks in the Santa Clarita Valley Planning Area, totaling 578 acres and serving various communities throughout the Valley (see Figure 4.9-3). County parks are classified as follows:

- Neighborhood parks, generally from 5 to 10 acres in area, provide active recreational areas intended to serve a population of up to 5,000 within a half-mile radius. There are seven County-owned neighborhood parks in the planning area (Chesebrough, Del Valle, Hasley Canyon, Jake Kuredjian, Pico Canyon, Plum Canyon/David March, and Northbridge).

- Community parks are generally 10-40 acres, provide both passive and active recreation facilities, and are intended to serve a population of up to 20,000 within a two-mile radius. There is one County-owned community park in the planning area (Richard Rioux Park).

- Regional parks are generally over 50 acres, and offer a wide range of specialized recreational activities to serve the population within a one-hour's drive. There are two County regional parks in the planning area: Val Verde Park and William S. Hart Park.

The City of Santa Clarita Parks, Recreation and Community Services Department operates 20 City parks totaling 246 acres and ranging in area from about 0.5 to 80 acres, which provide a wide range of recreational facilities. City standards for neighborhood and community parks are similar to the categories used by the County, described above. Based on these categories, there are 12 neighborhood parks within the City and five community parks. Special use and passive parks are also included in the City's Master Plan, and are generally used for open space greenbelts and vista points. There are dozens of passive and special use parks in the City. The City's Central Park is a multi-use park intended to serve the entire Santa Clarita Valley, and is classified as a regional park.

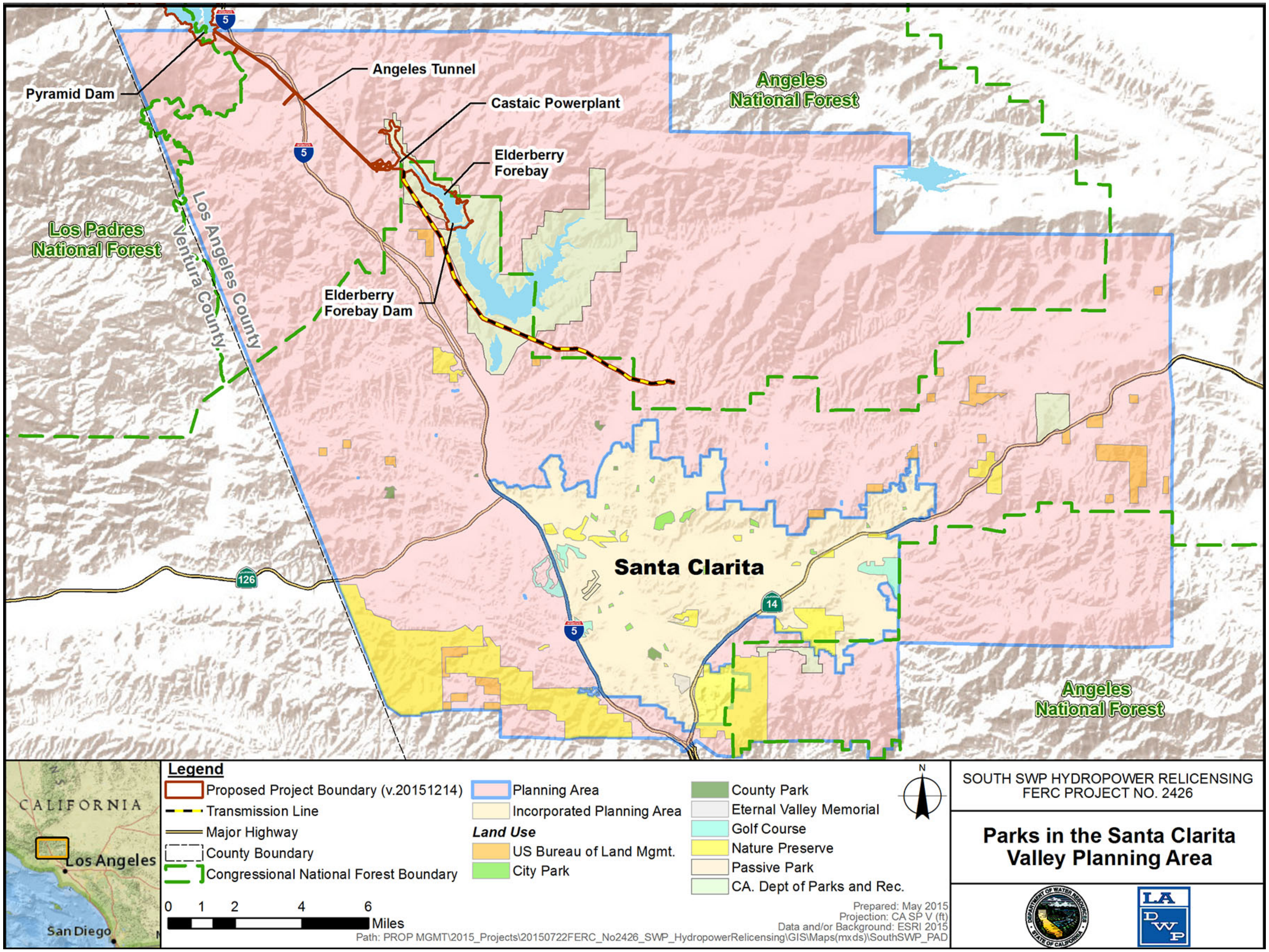


Figure 4.9-3. Parks in the Santa Clarita Valley Planning Area

4.9.2.3 Angeles National Forest

Visitors to the ANF choose specific settings for their activities to enjoy desired experiences. These settings vary by place and are further refined by the recreation opportunity spectrum (ROS), a classification system that describes different settings across the national forests using five classes that range from highly modified and developed settings to primitive, undeveloped settings. These are:

- Primitive: Characterized by an essentially unmodified natural environment of fairly large size. Interaction between users is very low and evidence of other users is minimal. The area is managed to be essentially free of evidence of human-induced restrictions and controls. Motorized use within the area is not permitted. There are no developed facilities.

- Semi-primitive Non-motorized: Characterized by a predominantly natural or natural-appearing environment of moderate to large size. Interaction among users is low, but there is often evidence of other users. The area is managed in such a way that minimum on-site controls and restrictions may be present, but would be subtle. Motorized recreation is not permitted, but local roads used for other resource management activities may be present on a limited basis. Use of such roads is restricted to minimize impacts on recreation experience opportunities. A minimum of developed facilities (if any) are provided.

- Semi-primitive Motorized: Characterized by a predominantly natural or natural-appearing environment of moderate to large size. Concentration of users is low, but there is often evidence of other users. The area is managed in such a way that minimum on-site controls and restrictions may be present but would be subtle. Motorized use of local primitive or collector roads with predominantly natural surfaces and trails suitable for motorbikes is permitted. Developed facilities are present but are more rustic in nature.

- Roaded Natural: Characterized by predominantly natural-appearing environments with moderate evidence of the sights and sounds of people. Such evidence usually harmonizes with the natural environment. Interaction among users may be moderate to high, with evidence of other users prevalent. Resource modification and utilization practices are evident, but harmonize with the natural environment. Conventional motorized use is allowed and incorporated into construction standards and design of facilities, which are present and well defined.

- Rural: Characterized by a substantially developed environment and a background with natural-appearing elements. Moderate to high social encounters and interaction between users is typical. Renewable resource modification and utilization practices are used to enhance specific recreation activities. Sights and sounds of humans are predominant on the site and roads and motorized use is extensive. Facilities are more highly developed for user comfort with ample parking.

By describing existing recreation opportunities in each class, the ROS system helps match NFS visitors with their preferred recreation setting. The recreation opportunity spectrum can also be used to plan how NFS lands should be managed for recreation in the future (USFS 1986; in USFS 2005d). Changes in a national forest's mix of ROS classes affect the recreation opportunities offered.

As shown in Figure 4.9-4, the ROS settings for NFS lands near the Warne Powerplant, Pyramid Lake, Pyramid Dam, Castaic Powerplant, Elderberry Forebay, and Elderberry Forebay Dam are "semi-primitive non-motorized" and "roaded natural."

4.9.3 Land Use and Management in the Project Region

The County of Los Angeles General Plan (Los Angeles County Department of Regional Planning 1980) consists of two major components: (1) the countywide chapters and elements that set the countywide policy framework; and (2) the areawide and community plans that deal with local issues. This plan (and the area plans described below) applies only to privately owned lands in the County and not to lands owned by other jurisdictions, such as USFS, DWR, or LADWP. As described below, the Project is located within the Antelope Valley and Santa Clarita Valley planning areas.

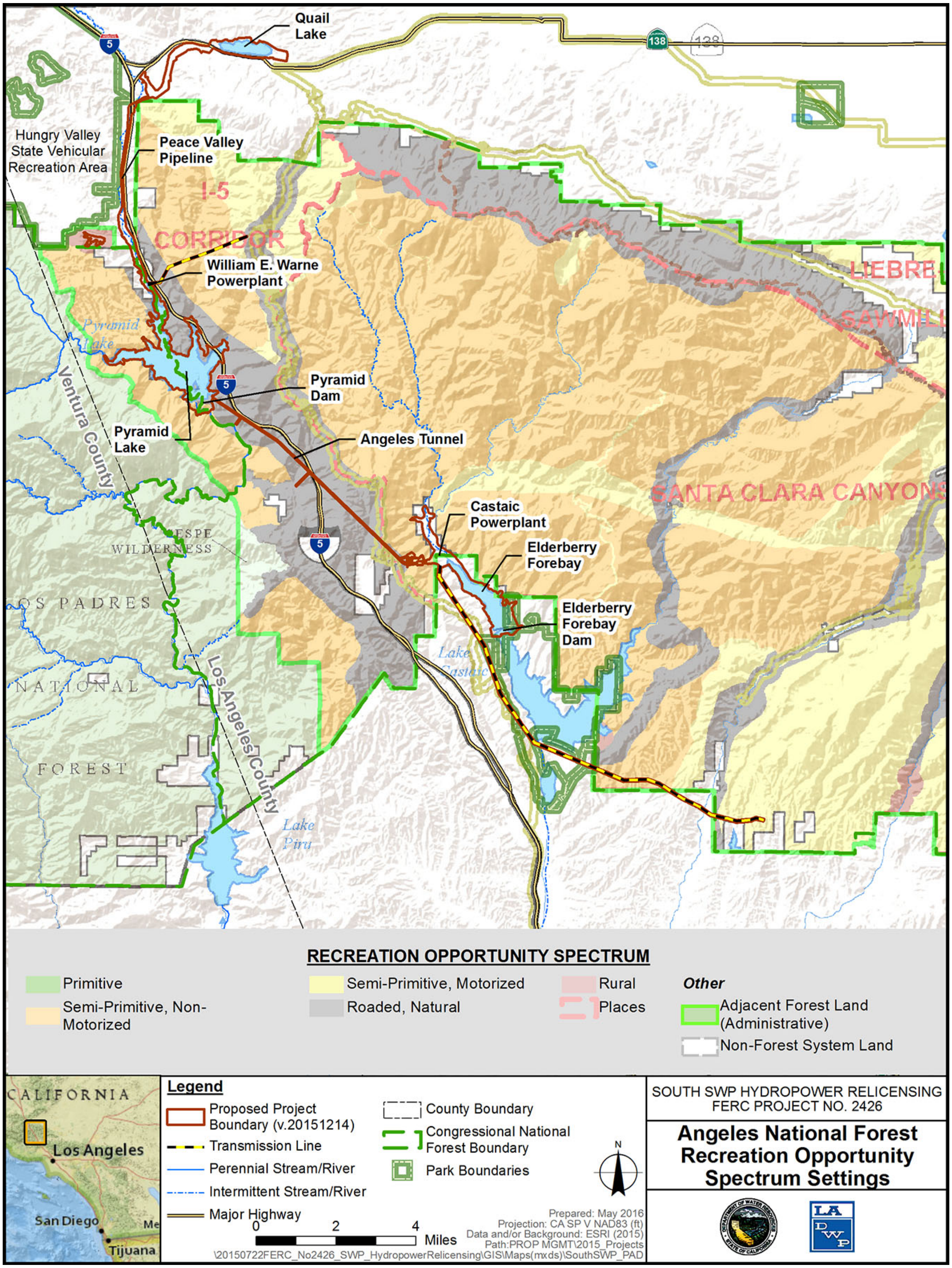


Figure 4.9-4. Angeles National Forest Recreation Opportunity Spectrum Settings in the Project Vicinity

4.9.3.1 Antelope Valley

The Antelope Valley Area Plan: Town & Country (Los Angeles County Department of Regional Planning 2015a) planning area surrounds the Project's Quail Lake and Pyramid Lake. The purpose of the Antelope Valley Area Plan is to achieve the communities' shared vision of the future through the development of specific goals, policies, land use and zoning maps, and other planning instruments.

The Antelope Valley Area Plan includes 21 land use types (5 Rural, 5 Residential, Commercial, Mixed Use, Light Industrial, Heavy Industrial, 7 Public and Semi-Public) and 5 overlays (Special Management Area, Agricultural Resource Area, Mineral Resource Zone, Significant Ecological Area, and Specific Plan). Land uses in the Project vicinity (Figure 4.9-5) include:

- RL 20 (rural land, maximum density of 1 residential unit for each 20 gross acres of land) areas immediately surrounding Quail Lake. Immediately east of the Quail Lake is the Quail Lake Sky Park (small airport).
- RL 1 (rural land, maximum density of 1 residential unit for each 1 gross acre of land) areas to the north of Quail Lake.
- OSC (open space, conservation), RL 20, and CR (rural commercial) areas to the west of Quail Lake.
- OSC and H 5 (residential, maximum density of 5 units for each 1 net acre of land) areas to the east of Quail Lake.
- OS-NF (open space, national forest) areas surrounding Pyramid Lake.

In addition, areas in the Quail Lake vicinity are included in the "West Economic Opportunity Area". The Northwest Highway 138 Corridor Improvement Project being implemented by Los Angeles County Metropolitan Transportation Authority and Caltrans has the potential to bring growth and economic development to the region.

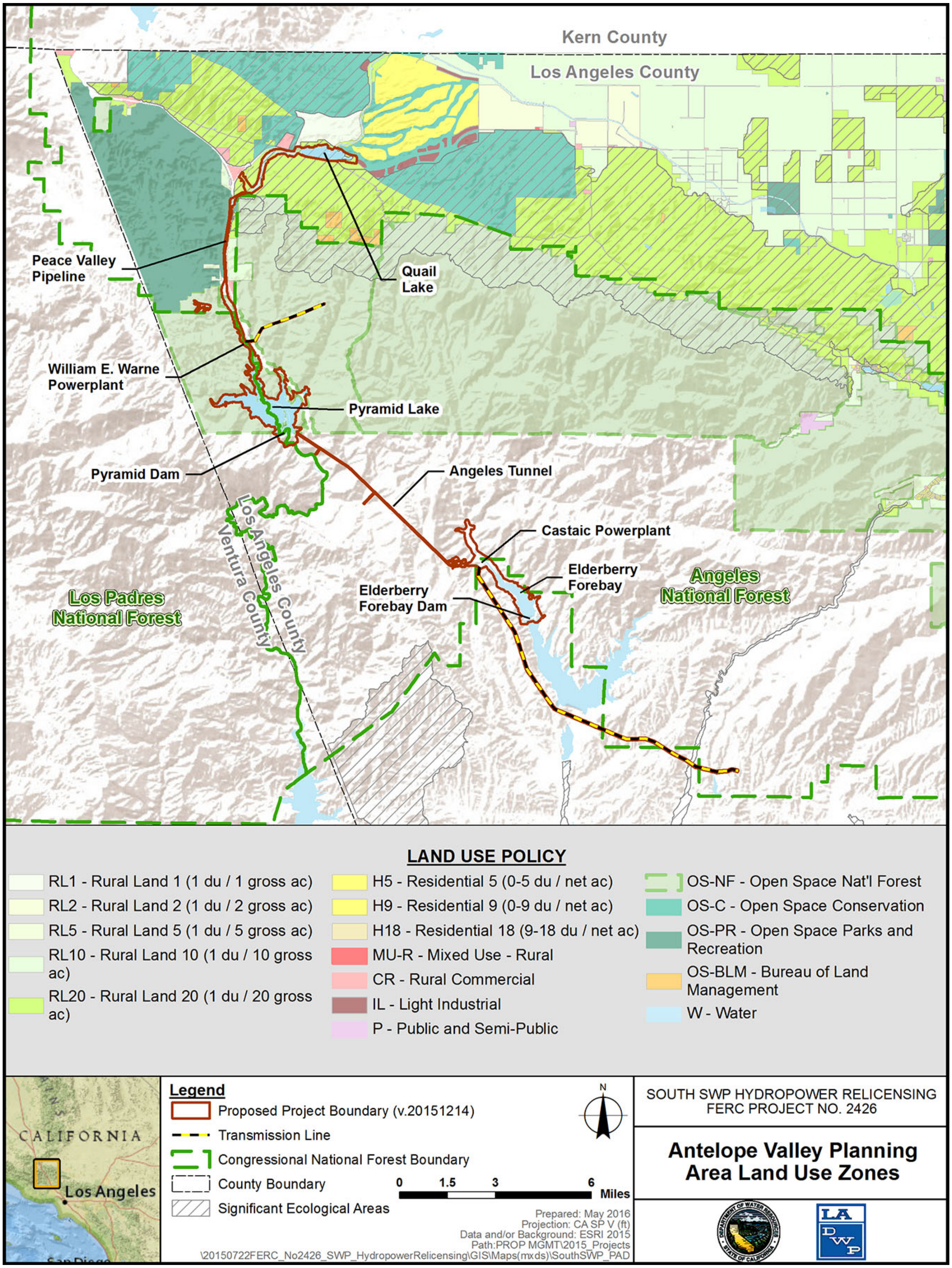


Figure 4.9-5. Antelope Valley Area Plan Land Uses

4.9.3.2 Santa Clarita Valley

The Project's Angeles Tunnel, Castaic Powerplant, Elderberry Forebay, Elderberry Forebay Dam, and Castaic Transmission Line are surrounded by the Santa Clarita Valley Area Plan: One Valley One Vision (Los Angeles County Department of Regional Planning 2012). The Santa Clarita Valley Area Plan is a component of the Los Angeles County General Plan, and is intended to provide focused goals, policies, and maps to guide the regulation of development within the unincorporated portions of the Santa Clarita Valley.

The Santa Clarita Valley Area Plan's Land Use Element contains descriptions of the designations applied to land within the Santa Clarita Valley to guide the type, intensity, and density of future uses. The Plan contains 21 land use types (5 Rural, 4 Residential, 2 Commercial, 2 Industrial, Community Serving, Transportation Facilities, 5 Open Space, and Specific Plan). Not all of the land use types are in the proposed Project boundary. Land uses in the Project vicinity (Figure 4.9-6) include:

- OS-NF (open space-national forest) areas surrounding the Angles Tunnel, Castaic Powerplant, Elderberry Forebay, Elderberry Forebay Dam and the Castaic Lake State Recreation Area (SRA).

- OS-PR (open space-parks and recreation) areas immediately adjacent to the Castaic Powerplant, Elderberry Forebay, Elderberry Forebay Dam and the Castaic Lake SRA.

- RL 10 (rural land, maximum density of 1 residential unit for each 10 gross acre of land) land to the west of the Elderberry Forebay and Elderberry Dam.

- Specific Plan (Northlake) to the west of the Castaic Lake SRA and to the east of I-5. Land use types in the Northlake area include: open space, single family residential, multiple family residential, commercial, light industrial and school/park.

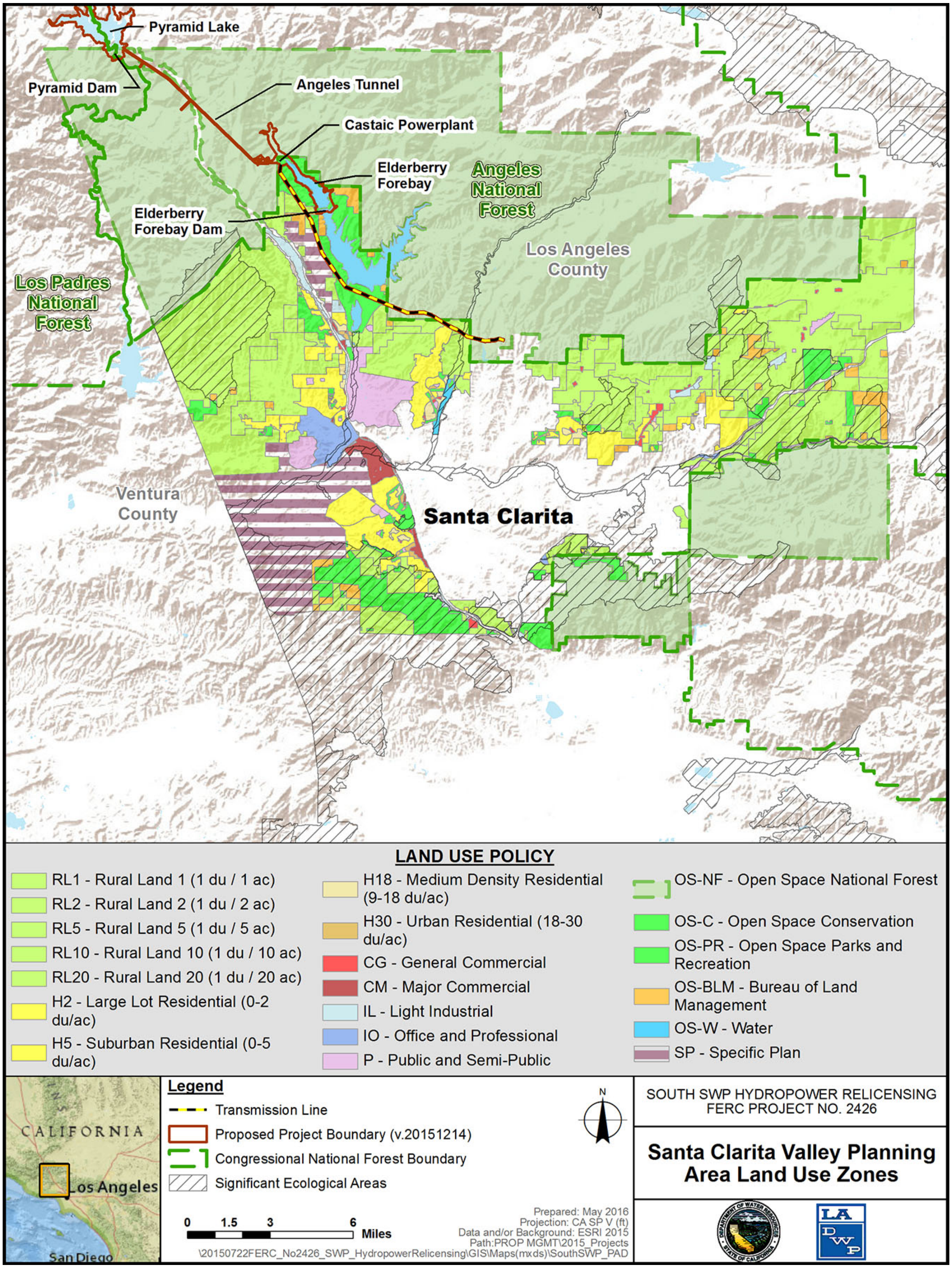


Figure 4.9-6. Santa Clarita Valley Area Plan Land Uses

4.9.3.3 Angeles National Forest

The revised land and resource management plans (forest plans) for the southern California national forests (i.e., Angeles, Cleveland, Los Padres, and San Bernardino national forests; with the Project situated within the overall boundaries of the ANF and portions of the LPNF administered by the ANF) describe the strategic direction at the broad program-level for managing the land and its resources over the next 10 to 15 years. The strategic direction was developed by an interdisciplinary planning team working with forest staff using extensive public involvement. (USFS 2005c).

The forest plans were developed to implement Alternative 4a (selected). Alternative 4a (selected) represents the adjustment of the preferred alternatives identified in the draft environmental documents. The accompanying FEIS describes the analysis used in formulating the revised forest plans (USFS 2005a).

Land Use Zones

As noted above, 2,222 acres (49.3 percent) of the area within the proposed Project boundary is on NFS lands. Policies and programs associated with the ANF apply only to those NFS lands.

Seven land use zones have been identified for the ANF. The zones, in order of decreasing land use intensity, are:

- Developed Area Interface
- Back Country
- Back Country Motorized Use Restricted
- Back Country Non-Motorized
- Critical Biological
- Recommended Wilderness
- Existing Wilderness

Developed Area Interface, Back Country Motorized Use Restricted and Back Country Non-Motorized land use zones dominate NFS lands in and around the Project (see Figure 4.9-7).

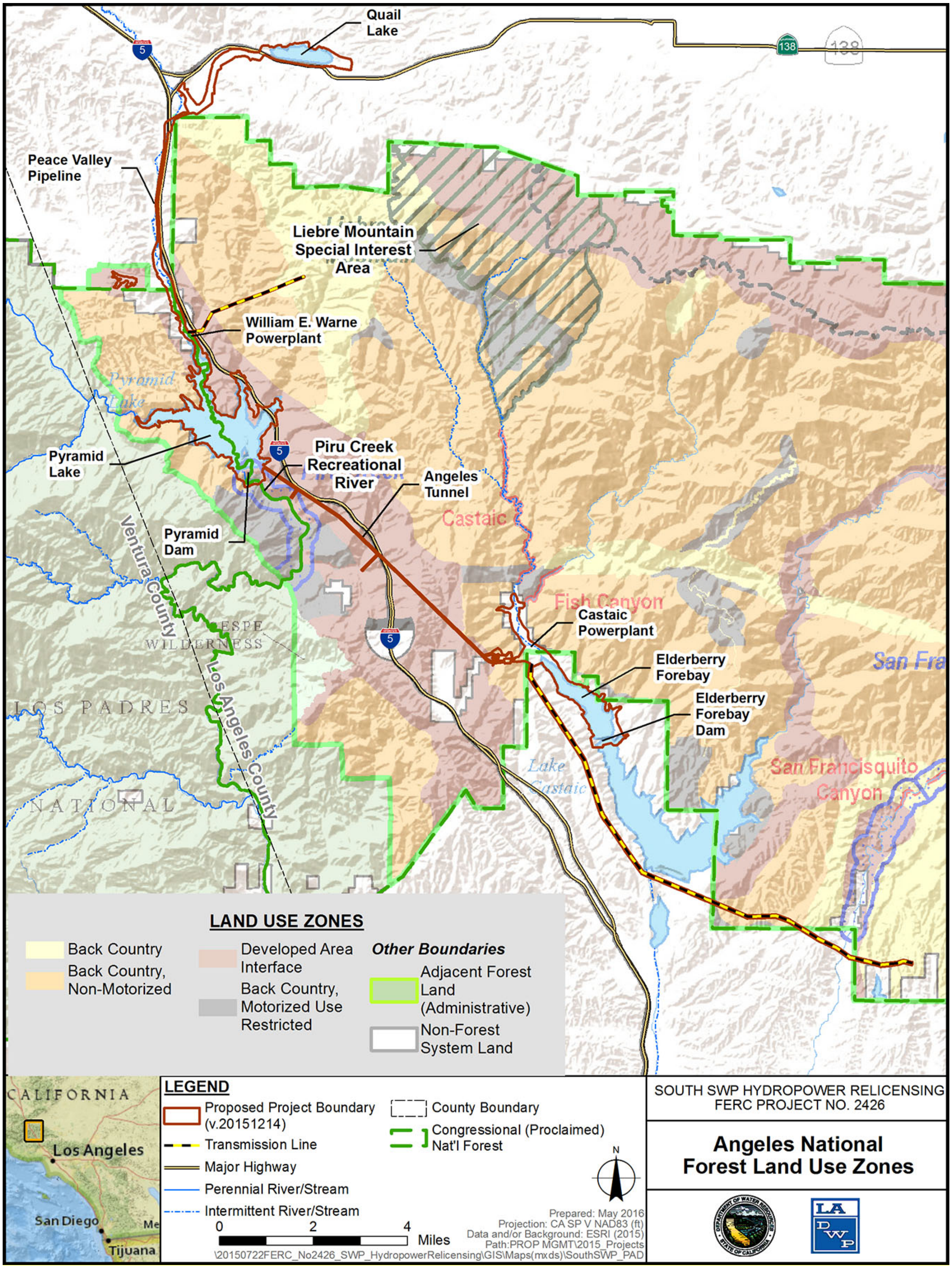


Figure 4.9-7. Angeles National Forest Land Use Zones in the Project Vicinity

The Developed Area Interface land use zone includes areas adjacent to communities or concentrated use areas and developed sites with more scattered or isolated community infrastructure. The level of human use and infrastructure is higher than in other zones.

The Back Country Motorized Use Restricted land use zone includes areas of the national forest that are generally undeveloped with few roads. Few facilities are found in this zone, but some may occur in remote locations. The level of human use and infrastructure is low to moderate. The zone is managed for non-motorized (mechanized, equestrian, and pedestrian) public access. Motorized use is restricted to administrative purposes only, that includes USFS, other agency, or tribal government needs, as well as access needed to private land or authorized special-uses. Administrative access is intermittent and generally limited to existing roads or to temporary roads needed for resource management purposes. The intent is to use temporary roads or gated permanent roads while management is occurring and then gate the permanent roads or remove the temporary routes when done.

The Back Country Non-Motorized zone generally includes areas of the national forest that are undeveloped with few, if any roads. The level of human use and infrastructure is low. The zone is managed for a range of non-motorized uses that include mechanized, equestrian and pedestrian public access. Administrative access (usually for community protection) is allowed by exception for emergency situations and for short duration management purposes (such as fuel treatment).

Wild and Scenic River, and Other Designations

Approximately 7.3 miles of Piru Creek downstream of Pyramid Dam (Pyramid reach) were included in the National Wild and Scenic River System in 2009. Of this, approximately 4.3 miles were designated as “Wild River” and approximately 3.0 miles (nearest to Pyramid Dam, beginning within the Project boundary, 300 feet downstream from the dam) were designated as “Recreation River.” Along this stretch of the river, geological values were determined to be outstandingly remarkable, including scenic tilted layers of sedimentary rocks as well as faults and rock formations with features crucial to the understanding of geological formation on the west coast of North America (USFS 2005a).

Approximately 5 miles northeast of Pyramid Lake is the Liebre Mountain Special Interest Area. This 9,521 acre area offers an interesting mix of plant communities. On northerly slopes, black oak woodland grades into mixed oak, canyon live oak, and bigcone Douglas-fir woodland, while on the southerly slopes it generally gives way to chaparral dominated by shrub species of oak. Another unique feature of the area is the occurrence of the California spotted owl, a Region 5 sensitive species.

4.9.3.4 Floodplains

A search of the FEMA flood hazard mapping website (https://msc.fema.gov/portal) indicates that lands immediately adjacent to Quail Lake are "special flood hazard areas subject to inundation by the 1 percent annual chance flood" (see Figure 4.9-8).

Lands adjacent to Warne Powerplant, Pyramid Lake, Pyramid Dam and Piru Creek (upstream of Pyramid Lake and downstream of Pyramid Dam) are also "special flood hazard areas subject to inundation by the 1 percent annual chance flood" (Figure 4.9-9).

Finally, lands immediately adjacent to Castaic Powerplant, Elderberry Forebay, and Elderberry Forebay Dam are "special flood hazard areas subject to inundation by the 1 percent annual chance flood" (Figure 4.9-10).

Zone "A" indicates areas subject to the 100-year annual flood chance, where no base flood elevations have been determined. Zone "X" indicates areas determined to be outside the 0.2 percent annual chance floodplain. Zone "D" indicates areas in which flood hazards are undetermined, but possible.

4.9.4 <u>Land Use Within the Project Boundary</u>

4.9.4.1 Land Ownership

Land ownership within the proposed Project boundary is shown in Figure 4.9-11 and summarized in Table 4.9-3.

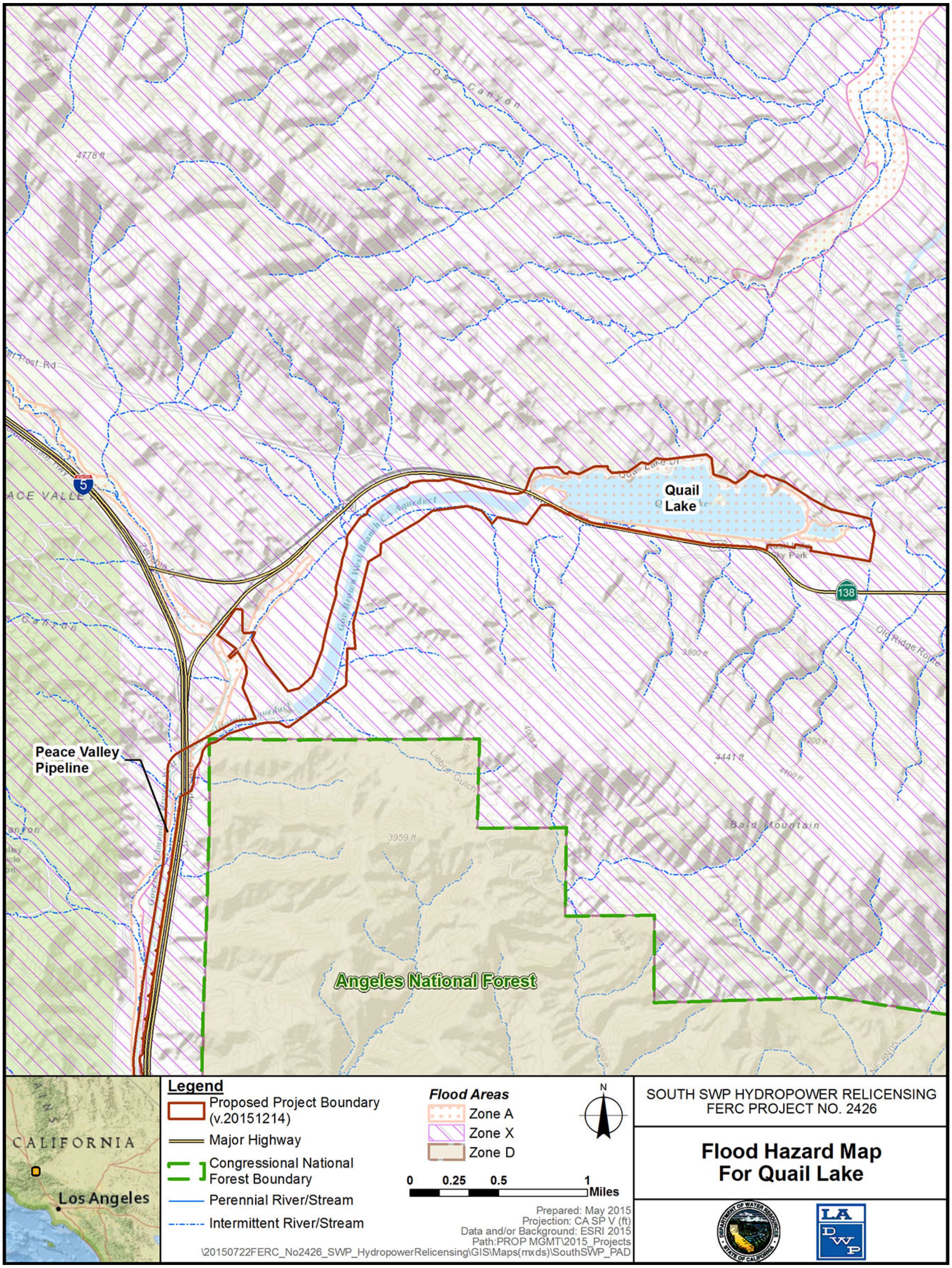


Figure 4.9-8. Flood Hazard Map for Quail Lake and Vicinity

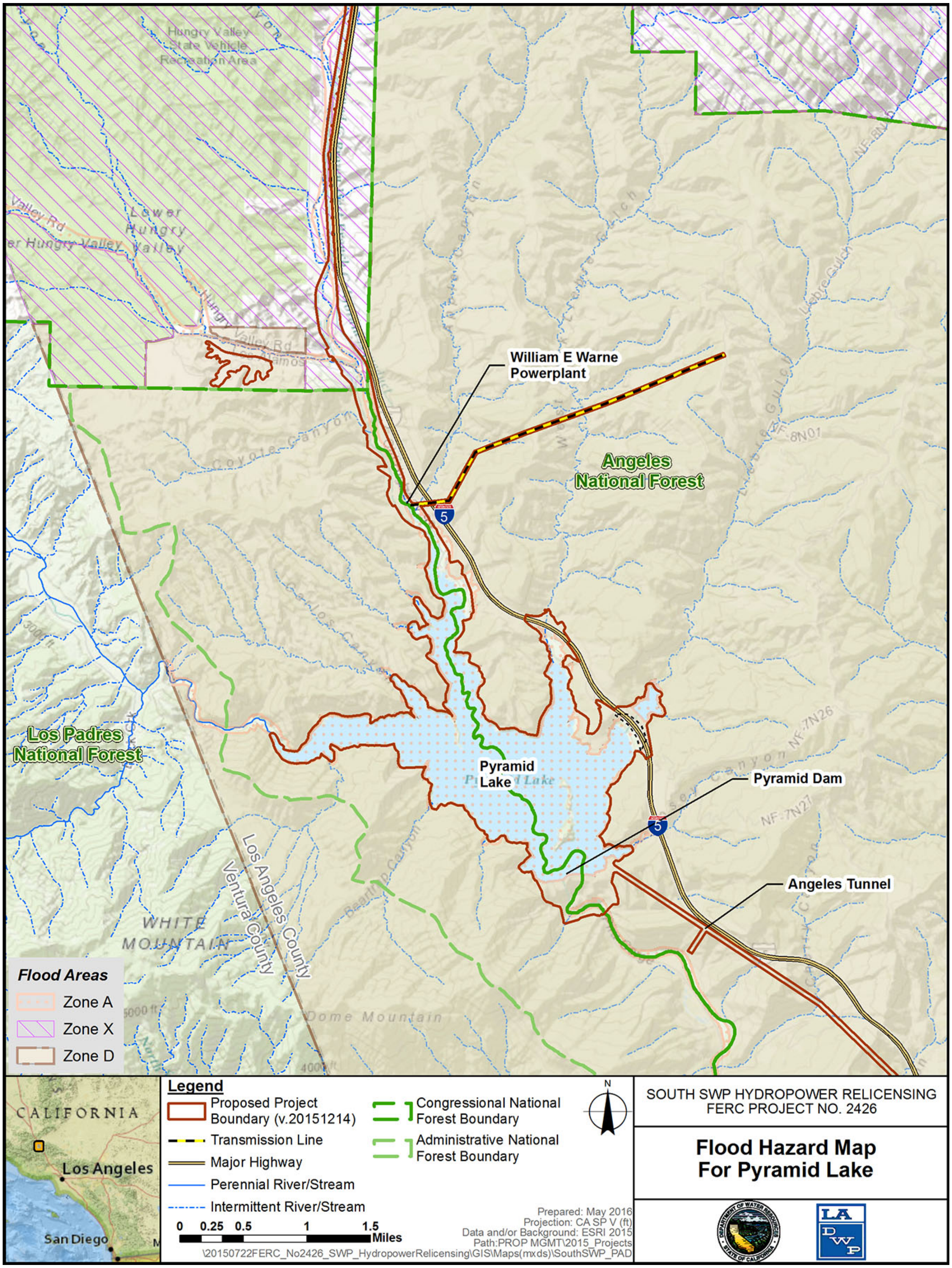


Figure 4.9-9. Flood Hazard Map for Pyramid Lake and Vicinity

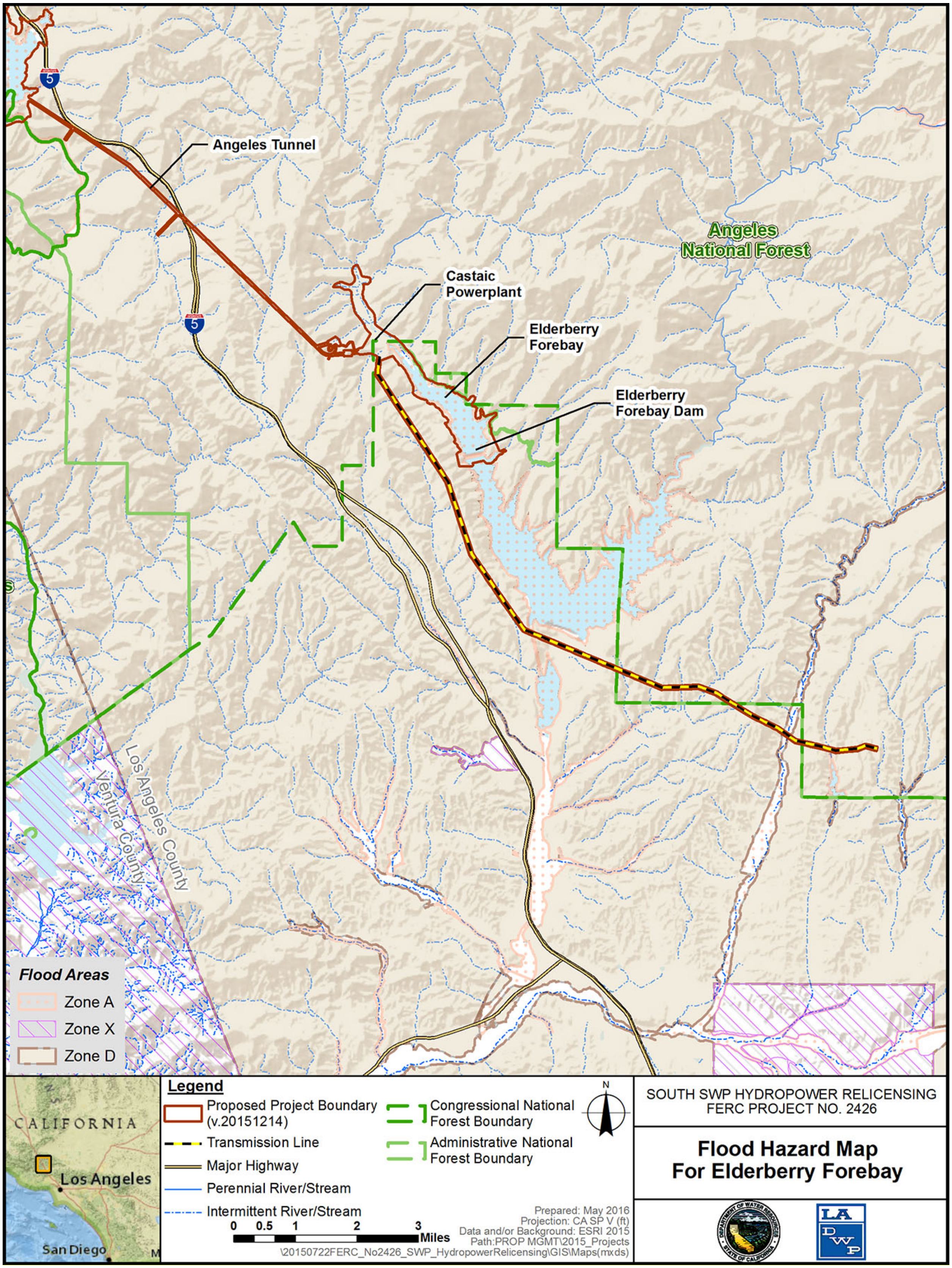


Figure 4.9-10. Flood Hazard Map for Elderberry Forebay and Vicinity

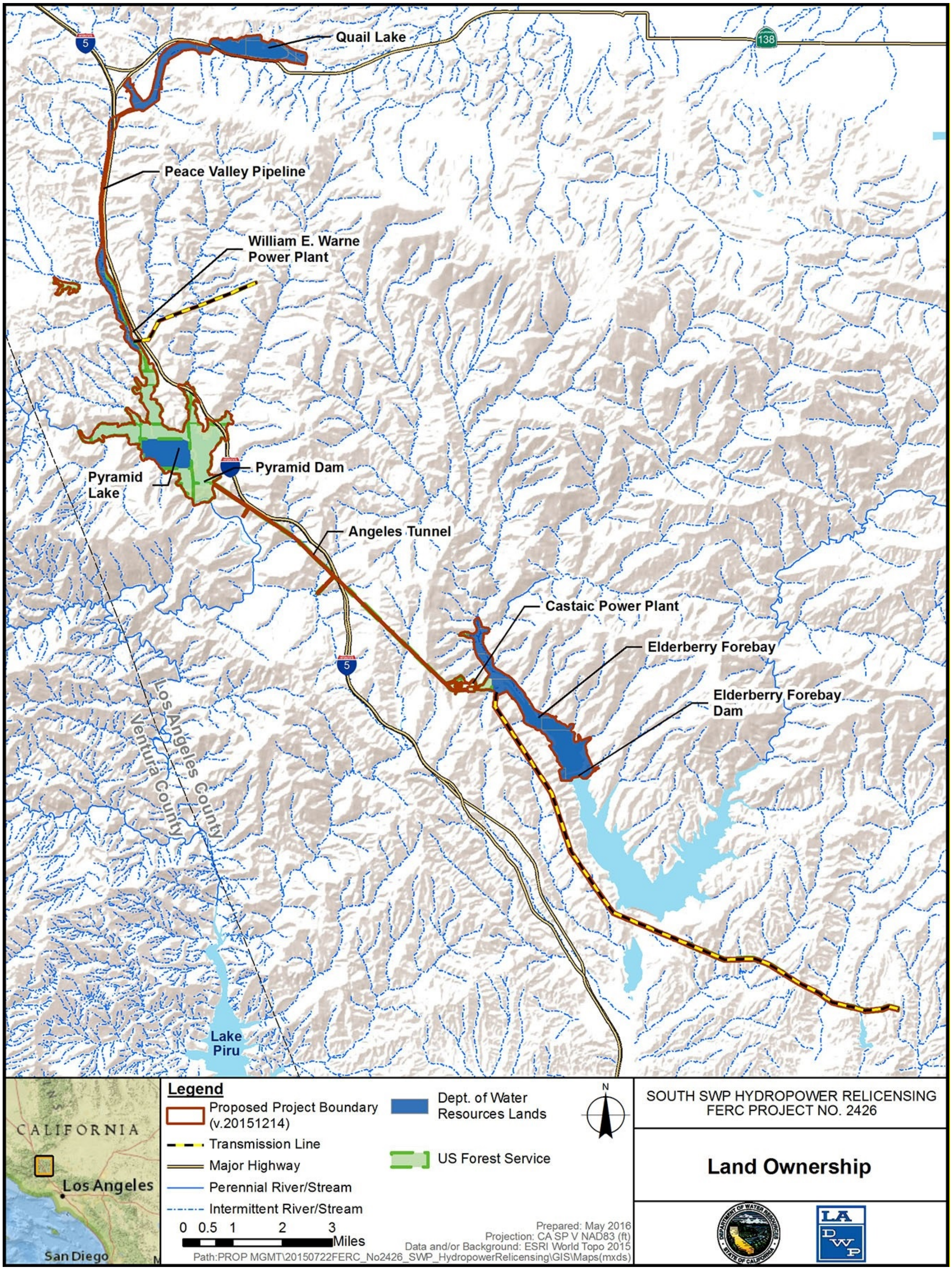


Figure 4.9-11. Land Ownership Within the Proposed Project Boundary

Table 4.9-3. Land Ownership Within the Proposed Project Boundary

Ownership	Acres	Percent of Total
State of California, DWR, DPR, and Caltrans	2,113	46.8
Angeles National Forest/Los Padres National Forest	2,222	49.3
Bureau of Land Management	<5	0.1
LA Department of Water and Power	156	3.5
Private	15	0.3
Total	4,512	100

Source: DWR 2015c and BLM 2015b
Key:
< = less than
DPR = California Department of Parks and Recreation
DWR = California Department of Water Resources

4.9.4.2 Land Use Permits and Easements

In 1969 (amended 1970), DWR and USFS entered into a memorandum of understanding (MOU) for construction, operation and maintenance of the SWP on the Los Padres (areas managed by the ANF) and Angeles national forests. This MOU facilitated development of Project facilities at Pyramid Lake and Elderberry Forebay.

Effective January 1, 2011, DWR assumed responsibility from USFS for routine operation and maintenance of certain recreation sites, and management of public recreation activities at said sites and on Pyramid Lake, at the Pyramid Lake Recreation Area. These recreation sites are:

- Los Alamos Campground
- Los Alamos Group Campground
- Emigrant Landing Day Use Area
- Yellowbar, Bear Trap, Serrano, and Spanish Point Boat-in Picnic Areas
- Two Floating Toilets
- Vaquero Day Use Area
- Entrance Stations at Emigrant Landing and Vaquero Day Use Areas
- Potable water supply to Emigrant Landing, Los Alamos and Los Alamos Group Campgrounds, and Vaquero Day Use Area
- Two offices in the administrative building at Emigrant Landing Day Use Area
- Two administrative trailer pads at Los Alamos Campgrounds

In 2004 (Stream Alteration Notification No. 2004-0154-R4), the CDFG (now CDFW) and DWR entered into an agreement delineating and defining routine maintenance activities within streams and lakes associated with the SWP in the DWR SFD. The Agreement identifies general and site-specific provisions and restrictions on DWR activities, to prevent any substantial adverse impacts to fish and wildlife resources while permitting required maintenance activities to proceed. Activities authorized by this Agreement are as follows:

- Removal of living and dead vegetation, sediment, and debris, from inside and upon structures, and immediately upon or adjacent to inflow/discharge aprons, basins, wing walls and dissipaters of existing bridges, culverts, diversions and flow control and measurement structures.
- Removal of living and dead vegetation, sediment, and debris from the channel bottom and the bottom one-half of the banks of miscellaneous streams that are an obstruction to flow.
- Removal of living and dead vegetation, emergent vegetation, sediment, and debris from seeps and ponds.
- Maintenance of existing structural and other flow and erosion control features to their original location and configuration.
- Maintenance of existing access routes to their original location and configuration.

Maintenance activities authorized by Stream Alteration Notification No. 2004-0154-R4 shall be performed at a time and in a manner to minimize adverse impacts and provide for the protection of fish and wildlife resources, in part, as follows:

- Routine maintenance work within the streams shall be completed when the area is dry, if possible.
- Routine maintenance work shall be limited to periods when actively nesting birds are not present in the riparian area of the stream, when nearby actively nesting birds will not be adversely affected.
- If routine maintenance work takes place during periods other than those described above, DWR shall consult with CDFW and all other appropriate agencies for approval.
- Routine maintenance work within the streams may commence after all pertinent permits and authorizations from other agencies are secured.
- This agreement is subject to renewal every 5 years.
- Any oaks removed that are greater than 3 inches diameter at breast height shall be replaced in kind, at specified replacement ratios.

- Whenever possible, invasive species shall be removed and controlled in a legal manner that prevents seed dispersal.

- Where control of non-native vegetation is required within the bed, bank, or channel of the stream, the use of herbicides is necessary, and where there is a possibility that the herbicides could come into contract with water, DWR shall employ only those herbicides, such as Rodeo®, which are approved for aquatic use.

- Cleared or trimmed vegetation and woody debris shall be disposed of in a legal manner, and may be used as part of a bio-technical bank stabilization technique or used to enhance wildlife habitat.

- Sand, silt, and sediment removal shall be generally limited to the stream bottom and no more than 200 linear feet upstream or downstream of the structure.

- Cleared debris shall be removed from the stream zone and placed in an approved spoil site.

- Clean natural boulders or “shot-rock” (not broken concrete) shall be used to replenish and maintain bank stability in previously rip-rapped areas.

- Any temporary stream diversion shall be coordinated and approved by CDFW.

- DWR’s ability to minimize turbidity, siltation, and erosion in a stream shall be subject to conditions of the RWQCB Lahontan Basin Plan.

- A DWR biologist shall review each routine maintenance work activity and shall issue a standard DWR environmental clearance (DWR Standard Form 77) for the subject activity.

- This Agreement does not allow for the take, or incidental take, of any federal or State-listed special-status species.

- In areas that potentially support special-status species, a qualified DWR biologist shall conduct pre-construction surveys and notify CDFW regarding the results of these surveys.

- A qualified biologist shall be present during any routine maintenance work in areas where federal or State-listed special-status species are known to be present and are potentially at risk.

- DWR assumes responsibility for the restoration of any fish and wildlife habitat that may be impaired or damaged either directly or incidental to the maintenance activity.

- After routine maintenance work is completed, exposed areas shall be seeded, mulched, and fertilized with a blend of a minimum of three locally native grass species, with the mix submitted to CDFW prior to application.
- Annual reports, summarizing the activities completed during the past year, shall be submitted by January 31 of each year.
- DWR shall have primary responsibility for monitoring compliance with all protective measures included in the Agreement.

4.9.4.3 DWR Vehicular Access Routes to Project Facilities

Public vehicular access to Project facilities at Quail Lake and the Lower Quail Canal is provided by Interstate 5, and Gorman Post Road/West Lancaster Road (State Route 138). Restricted vehicular access (official vehicles only) is provided to the Quail Lake inlet and outlet structures via a gated, graveled shoreline access road. The nearby Peace Valley Pipeline Intake Embankment is reached via Edison Springs Road.

The Peace Valley Pipeline is accessible from Interstate 5 via Orwin/Pyramid Lake Road. The Warne Powerplant and Emigrant Landing Day Use Recreation Area at Pyramid Lake are also accessible via Pyramid Lake Road. Vehicular access to the immediate vicinity of the Warne Powerplant is restricted to official vehicles only.

The Los Alamos Campground is accessible to the public from Pyramid Lake Road and Hard Luck Road, crossing Gorman Creek on a bridge located just north of the Warne Powerplant.

The VDL Visitor Center is immediately adjacent to Interstate 5 and reachable by the exit of the same name. The Vaquero Day Use Recreation Area is accessible from this same exit.

The public may access Spanish Point Picnic Area only by boat, although official vehicles may reach this area by road from the Vaquero Day Use Area.

The Pyramid Dam vicinity is accessible from Interstate 5 via the Golden State Highway Old Road. Only official vehicles are permitted north of the USFS Frenchman's Flat Campground, although pedestrians may access Piru Creek closer to the dam.

Access to the Castaic Powerplant and Elderberry Forebay vicinity is from Interstate 5 and 6N32/Templin Highway. Vehicular access is restricted (by gates) to official vehicles only east of the Templin Highway intersection with the Los Angeles City Water and Power Road. Pedestrian access is allowed along the Los Angeles City Water and Power Road north of the Castaic Powerplant security gate and along Goodell Fire Road/Castaic Canyon Road - 6N13 (east side of Elderberry Forebay). No pedestrian access to the Elderberry Forebay is allowed.

4.9.4.4 Wildfires and Fire Suppression and Prevention Policies

Numerous fire starts originate from Interstate 5. Fire safe conditions along the interface are inconsistent and private landowners look to the ANF to create community defense zones. The urban development in the south (Santa Clarita) is creating issues of community defense in the Interstate 5 Corridor Place, as well as encroachment and unauthorized activities. Fuel treatments have been limited in the past. Most of the fire occurrence has been within the historic range of variability, but there are areas (e.g., along the highway corridor) that have been identified with excessive fire occurrence. (USFS 2005a).

USFS wildland fire suppression in the ANF (including lands adjacent to the Warne Powerplant, Pyramid Lake, Castaic Powerplant, and Elderberry Forebay) encompasses all activities included in containing and mitigating the damages of wildland fires caused by either natural or human means. This program also includes national support of fire and disaster teams in other areas of the country. (USFS 2005a).

USFS fire prevention is based on three primary categories: education, engineering and enforcement. Education includes Smokey Bear programs to instill a fire prevention ethic in school children and Firewise community programs that target civic and homeowner groups. Engineering includes abatement of fire hazard along roadways and in high-use areas using fire retardants and removal of flammable vegetation. Enforcement includes executing State fire law regarding hazard abatement around structures, for both public and private land in the ANF. This is also done along all electrical transmission and distribution systems, (placed by public utility agencies), across the ANF. (USFS 2005a).

Hazardous fuel reduction is the set of activities associated with removing brush and vegetation from areas where they pose a significant threat to human life, property, and national forest resources, and where they interfere with the health of natural fire-adapted ecosystems. Fuel reduction involves direct management of vegetation using prescribed fire, mechanical, manual, or chemical methods. This is accomplished by a multidisciplinary planning approach using resource specialists, local governments, communities and contractors. The ANF Fuels Officer provides overall leadership for this program, which is then carried out by fire management personnel and local government. (USFS 2005a).

Suppression of wildland fires is the first priority for ANF program managers. All wildland fires on southern California national forests are considered to be a threat to communities. Aggressive fire suppression and prevention strategies will be implemented near communities to achieve the objectives to protect life and property from wildland fire, subsequent floods and debris flows. (USFS 2005a).

Wildland/Urban Interface (WUI) Defense and Threat Zones around structures, fuelbreaks, and vegetation treatments to maintain or restore forest health within community protection areas are also an ANF priority. Vegetative treatments are strategically integrated to maximize community protection efforts and minimize wildland fire size, while considering habitat needs. Mortality removal is integrated with thinning within the community protection areas (USFS 2005a).

In late August and early September 1996, the Marple Fire burned approximately 33 square miles north and east of Castaic, including lands near the Elderberry Forebay Dam, Elderberry Forebay, and the Castaic Powerplant (Los Angeles Times 1996). The fire, which was set by a teenage arsonist, did not damage any Project facilities.

Campfire Permits are not required at the developed Pyramid Lake picnic areas or campgrounds accessible to the public by motor vehicle. Visitors may use the stoves, fire pits and campfire circles which are provided, or their own liquid or gas fuel portable stoves as long as proper clearance is maintained. Visitors cannot build their own fire rings (USFS 2011).

No public access is permitted to the Castaic Powerplant, Elderberry Forebay, or Elderberry Forebay Dam. Therefore, no public use fire restrictions are required.

The California Department of Forestry and Fire Protection (CAL FIRE) is dedicated to the fire protection and stewardship of over 31 million acres. In addition, CAL FIRE provides varied emergency services in 36 of the State's 58 counties via contracts with local governments (CAL FIRE 2012).

The SRA is the area of the State where the State is financially responsible for the prevention and suppression of wildfires. The SRA does not include lands within city boundaries or in federal ownership. Quail Lake, the Warne Powerplant, Castaic Powerplant, and the Elderberry Forebay Dam are within the CAL FIRE SRA, as are the lower portions of the Castaic Powerplant penstocks, much of the Elderberry Forebay, and much of the Castaic transmission line (State of California 2012).

4.9.4.5 Public Safety in Project Area

As described in the Project Public Safety Plan (DWR 2014g), DWR has implemented many practices to ensure the safety of its employees and the public. DWR educates and informs the public with many different displays and attractions, including those at the VDL Visitors Center. At VDL, visitors can learn all about the SWP, the facilities, their purpose and operations, and many safety items. VDL informs the public about safety features on the public recreation lakes and reservoirs as well as the recreational fishing sections of the SWP. VDL has brochures and videos for visitors to learn about water safety especially for children.

The DWR Water Safety web page (http://www.water.ca.gov/recreation/safety/) includes all the brochures and videos that are at VDL. The videos “Water Safe for Life” and “Come Back Alive!” are to educate and inform the public on SWP recreational facilities and the brochures “SWP Water Safety” and “Water Safety Materials” are helpful tips and information to help keep the public informed and safe.

DWR uses many warning devices, such as signs, buoy lines, and alarms to warn the public of any dangers or hazards. Many signs will tell the public that the said area is dangerous and that their access is prohibited, some will tell the public they can enter but only on foot, with no bicycles or vehicles, and some inform the public of extreme dangers such as high voltage power lines.

DWR uses many miles of restraining devices such as fences, gates, and boat barriers to keep the public out of unsafe areas. Almost all the facilities are surrounded by six-foot-high chain link fence with three-strand barbed wire tops. Manually operated gates are locked with chains and special locks made solely for DWR staff. Electric gates require a specific key, or authorized security badge to get through, and most pumping plants and power plants have a security camera watching the front gate with an operator and security guard monitoring at all times.

Procedures for safer project operations are continually evolving and expanding. DWR always places safety first, and makes safety the premier aspect of all its operations. DWR currently has many safety standards set forth in Dam specific FERC EAP, internal regulations and daily project operations. Daily patrols are conducted and all safety procedures and implementations are checked. If anything is damaged or needs replacement, a Trouble Report (TR) is generated immediately and action is taken to isolate the danger and to make the needed repair/replacement. All DWR buildings are locked at all times and all exterior doors to these facilities will alarm the plant operator and Area Control Center (ACC) if opened.

Public safety practices at Project features are as follows:

Quail Lake

DWR encourages the recreational use of Quail Lake shorelines for fishing, but also posts signs at many locations to inform the public of rules and to inform them of potential dangers. Signs such as “DANGER HIGH VOLTAGE OVERHEAD LINES” are easy to see and clearly convey a message of safety to the public. The signs around Quail Lake also serve as warning devices. For public safety, the signs are mounted to fences/gates and are routinely maintained.

A buoy line across the entire width of the Lower Quail Canal at the Quail Lake outlet prevents the public from getting too close to the outlet gates and signage warns the public of the direction of the flowing water. The lake is surrounded by a four-foot-high barbed wire fencing and the facilities within the fence line are also surrounded by six-foot-high chain link fencing with a three-strand barbed wire top.

At the Quail Lake inlet there are escape ladders mounted to the canal liner on both sides upstream of the gates. The liner is also marked by a painted on, easily visible large yellow square. Quail Lake is inspected daily.

Lower Quail Canal and Peace Valley Pipeline Intake

The Lower Quail Canal and Peace Valley Pipeline Intake are not accessible to the public due to safety concerns. The safest practice is to keep the public away from all dangerous and hazardous equipment or operations. The Lower Quail Canal and Peace

Valley Pipeline Intake are a part of the information videos available at VDL and on the DWR website. Also, these areas are surrounded by signs that inform the public that the area has restricted access due to the dangers of swimming in the water. Signs that say "DANGER STAY ALIVE BY STAYING OUT" and "STAY OUT OF AQUEDUCT YOU MAY DROWN" (both also printed in Spanish) educate the public of the danger of trying to swim in the aqueduct.

There are buoy lines and boat barriers in the water crossing the entire width of the canal at both the inlet and outlet of the Lower Quail Canal. The entire area is enclosed with 4 foot high barbed wire fencing and the facilities within the fence line are also surrounded by 6 foot high chain link fencing with a three-strand barbed wire top.

At the inlet and outlet of Lower Quail Canal there are escape ladders mounted to the canal liner on both sides. The liner is also marked by a painted on, easily visible large yellow square at the location of the escape ladders.

The Lower Quail Canal and Peace Valley Pipeline Intake are inspected daily.

Peace Valley Pipeline

The Peace Valley Pipeline is a 12-foot diameter pipe that is buried underground. The Gorman Improvement Channel (GIC) is a concrete lined channel that delivers project water and local storm water runoff from the Lower Quail Canal to Pyramid Lake. The Gorman Improvement Channel runs parallel to I-5 and the Peace Valley Pipeline. The Gorman Improvement Channel is not open to the public and is secured within a 6 foot high chain link fence with three-strand barbed wire top.

Yellow post markers warn the public that a pipeline is buried underneath. These post markers also warn the public not to dig in that location. Many signs around the Gorman Bypass Channel fence warn the public to stay out of the channel, "STAY OUT OF AQUEDUCT YOU MAY DROWN."

The area above the Peace Valley Pipeline is enclosed within a 6 foot high chain link fence with a three-strand barbed wire top to prevent the public from accessing the area.

The area above and around the Peace Valley Pipeline and Gorman Bypass Channel is inspected daily for wet spots or signs of damage (i.e. signs of digging near the pipeline or cracks in the concrete liner of the channel). Anything unusual is documented and reported.

Warne Powerplant

The Warne Powerplant is not publicly accessible. The exterior fence of the facility has many warning signs informing the public of restricted access and potential dangers. Examples of such signage are "Authorized Personnel Only" and "Warning High Voltage Keep Out."

The Warne Powerplant is surrounded by a six-foot-high chain link fence with a three-strand barbed wire top. All entrance gates to the facility are locked at all times, and can only be opened by specific keys or authorized ID badges. Exterior doors will alarm if opened. Two buoy lines and two boat barriers prevent the public from venturing too close to the Warne Powerplant.

A security camera is operated and monitored by the Warne Powerplant operator on duty. The front gate and surrounding grounds of the facility are monitored. The operator is in constant contact with the onsite security guard and the ACC. The Warne Powerplant is inspected daily and has an operator on duty 24/7.

Pyramid Dam

Pyramid Dam is a limited access public facility. Pyramid reach is accessible to the public by walking only and there are many signs immediately below the dam that express the danger of flooding.

There are many signs around Pyramid Dam to keep the public informed and safe. There are signs on the buoy lines around the emergency spillway and radial gate that say “KEEP OFF RESTRICTED AREA DO NOT ENTER OR TIE BOATS TO FLOAT LINE.” There are also signs that inform the public of where access is granted and where it is restricted “RESTRICTED AREA, NOTIFY ACC BEFORE ENTRY.”

The downstream side of the dam is only accessible over a bridge that has a large metal gate that is locked at all times, and surrounded by a chain link fence. Also, the stream release access tunnel, and the adits all have large metal doors that are locked at all times and will alarm the ACC when opened.

A security camera is monitored by the security control room operator on duty. The security control room operator monitors the dam access tunnel and surrounding grounds of the facility. Exterior lights allow monitoring 24/7. Gates and doors at Pyramid Dam are locked at all times, and will alarm if opened. The dam is also patrolled daily and any sign of unsafe or unusual activities are noted and reported to the ACC.

Castaic Powerplant and Elderberry Forebay

Castaic Powerplant and Elderberry Forebay are not opened to the public and onsite security maintains site control. The water level regularly fluctuates in Elderberry Forebay by up to 25 feet due to operation of the Castaic Powerplant; therefore it is closed for public safety.

4.9.4.6 Law Enforcement in Project Area

As described above, the Quail Lake shorelines are open to pedestrians for fishing, hiking, and walking; while the lake surface is not open to the public. Law enforcement at the recreational parking area, on the shorelines, and on the lake surface is the responsibility of DWR security staff. DWR’s private security staff monitor the facilities, and anything unusual is documented and reported.

The Lower Quail Canal, Peace Valley Pipeline Intake, and Peace Valley Pipeline are not open to the public. Patrols in these areas are the responsibility of DWR. Daily inspections are performed, and anything unusual is documented and reported.

The Warne Powerplant and related facilities are not open to the public. Security at these facilities is the responsibility of DWR.

Pyramid Lake Recreation Area law enforcement is carried out by the California Highway Patrol and Los Angeles County Sheriff's Department. Enforcement of Pyramid Lake boating rules is done by the Los Angeles County Sheriff's Department from offices located at Emigrant Landing.

Pyramid Dam and related facilities are not open to the public. The dam is also patrolled daily and any sign of unsafe or unusual activities are noted and reported to the ACC.

The Castaic Powerplant, Elderberry Forebay, Elderberry Forebay Dam, penstocks, and related facilities are not open to the public.

4.9.4.7 Restrictions to Project Waters and Lands

As described above, Quail Lake shorelines are open to pedestrians for fishing, hiking, and walking; while the lake surface is not open to the public. No hunting is allowed at Quail Lake.

The Warne Powerplant and related facilities are not open to the public.

Pyramid Lake Recreation Area boating and fishing rules are described above. Additional restrictions to Project waters and lands at Pyramid Lake, also described above, address dispersed recreation, fire, and public safety.

No hunting is allowed in the Pyramid Lake recreation areas. As described above, Pyramid Dam, Castaic Powerplant, Castaic penstocks, Elderberry Forebay, Elderberry Forebay Dam and related facilities are not open to the public.

4.9.4.8 Shoreline Management and Buffer Zone Policies

Licensees do not have a formal shoreline management policy because there are no private developments or uses and all of the shoreline is managed by Licensees. Licensees do not have a buffer zone policy.

Figure 4.9-12. Quail Lake Parking Area (2015)

Figure 4.9-13. Quail Lake Service Road from Parking Area (2015)

Figure 4.9-14. Pyramid Lake, Emigrant Landing Fishing Platform from Parking Area (2015)

Figure 4.9-15. Pyramid Lake, Emigrant Landing Fishing Area Comfort Station (2015)

Figure 4.9-16. Pyramid Lake, Emigrant Landing Boat Launch (2015)

Figure 4.9-17. Pyramid Lake, Emigrant Landing Courtesy Docks and Rental Boat Area (2015)

Figure 4.9-18. Pyramid Lake, Emigrant Landing Swim Beach (2015)

Figure 4.9-19. Pyramid Lake, Emigrant Landing Picnic Area (2015)

Figure 4.9-20. Pyramid Lake, Vista del Lago Visitors Center Entrance (2015)

Figure 4.9-21. Pyramid Lake, Vista del Lago Visitors Center Interpretive Exhibit (2015)

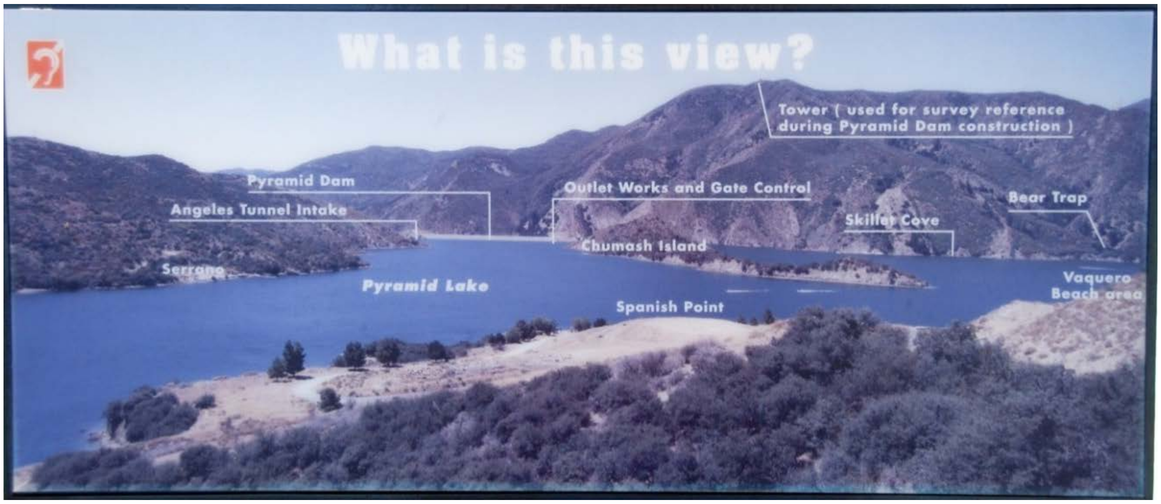


Figure 4.9-22. Pyramid Lake, Vista del Lago Visitors Center Interpretative Exhibit (2015)

Figure 4.9-23. Los Alamos Campground (2015)

Figure 4.9-24. Los Alamos Campground (2015)

4.10 AESTHETIC RESOURCES

This Section provides information regarding existing aesthetic resources. Besides this general introductory information, this Section includes three main sub-sections: Section 4.10.1 characterizes aesthetic resources in the Project region; Section 4.10.2 describes management plans that are pertinent to aesthetic resources affected by the Project; and Section 4.10.3 describes the aesthetic character of each above-ground Project facility.

4.10.1 Aesthetic Character of Project Vicinity

Los Angeles County is endowed with a physical setting of great beauty. The San Gabriel Mountains, which are located east of the Project, rise 10,000 feet over the metropolitan areas. Stands of pine, fir, and other evergreens cover the higher slopes of the San Gabriel Mountains, and the desert floor of the Antelope Valley, located north of the Project's Quail Lake, is carpeted with wildflowers in early spring (County of Los Angeles 1980). West of the Project area, the Santa Clara Canyons rise up from the Santa Clara River at elevations starting at about 1,200 feet and reaching up to 5,000 feet.

Quail Lake and Pyramid Lake are located on the western edges of the Sierra Pelona Mountains. This range separates the Antelope Valley from the Santa Clarita Valley.

The Interstate 5 Corridor, which may be defined as the area visible by travelers on Interstate 5 between State Highway 138 on the north and Marple Canyon on the south, functions as a scenic gateway and transitional landscape for visitors to southern California. The flow of people and materials through this corridor links the greater Los Angeles area to northern California and to the northern parts of the nation. Elevations along the Interstate 5 Corridor range from approximately 2,100 to 3,000 feet. The deep canyon of Pyramid Lake, along with its various lesser side canyons, are a point of interest within this landscape. The mostly hot to temperate climate affects vegetation types and water availability. All but the larger streams are dry through the summer. The predominant plant community at lower elevations is mixed chaparral, which is continuous on most slopes. Pine and juniper are present at higher elevations. Canyon and coast live oaks are present in dense woodlands along shaded slopes and canyons. (USFS 2005a).

Approximately 7.3 miles of lower Pyramid reach were included in the National Wild and Scenic River System in 2009. Approximately 4.3 miles of the reach were designated as "Wild River" and upstream of that segment approximately 3.0 miles were designated as "Recreation River," nearest to the Project.

This Project area is generally accessed from Interstate 5, State Highway 14, and State Highway 138. The southern part includes steep to very steep ridges with sharp to rounded summits, and deep, narrow canyons. The lower elevation edge is marked by the urban interface with the community of Santa Clarita. The higher elevation edge is marked by a series of peaks and ridges. Steeper slopes are barren and show evidence of erosion. Canyons have steep, rocky sides with large boulders (USFS 2005a).

4.10.2 Pertinent Management Plans

4.10.2.1 Antelope Valley Area Plan

The planning area for the Antelope Valley Area Plan: Town & Country (Los Angeles County Department of Regional Planning 2015a) includes the Project's Quail Lake and Pyramid Lake. Because the plan was prepared by a local government agency, it does not apply to State and federal agencies, but is a useful reference for relicensing in that it describes the local environmental setting and the County's plans for development in the area. As described in this plan's Draft EIR (Los Angeles County Department of Regional Planning 2014), scenic landform features include hillsides and ridgelines, canyons, creeks, trees, and water features. The most prominent landforms are the Antelope Valley and Mojave Desert in the north, and the San Gabriel Mountains in the south. The dramatic transition between these two regions is the visual backdrop for most of the inhabited portions of the planning area. Visual character varies widely throughout the planning area. However, because most of the region is undeveloped, the area is known for its rural character.

Interstate 5, which passes along the east side of Pyramid Lake, and Gorman Post Road/West Lancaster Road, situated south of Quail Lake, are both designated as "Priority Scenic Drives" in the Antelope Valley Area Plan. Goal COS-5 of this plan states that the Antelope Valley's scenic resources, including scenic drives, water features, significant ridgelines, buttes, and hillside management areas, shall be enjoyed by future generations. Policy COS 5.7 of this plan was established to help ensure that incompatible development is discouraged along designated scenic drives by developing and implementing standards and guidelines for these identified viewsheds.

4.10.2.2 Santa Clarita Valley Area Plan

The planning area for the Santa Clarita Valley Area Plan: One Valley One Vision (Los Angeles County Department of Regional Planning 2012) includes the Project's Pyramid Dam, Angeles Tunnel, Castaic Powerplant, Elderberry Forebay, Elderberry Forebay Dam, and Castaic Transmission Line. Because the plan was prepared by a local government agency, it does not apply to State and federal agencies, but is a useful reference for relicensing in that it describes the local environmental setting and the County's plans for development in the area. As described in this plan's EIR (Los Angeles County Department of Regional Planning 2010), the planning area is dominated by a physical setting that offers residents and visitors a variety of scenic experiences due to the mixture of topography, flora and fauna, and a rich historical and cultural heritage. Memorable and distinctive scenery provides residents with a sense of place and identity, heightening the feeling of belonging and instilling a sense of uniqueness and civic pride. Prominent scenic resources include ridgelines, rivers and creeks, canyons and forestlands. ANF land, most of which is undeveloped and protected, occupies much of the planning area.

As described in the Santa Clarita Valley Area Plan, development has the potential to impair scenic resources if not carefully planned and controlled. Increasing development pressures could impact the quantity, quality, and variety of scenic vistas in the Valley through increased smog and light pollution, development on prominent ridgelines and hillsides, obstruction of scenic views along various roadways, signage and streetscape clutter, and aesthetically deficient development. Policies have been added to address the goal of protecting the scenic and aesthetic beauty of the valley. Objective LU-6.1 of the Plan is to maintain the natural beauty of the Santa Clarita Valley's hillsides, significant ridgelines, canyons, oak woodlands, rivers and streams. Objective LU-6.2 is to provide attractive public and open spaces in places visited by residents and visitors, where feasible and appropriate.

4.10.2.3 Angeles National Forest Land Management Plan

NFS lands occupy over 49 percent of lands within the proposed Project boundary and are managed by the ANF. Policies and programs associated with the ANF apply only to NFS lands within the Project boundary.

To help ensure that scenic integrity of NFS land is maintained, the USFS has established five scenic integrity objectives, derived from the landscape's attractiveness and the public's expectations or concerns. Generally, landscapes that are most attractive and viewed from popular travel routes are assigned higher scenic integrity objectives. Each scenic integrity objective depicts a level of scenic integrity used to direct landscape management on NFS lands: very high (unaltered), high (appears unaltered), moderate (slightly altered), low (moderately altered), and very low (heavily altered).

As shown in Figure 4.10-1, the Scenic Integrity objective for USFS lands in and around the Warne Powerplant, Pyramid Lake, Pyramid Dam, Castaic Powerplant, Elderberry Forebay, and Elderberry Forebay Dam is predominately "High."

4.10.2.4 State Water Project Architectural Motif

As described in Water Resources Engineering Memorandum No. 30a, dated March 15, 1984, DWR has established an architectural motif which, consistent with economy and operational efficiency, is applied to all SWP facilities with the objective of creating an identifiable, aesthetically pleasing, and unifying appearance throughout the SWP. As described in the memorandum, components of the architectural motif are:

1. The design shall be functional and shall meet applicable code requirements.

2. The design shall incorporate the use of basic building materials in a contemporary architectural expression which will accentuate basic structural configurations. The basic structural configurations must be simple, clear, and well proportioned.

3. The design shall take into consideration water and energy conservation measures.

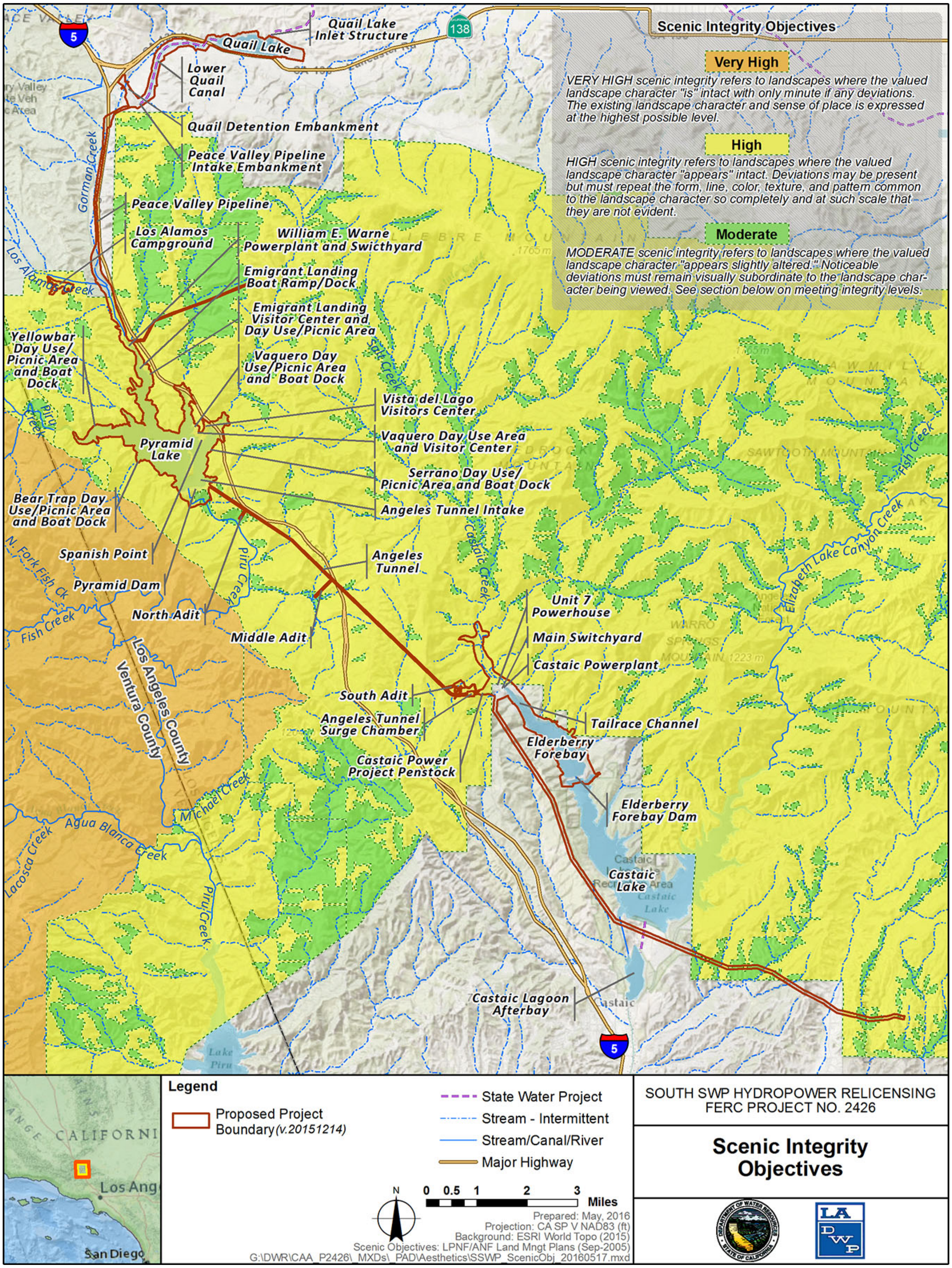


Figure 4.10-1. Scenic Integrity Objectives for NFS Lands Within and Around the Proposed Project Boundary

4. For buildings and structures, neutral colors shall be used. Accent colors shall be predominantly blue and gold. Red may also be considered if the overall color effect is more compatible with red as an accent color. These colors are further defined as the following or equivalent:

Color	Fuller's Paint Co. Color Name & Number	Reflection Factor (percent)
Neutral	Cottonwood H59H	54
Blue	Belair Blue D126D	15
Gold	Ultra Gold A125A	29
Red	Flaming Bush C126C	17

Source: DWR 1994

5. Lighting shall be consistent with energy conservation, safety, and security. The lighting fixtures must be aesthetically pleasing.

6. Signs, emblems, plaques, and mountings shall conform to the Department's Sign Manual.

7. The natural environment shall be preserved whenever possible. Cut and fill slopes shall be planted or otherwise protected for erosion control, and to the extent practical shall be constructed to blend into the natural environment.

8. Landscaping is appropriate for:

   - enhancing the attractiveness of facilities,
   - controlling dust, mud, wind and unauthorized access,
   - reducing noise and glare,
   - screening of unsightly areas,
   - providing shade for buildings and equipment, and
   - establishing vehicular and pedestrian traffic patterns.

Irrigation systems and plantings shall be consistent with water conservation.

As a participant in the planning and design of new facilities, or the modification of existing facilities, the DWR Architectural Section shall be responsible for application of this motif consistent with site conditions. The Architectural Section will review contract drawings and specifications for conformity with the motif.

The Division of O&M shall be responsible for application of this motif to existing facilities. Existing facilities requiring repainting shall be brought into compliance with this motif.

Upon the request of the DWR Division of O&M, the Architectural Section will provide consultation, review, and make recommendations for any proposed modification of SWP buildings, provided that consideration of such modifications has prior approval by the appropriate DWR Deputy Director.

4.10.3 Aesthetic Resources at Project Facilities

Aesthetic resources within the Project area outlined by the following grouping of Project facilities:

- Quail Lake, Associated Recreation Facilities and Lower Quail Canal
- Peace Valley Pipeline Intake Embankment and Gorman Bypass Channel
- Warne Powerplant, Switchyard and Transmission Line
- Pyramid Dam, Pyramid Lake and associated recreation facilities
- Castaic Powerplant, Penstocks, Switchyard and Transmission Line
- Elderberry Dam and Forebay
- Appurtenant Project Facilities, including project roads

Aesthetic resources are described below and photographically documented at the end of this Section (Figure 4.10-2 through Figure 4.10-17). Recreation facilities and roadways constitute key viewing areas from which the public may observe the Project facilities and landscape features.

4.10.3.1 Quail Lake, Associated Recreation Facilities and Lower Quail Canal

Quail Lake (see Figures 4.10-2 and 4.10-3), described in Section 3.0, is located east of Interstate 5 and just north of Gorman Post Road/West Lancaster Road (State Highway 138). These roadways are designated as “Priority Scenic Drives” in the Antelope Valley Area Plan. The lake, which was originally a sag pond formed by the San Andreas fault, was enlarged by DWR to provide the SWP with additional operational flexibility (DWR 1990).

There is an area southwest of Quail Lake that is relatively flat, while low, rolling hills occur to the north and south. For the most part, land around the lake is owned by DWR. A chain-link fence, portions of which are topped with barbed wire, separates DWR land from adjoining private property, which is predominantly used for cattle grazing. A portion of the land to the east of the lake is owned by Tejon Ranch and to the southeast by Pyramid Ranch. The remaining sections are privately owned under a joint ownership. A small air strip (Quail Lake Sky Park) is located along the southeast shore of the lake. Vegetative cover in the area is characterized by annual and perennial grasses, wildflowers, shrubs, and occasional Joshua trees (DWR 1990).

Most of the Quail Lake shoreline is riprapped, with shrubs, grasses, and wetland vegetation covering the riprap in some locations. At the west end of the lake, a concrete outlet structure routes water to Lower Quail Canal. The light gray of the concrete outlet structure contrasts with the greens and browns of the surrounding landscape and the dark blues of the water surface. Water levels in the lake can fluctuate daily from 1 to 1.5 feet and can drop as much as 10 feet from the NMWSE (DWR 1990).

Quail Lake has been open to the public since 1972 (DWR 1990). A large, light gray, graveled parking area with portable restrooms, signage, and trash receptacles is located at the west end of the lake, adjacent to State Route 138 and the outlet structure. Natural surface trails lead to the lake from the parking area. A light gray, graveled service road (closed to public vehicles, but open to hikers, bicyclists, and fishermen) surrounds the lake.

The light gray concrete sideslopes and dark blue waters of the Lower Quail Canal (Figure 4.10-4) contrast with the greens and browns of the surrounding landscape, as seen in the middleground from State Route 138, Lancaster Road, the Quail Lake parking area, West Fork Road (private) and Edison Spring Road.

4.10.3.2 Peace Valley Pipeline Intake Embankment and Gorman Bypass Channel

The Peace Valley Pipeline Intake Embankment (Figure 4.10-5), which is located on DWR land, comprises homogenous earth fill that is light brown in color and unvegetated. The embankment, associated concrete structures, and maintenance roads, which are light gray in color, are visible in the middleground from a short stretch of the lightly traveled Edison Spring Road to the south and west.

The light gray concrete of the Gorman Bypass Channel (Figure 4.10-6), located on DWR land, and the light browns of the exposed earth on either side, contrast with the greens and browns of the surrounding landscape, as seen in the foreground and middleground from Copco Avenue, Interstate 5, DWR Road, Orwin Way, the Hungry Valley SVRA District Office, Hungry Valley Road, Hardluck Road and Pyramid Lake Road.

4.10.3.3 Warne Powerplant, Switchyard and Transmission Line

Located at the upstream end of Pyramid Lake on DWR land and visible from Pyramid Lake Road, Hardluck Road (which provides access to the Los Alamos Campgrounds), and from the Emigrant Landing fishing area in the middleground are the Warne Powerplant (Figure 4.10-7), switchyard, transmission line and related structures, located on DWR land. The low-profile powerhouse is white and gray in color, contrasting with the greens and browns of the surrounding landscape and with the blue-greens of Pyramid Lake.

The 3-mile long, 220 kV Warne transmission line and steel lattice tower begin at the powerplant, cross Interstate 5, and run east/northeast to SCE's Pardee-Pastoria distribution lines. The line and towers are readily apparent in the foreground and middleground to motorists on Interstate 5.

4.10.3.4 Pyramid Dam, Pyramid Lake and Associated Recreation Facilities

Pyramid Dam is located on DWR land on Piru Creek, north of the Town of Castaic, and surrounded by lands administered by the ANF. As seen from the lake (located north of the dam) in the foreground and middleground, the uppermost portion of the dam is visible. The zoned earth and rock fill is light brown to light gray in color, contrasting with the greens and browns of the surrounding landscape and the blue-greens of Pyramid Lake.

Impounded by Pyramid Dam, Pyramid Lake is popular with boaters, swimmers, hikers, and picnickers. The dam, lake and surrounding landscapes are visible from the many Pyramid Lake recreational areas and access roads, including:

- Emigrant Landing Day Use Area, Boat Launch, Marina, and Swim Beach (Figures 4.10-8, 4.10-9 and 4.10-10)
- Interstate 5 (Figure 4.10-11)
- VDL Visitors Center (Figure 4.10-12)
- Vaquero Day Use Area, Boat Launch, and Swim Beach
- Spanish Point Boat-in Picnic Area
- Serrano Boat-in Picnic Area
- Bear Trap Boat-in Picnic Area
- Yellow Bar Boat-in Picnic Area

The Pyramid Dam Outlet Works and Angeles Tunnel Intake are largely hidden from view from the lake, recreation areas, and from Interstate 5.

While Pyramid Dam and its Outlet Works are widely visible in the middleground from downstream (Figure 4.10-13), this area along Piru Creek is closed to public vehicular traffic (Golden State Highway Old Road) north of Frenchman's Flat, and receives relatively few visitors. This segment of Piru Creek is a designated National Wild and Scenic River.

The Los Alamos Campground (Figure 4.10-14) is located approximately 2 miles northwest of the Warne Powerplant and accessible via Hardluck Road. While not currently within the Project boundary and not on Pyramid Lake, this campground, located on relatively level and sparsely wooded terrain to the south of Los Alamos Creek, is a Project recreation facility.

4.10.3.5 Castaic Powerplant, Penstocks, Switchyard and Transmission Line

Located at the upstream (north) end of the Elderberry Forebay are the Castaic penstocks, powerplant, switchyard, and associated facilities. A surge tank (Figure 4.10-15), which has been painted light green to blend in with the greens and browns of the surrounding landscape, is visible in the foreground and middleground to motorists on the Templin Highway (USFS Road 6N32), as are brief glimpses of the Elderberry Forebay in the background. This road is lightly used, with vehicular access prohibited north of its intersection with Los Angeles City Water and Power Road, a restricted roadway that provides access to the Castaic Powerplant, with "no trespassing" signs posted.

The six penstocks (light green in color), low profile powerplant (also white to gray in color), switchyard, Castaic Creek check dams and sediment basins, spoil piles, laydown areas, and main entry area are readily apparent from the Los Angeles City Water and Power Road (west side of Castaic Creek) and from the Goodell Fire Road/Castaic Canyon Road - USFS Road 6N13 (east side of Castaic Creek); however, public vehicular access on these roadways is prohibited. Pedestrian use of these roads is very light; therefore, the facilities (Figure 4.10-16) are largely unseen by the general public.

The 11.4 mile-long, 230 kV Castaic transmission line, associated dual steel lattice towers and natural surfaced transmission line access road begin at the powerplant and run south along the top of the slope that forms the west shore of the Elderberry Forebay. The transmission line continues along this slope, past the Elderberry Forebay Dam and runs adjacent to Castaic Lake SRA. The transmission line then crosses Castaic Lake Dam and continues southeast. The transmission line and towers are readily apparent in the middleground from the surface of Castaic Lake (non-Project facility) and Castaic Lagoon. The transmission line, towers and access road are also readily apparent in the foreground and middleground from Castaic Lake SRA recreation areas and from recreational access roads located near Castaic Lake Dam. These structures are also readily apparent in the foreground, middleground, and background from San Francisquito Canyon Road, Rosewood Equestrian Center (at Windmill Ridge), Summerhill Equestrian Center, USFS Road 5N29, USFS Road 5N28, City Highline Fire Road, and from residential areas at the north end of Santa Clarita.

4.10.3.6 Elderberry Dam and Forebay

The downstream face of Elderberry Dam, vegetated with grasses and shrubs, is visible from the upstream end of Castaic Lake SRA in the middleground. Vegetation on the downstream face of the dam helps it blend into the surrounding landscape, when viewed from Castaic Lake (non-Project facility).

Recreational access to the Elderberry Forebay area and waters is prohibited, as the water level regularly fluctuates by up to 25 feet due to operation of the Castaic

Powerplant. While roads are located along the west (Los Angeles City Water and Power Road) and east (Goodell Fire Road/Castaic Canyon Road - USFS Road 6N13), public vehicular access on these roadways is prohibited. Pedestrian use of the gated Goodell Fire Road/Castaic Canyon Road (USFS Road 6N13) and adjacent upland areas is allowed. Pedestrian use is however very light; therefore, the Elderberry Forebay waterbody (Figure 4.10-17) is largely unseen by the general public. Similarly, the forebay's concrete outlet structure (southwest shore) and emergency spillway (southeast shore), which is currently undergoing repairs, are largely unseen by the general public.

Figure 4.10-2. Quail Lake, Looking East from Trail Near Parking Area (2015)

Figure 4.10-3. Quail Lake, Looking Northwest from Trail Near Parking Area (Note Outlet at Left in Middleground) (2015)

Figure 4.10-4. Lower Quail Canal, Looking West from Area Downstream of Quail Lake (2015)

Figure 4.10-5. Peace Valley Pipeline Intake Embankment, Looking Northwest from Edison Spring Road (2015)

Figure 4.10-6. Gorman Creek and Upstream End of Pyramid Lake, Looking North from Pyramid Lake Road near Warne Powerplant (2015)

Figure 4.10-7. Warne Powerplant, Looking Southwest from Pyramid Lake Road (2015)

Figure 4.10-8. Pyramid Lake, Looking South from Emigrant Landing Fishing Area (2015)

Figure 4.10-9. Pyramid Lake, Looking South from Emigrant Landing Boat Launch (2015)

Figure 4.10-10. Pyramid Lake, Looking Northwest from Emigrant Landing Swim Beach (2015)

Figure 4.10-11. Pyramid Lake, Looking Southwest from Interstate 5 (2015)

Figure 4.10-12. Pyramid Lake, Looking South from Vista del Lago Visitor Center (Note Dam in Center, Far Middleground) (2015)

Figure 4.10-13. Pyramid Dam, Looking North from Downstream (2015)

Figure 4.10-14. Los Alamos Campground, Looking West (2015)

Figure 4.10-15. Castaic Surge Tank from Templin Highway, Looking Southeast (2015)

Figure 4.10-16. Castaic Powerplant, Tailrace Channel, Elderberry Forebay, Penstocks, Switchyard, Transmission Line and Surge Tank, Looking Southwest (2015)

Figure 4.10-17. West Shore of Elderberry Forebay, Looking Southeast (2015)

4.11 CULTURAL RESOURCES

This Section provides information regarding existing cultural resources. For the purpose of this PAD, a cultural resource is any prehistoric or historic district, site, building, structure or object, regardless of its National Register of Historic Places (NRHP) eligibility. Besides this general introductory information, this Section includes seven main sub-sections. Section 4.11.1 describes the prehistory, Section 4.11.2 describes the ethnohistory, Section 4.11.3 describes the history of the Project vicinity, Section 4.11.4 describes the history of the development of the Project, Section 4.11.5 describes the previous cultural resources investigations, Section 4.11.6 describes the previously recorded cultural resources in the Project area, and Section 4.11.7 describes the potential historic cultural resources identified on historical maps. Traditional Cultural Properties (TCP) are not discussed in this section, but in Section 4.13.

The existing, relevant and reasonably available information focused on cultural resources within the existing Project boundary and a 0.25-mile-wide buffer around the boundary. The buffer was examined to provide information regarding cultural resources in the Project vicinity. These cultural resources were examined in the following types of sources: cultural resource records; cultural resource investigation reports; historic maps; newspaper articles; local and regional histories; journals; and other academic publications. Record searches were conducted that included a review of documents on file at DWR, the South Central Coastal Information Center (SCCIC) at California State University, Fullerton, the Los Angeles County Library, and various on-line repositories.

4.11.1 <u>Prehistory</u>

Understanding when, how, and why people occupied the California desert region and southern California during prehistoric times has been a work-in-progress for more than 60-years (Crabtree 1981; King 1976; Rogers 1939, 1945; Stickel et al. 1980; Wallace 1962; Warren and Crabtree 1972, etc.). Based on some of the more recent studies, the area Licensees examined for the records search is within the Mojave and Great Basin Desert Chronological Region (Moratto 1984:348-430; Sikes 2006: 2-21). This region is divided into five cultural complexes that use temporal periods based on years Before Present (B.P.); meaning the number of years prior to 1950. These include the Lake Mojave Complex (circa [ca.] 10,000-7000 B.P.), the Pinto Complex (ca. 7000-4000 B.P.), the Gypsum Complex (ca. 4000-1500 B.P.), and the Saratoga Springs Complex (ca. 1500-800 B.P.).

Some researchers have suggested categorizing local chronologies using the broader temporal periods discussed by Fredrickson to better reflect cultural traits found similarly throughout the State. These include the Paleoindian Period (ca. 10,950-7950 B.P.), the Archaic Period (ca. 7950-1450 B.P.), and the Emergent Period (ca. 1450 B.P. - Historic Contact). The discussion below provides a brief overview of these temporal periods and the Mojave and Great Basin Desert Regions' chronological complexes associated with each. (Fredrickson 1973, 1974, 1994a, and 1994b; Sikes 2006:2-22).

4.11.1.1 Paleoindian Period

Less is known about the Paleoindian Period than other periods, although significant initial human occupation in California has been identified with this period. The Paleoindian Period is generally associated with the presence of lanceolate and fluted lanceolate Lake Mojave, Clovis, Folsom and other types of projectile points. Crescents, leaf-shaped and stemmed or shouldered points, knives, scrapers, and other tools also characterize this period. The start of this period is associated with the end of the Pleistocene, a geologic epoch that corresponds to the last glacial period, which is typified by a cooler, moist climate supporting an environment conducive to larger animals such as mammoths, camels, and other large game. Human occupation during the late Pleistocene is characterized by a focus on large game hunting and gathering of other resources around the shores of old Pleistocene lakes, the dry lake beds of which now include several that occupy the arid portions of modern southern California. (Moratto 1984:523; Sikes 2006:2-22; Warren 1967:177).

The Lake Mojave Complex occurs during this period with the majority of archaeological evidence found in the Mojave Desert and southwestern Great Basin. Artifact assemblages from this complex indicate that humans were very mobile at this time, traveling in small groups and exploiting plant and animal resources from early Holocene marshes and wetland environments. The Holocene is the current geologic epoch, which followed the Pleistocene, marking the start of the current warm period. The Lake Mojave Complex is one of several that have been grouped under the Western Pluvial Lakes Tradition (WPLT), associated with human exploitation of wet, grassland environments from as far north as Oregon to southern California, and along the Cascade and Sierra Nevada ranges into the Great Basin. Hunting appears to have been the dominant source of food acquisition as milling equipment associated with the WPLT is sparse. However, Lake Mojave artifact assemblages differ somewhat from that of the typical WPLT assemblage in that large slabs and handstones have been found at Lake Mojave sites, indicating that vegetal resources were also incorporated into the regional diet (Basgall and Hall 1993:19; Goldberg 2010:18; Moratto 1984:90).

4.11.1.2 Archaic Period

The Paleoindian Period concludes and the Archaic Period emerges around 6000 B.C. with the onset of a warmer, drier environment referred to as the Altithermal (Sikes 2006:2-23). It is during this time frame that the pluvial lakes of the Great Basin dried up and desert biotic communities replaced wet marshlands (Moratto 1984:461). The Archaic Period is defined by three subdivisions, each of which is described below.

<u>Lower Archaic Period (ca. 7950-4950 B.P.)</u>

The first 3,000 years of the Archaic Period are referred to as the Lower Archaic and is represented by an increase in the number of archaeological sites found from this time period. Artifact assemblages include an increase in milling equipment and, therefore, an increase in the use of plant resources, the addition of seeds, the continuation of hunting, and the suggested scheduling of seasonal procurement activities. Tools associated with the Lower Archaic Period include large, side-notched points and large, simple core and flake tools. (Sikes 2006:2-24).

The Pinto Complex begins during the Lower Archaic Period but continues throughout the Middle Archaic Period described below. For the desert regions of southern California, the patterns of human occupation transitioned at this time in response to the aridity occurring in the deserts. The reliance on pluvial lakes changed to the use of seasonal water sources. The shift in climatic conditions further resulted in a transition to a more plant and seed resource base, the hunting of smaller game animals as opposed to the large game of the Lake Mojave Complex, but with a continued reliance on artiodactyls. Sites related to this complex tend to be small, surface sites, likely reflective of small groups of people. Artifact assemblages include Pinto series points (i.e., coarsely made points with indented bases and weak shoulders), leaf-shaped bifaces, domed and heavy-keeled scrapers, milling equipment, and cobble tools. (Goldberg 2010:18).

<u>The Middle Archaic Period (4950-2950 B.P.)</u>

The Middle Archaic Period is designated by a heavier reliance on local and regional resources, with an evolution in milling equipment from slab mortars and handstones to pestle and mortar technology. Middle Archaic Period artifact assemblages become more diverse and include large stemmed points, lanceolate and leaf-shaped forms, drills, larger knives, flake scrapers, and an increase in bone awls and other tools, suggestive of a more diversified use of resources. This period is also defined by an increase in population and non-utilitarian objects. (Sikes 2006:2-25).

The Gypsum Complex immediately follows the Pinto Complex, starting during the Middle Archaic Period and extending into the Upper Archaic Period described below. It is represented by an expansion of the artifact assemblage identified during the Pinto Complex, likely in response to an increase in wetter conditions that occurred about 3700-3500 B.P. (Goldberg 2010:18-19). The increase in moisture resulted in the appearance of perennial lakes. Large villages occur at this time, suggesting there was less reliance on seasonal forays for resource procurement and an increase in sedentism, likely to exploit the permanent water sources and related resource procurement opportunities. During this time, ritual practices and hunting petroglyphs appear, and artifact assemblages include any combination of Humboldt concave base, Gypsum Cave, and Elko series points, in addition to leaf shaped points, rectangular base knives, flake scrapers, and milling equipment, among other items (Moratto 1984:414-416). Perishable materials associated with this complex were recovered from a cave site near the area examined by Licensees, and included tortoise-shell bowls, atlatl hooks, dart shafts and foreshafts, sandals, S-twist cordage, and other items that do not preserve in open air sites (Goldberg 2010:19; King and Blackburn 1978:536; Moratto 1984:416).

<u>The Upper Archaic Period (ca. 2950-1450 B.P.)</u>

The Upper Archaic Period is identified by an increase in the diversification of artifacts and features compared to Middle Archaic Period assemblages. This included the development of more permanent settlements, more complex societies, and wealth. Upper Archaic sites are associated with large contracting-stemmed and occasional concave base points, all types of milling equipment, stone effigies, stone pipes, charmstones, a variety of beads and bone tools, rock art, and items reflecting trade goods from long distances. Interment burials, sometimes under cairns, appear as the more common mortuary practice, with few cremations represented during this period (Sikes 2006:2-27).

4.11.1.3 Emergent Period

The Emergent Period (ca. 1450 B.P. - Historic Contact) is defined by an even further expansion of the changes witnessed during the Upper Archaic Period, including increased social complexities, divisions of class, intensification of resource exploitation, and population growth and associated increases in the number and size of settlements. Ornamental objects and pottery begin to appear at this time in the archaeological record (Sikes 2006:2-28 to 2-29).

The Saratoga Springs Complex dates to the Emergent Period and is represented by a similar material cultural to that of the Gypsum Period. This likely reflects similar climatic conditions that occurred for occupants associated with both complexes. However, the Saratoga Springs Complex is defined archaeologically by the intensification of permanent settlement patterns over those seen during the Gypsum Complex, with more focus on regional cultural developments, especially in the Mojave Desert. Anasazi and Hakataya groups move into southern California at this time, introducing Brown and Buff Ware pottery, and Cottonwood and Desert Side-notched points. Trade patterns emerge in the archaeological record based on the presence of coastal shell beads and steatite items, which may suggest advancing sedentary lifestyles with larger, permanent villages (Goldberg 2010:20).

4.11.2 Ethnohistory

Ethnographically, the area examined by Licensees lies within the territory ascribed to the Tataviam (King and Blackburn 1978:535). Although evidence regarding the origins of the Tataviam language is weak, it is believed that the Tataviam likely spoke a form of Takic, a sub-family of the Uto-Aztecan linguistic group related to the tribe's Shoshone roots (King and Blackburn 1978:535; Moratto 1984:541). The Uto-Aztecans are believed to have arrived in the Mojave Desert about 5000 years B.P., expanding their occupation in California through about 3900 B.P., during the time the Gypsum Complex of the Middle Archaic Period appears in the archaeological record (Moratto1984:559).

The Tataviam primarily occupied the Santa Clara River drainage, extending east from Piru Creek to about Elizabeth Lake, and north over the Sawmill Mountains to Antelope Valley (King and Blackburn 1978:535). The Chumash occupied lands to the north and west of the Tataviam, the Serrano lived to the east, and the Gabrielino occupied lands to the south. Documentation on Tataviam lifestyles is limited until the Spanish period of missionization (1776 through 1821), although archaeological data indicates that the Tataviam lived in villages of varying population size, obtained and prepared food in similar ways to neighboring groups, and were virtually all baptized at the San Fernando Mission by 1810 (King and Blackburn 1978:536). Primary food sources included acorns, sage seeds, juniper berries, small mammals, deer, and possibly antelope (King and Blackburn 1978:536). Villages varied in size from small settlements of 10 to 15 people up to large centers containing 200 people. At the time of historic contact, the total population is estimated to have been less than 1,000 people (King and Blackburn 1978:536). Research regarding the Tataviam social organization has not fully differentiated the tribe from the Kitanemuk or Gabrielino societies. However, archaeological evidence from a local cave site revealed ritual objects similar to those described ethnographically by Ventureño Chumash for ceremonies conducted by secret societies (Elsasser and Heizer 1963; King and Blackburn 1978:536).

4.11.3 History

From the early seventeenth century up to the middle of the nineteenth century, Spanish and Mexican governments established colonies, towns, and religious centers throughout the northern borderlands of the Spanish colonial empire. Starting in 1769, a total of 21 missions were established along the California coastline, from San Diego in the south to Sonoma in the north (HARD Townsites Team 2007).

Spanish missionization, although mostly confined to the coastal regions of California, eventually led to European exploration and settlement of inland regions. A Spanish exploratory mission led by Gaspar de Portola traveled through the San Gabriel Mountains in 1769. Another exploratory trip through the San Fernando Pass was undertaken by Francisco Garces in 1776, coming south from Mission San Gabriel (Robinson 1993:232-233). Subsequent cross-cultural contact and missionization activities during the Spanish Period, and especially the introduction of European diseases, led to the death of many Indians and the disintegration of Native American cultural lifeways in many areas of California, including within the region (Castillo 1978:99-107). Mission San Fernando was founded in 1797 in the San Fernando Valley, just south of the Project area. The mission acquired the headwaters of the Santa Clara River, easterly from Piru Creek, and called the area "Rancho San Francisco" (Perkins 1957: np). The Rancho was “originally built about 1804 as a granary of Mission San Fernando” (OHP 2016). Native villages in the area dwindled over the next few decades as the population was recruited into the mission as neophytes, and the subsequent contact led to the spread of epidemic diseases (Tartaglia 1997:15-16). Rancho San Francisco is now California State Historical Landmark No. 556 (OHP 2016).

In addition to the lands controlled by the missions, large land grants and ranchos were gifted to individuals by the Spanish government. These ranchos came under the control of the Mexican government after Mexico won independence from Spain in 1822. Many of these were sold, including to residents of the United States. After the missions were secularized in 1833, the Native Americans who had lived as mission neophytes turned to work as laborers on the ranchos (Tartaglia 1997:16). The era of the ranchos ended with the start of the Mexican-American war in April of 1846. Numerous uprisings occurred in California by Americans who had moved to the Mexican territory and acquired land claims, protesting rule by the Mexican government, which threatened the validity of their claims. The American rebellion culminated in the Bear Flag Revolt in June of 1846, during which the American settlers took over the town of Sonoma and captured Mexican general Mariano Vallejo. The United States took advantage of the turmoil and unsuccessfully attempted to purchase the land comprising the California territory from the Mexican government. War was declared by the United States when the purchase fell through. The signing of the Treaty of Guadalupe Hidalgo in 1848 concluded this era of disputes by relinquishing Mexican control of the California territory to the United States (Newmark 1916:88; CNPS 2015; Robinson 1993). California officially became a State on September 9, 1850.

The San Sebastian Indian Reservation, also known as the Tejon Indian Reservation, was established north of the Project area in 1852, north of the Tehachapi Range in the southern end of the San Joaquin Valley. The reservation housed approximately 1,600 local Native Americans. In 1854, the United States founded Fort Tejon, located 17 miles southwest of the reservation, in the Grapevine Canyon, to protect displaced Indian groups living on the reservation, as well as to protect Euro-American settlers from raids by the surrounding desert tribes. A stage line ran from the fort through San Francisquito Canyon, which was an important route for transporting goods, especially after the gold strike on the Kern River in 1854 and the subsequent rush of miners into California. The fort was in operation for only 10 years before it was abandoned and the land subsumed as part of the current Tejon Ranch (Stammerjohan 2015; Tartaglia 1997:18).

Gold was first discovered in the region by Francisco Lopez in 1842, a few miles from the town of Newhall (adjacent to Santa Clarita), followed by another discovery in San Feliciano Canyon in 1843. A rush of miners came to the region at this time, primarily to work the placer deposits. Mining activity was diverted to northern California in 1850 by the Gold Rush, but mining had again resumed in the San Gabriel Mountains by 1854. The Santa Anita Mining Company established its placer operations on the San Gabriel River in 1858. Hydraulic mining was carried out until the 1860s. Another wave of mining occurred when numerous migrants arrived in the area during the Great Depression (Robinson 1993:241-245).

The nearest communities in the Project vicinity include Castaic, Lebec, and Gorman (Figure 4.1-1). These towns are linked to the surrounding area by the historic Old Ridge Route highway, built in 1915. The Old Ridge Route traverses the Tehachapi and Sierra Pelona Mountains between the junction of the San Joaquin Valley and the Grapevine Grade in the north, and Castaic Junction in the south. It was constructed to provide a more direct route to reach Los Angeles from the San Joaquin Valley. The Grapevine Grade refers to a 6.5-mile portion of the route, extending between Fort Tejon and the bottom of the grade, where the highway enters the mountains from the valley. The Grapevine Grade was so named for the dense Cimarron grapevines growing in the canyons that had to be hacked through to construct the highway (Ridge Route 2015).

The Old Ridge Route was constructed following voter approval of an $18 million State highways construction bond in 1910, and was one of the first projects initiated by the California Highway Commission. Construction on the highway began in 1914 using mule-powered graders to clear the way. The resulting twisting roadway, with 697 turns along the route, was a result of the simple construction methods used and the lack of funding for dynamite. The road officially opened to traffic in 1915. In 1919, the 20-foot wide roadway was paved with a 41.5-inch thick reinforced concrete roadbed, and fencing and tall curbing was also established along the route for safety along the treacherous turns (Kehe 1998; Pool 1997). The route became lined with inns and restaurants, catering to the many travelers that used the route. These fell out of business after an Alternate Ridge Route (later Highway 99) was constructed in 1933 to the west of the original route, shortening the distance across the mountains. The alternate route was then replaced by Interstate 5 in 1960. A 17.6-mile long segment of the Old Ridge Route is listed on the NRHP. This is an unmaintained portion of the original road located on NFS lands south of Gorman. Additional portions of the road were excluded from the nomination due to the objections and concerns of private landowners with property along the route (Kehe 1998).

The origins of the name Castaic is likely from the native Tataviam word "Kashtuk," meaning "eyes." The origins of the town of Castaic are in nineteenth century settlement. A small railroad depot was built by the Southern Pacific Railroad at Castaic Junction in 1887. A large enough population existed for the establishment of a school district in 1889 and for a short-lived post office in 1894. The town did not grow significantly until the Old Ridge Route was opened in 1915, placing this remote area along a major travel corridor. This also spurred industrial development as evinced by the founding of Castaic Brick in 1927 and George Dunn's Wayside Dairy in 1929 (Castaic Area Town Council 2014).

The town of Gorman is situated in the prior location of the Tataviam village of *Kulshra'jek*. A prehistoric trail route passed by the town site, which was also later used by Spanish explorers and settlers and known as "El Camino Viejo," meaning "the old way." Data collected during Licensees' research did not reveal if the El Camino Viejo and Old Ridge Route are the same at this location. Early Euro-American settlement occurred at the site in the mid-1800s and included the Reed family and the family of Charles Johnson. The town took its name from settler James Gorman, who established a large log house with his family along the road, which was used as a stopping place and hotel by travelers. Gorman's brother Henry was the first postmaster when the post office was established there in 1877. When the mining industry took off in the surrounding mountains in the late 1800s, Gorman's establishment became significant as the main supply center. Traffic increased when the Old Ridge Route was paved in 1919, and the first gas station in the State not located next to a railway station, was established there in 1923 (Kane 2002).

Settlement at Lebec began when the nearby Fort Tejon was closed in 1864. Many civilians remained in the area, working at farming, mining, or as paid labor, and a settlement formed about 3 miles south of the closed fort. The town of Lebec was officially formed in 1895 with the establishment of a post office. The town was named for a trapper named Peter Lebeck, who was buried at Fort Tejon in 1837 after being killed by a bear. The town grew in conjunction with the nearby borax mining and oil industries, and benefitted from the increased traffic that came with the newly paved Old Ridge

Route in 1919. The town became a popular stopping point along the route and a large, grand hotel was built there in 1921 (Kane 2015).

4.11.4 Project History

The Project is situated on the West Branch of the SWP, which extends from the Tehachapi Afterbay, through Pyramid Lake, to its terminus at Elderberry Forebay. The majority of the West Branch was constructed from 1967 through 1973, although elements of the system were not constructed until the 1980s. (Brewster 2012; Gonzalez and Anderson 2014).

4.11.5 Previous Cultural Resources Investigations

A total of 108 previous cultural resources investigations or related communications were identified in the area examined by Licensees (Table G-7, Appendix G). Approximately 90 percent of these investigations occurred 10 or more years ago. The types of investigations represented were for various DWR projects, transportation projects, and land development projects. Maps depicting the previous survey coverage are provided in Appendix H, which contains privileged information.

4.11.6 Previously Recorded Cultural Resources and NRHP and CRHR Eligibility

Since the first archaeological surveys conducted during the late 1960s, 63 cultural resources have been documented within the area examined by Licensees. The resource records collected during the data gathering identify 37 prehistoric archaeological sites, 19 historic archaeological sites, two multicomponent archaeological sites, three historic built resources, and two isolated prehistoric artifacts. The locations of these resources are depicted on the maps included in Appendix H, which contains privileged information.

Evaluations of resources for their potential eligibility to the NRHP assist in determining whether significant resources are present in a project area and, subsequently, whether a project is having any effects on eligible properties. NRHP evaluations have been conducted on eight known resources; four of these were found to be eligible. The other four were tested (i.e., evaluated for the NRHP through archaeological excavation), but the results of the testing were not found during Licensees' data gathering; neither in the reports, the OHP Archaeological Determinations of Eligibility (ADOE) list, nor on the NRHP. Previously recorded cultural resources in the area examined by Licensees and their NRHP eligibility status are provided below in Tables G-7 (Appendix G), 4.11-1, 4.11-2, 4.11-3, and 4.11-4. The remainder of this Section is organized by resource type and affiliation: (1) prehistoric archaeological sites; (2) historic archaeological sites; (3) multicomponent archaeological sites; (4) historic built environment resources; and (5) isolated prehistoric artifacts.

4.11.6.1 Prehistoric Archaeological Sites

The 37 documented prehistoric sites within the area examined by Licensees represent Native American occupation prior to the presence of Euro-Americans. Several sites are associated with the manufacture of lithic tools and quarries. Numerous sites also represent longer occupation of the area as they include midden soil deposits, hearths, and a possible food storage feature.

4.11.6.2 Historic Archaeological Sites

There are 19 historic archaeological sites in the area examined by Licensees. These include habitation sites, mining sites, cattle raising sites, water resources facilities, an oil drilling site, an aircraft crash site, and the Old Ridge Route. Although most sites are currently unevaluated, a portion of the Old Ridge Route (P-19-000990) is eligible for listing on the NRHP (Table 4.11-1).

4.11.6.3 Multicomponent Archaeological Sites

There are two unevaluated multicomponent sites in the area examined by Licensees. These include a lithic scatter with historic foundations (P-19-000439) and a prehistoric campsite with the remains of a historic ranch (P-19-002401). Table 4.11-2 lists these resources.

4.11.6.4 Historic Built Resources

Three historic built resources were previously recorded in the area examined by Licensees (Table 4.11-3). These include the Los Angeles Aqueduct (P-19-002105), the Los Angeles Aqueduct Transmission Line (P-19-002132), and a stone and mortar building (P-19-190997). The Los Angeles Aqueduct is listed on the NRHP. The Los Angeles Aqueduct Transmission Line and the stone and mortar building are unevaluated.

4.11.6.5 Isolated Artifacts

Two prehistoric isolated artifacts were previously documented in the area examined by Licensees. One is an isolated stone chopper (P-19-100480) and the other is an isolated stone core. Isolated artifacts do not in themselves provide enough information to meet the eligibility criteria of the NRHP or the California Register of Historical Resources (CRHR). Thus, they are not considered for listing on either register (Table 4.11-4).

Table 4.11-1. Previously Recorded Historic Cultural Resources

Primary No.	Trinomial	USFS No.	Description	NRHP Eligibility
P-19-000990	CA-LAN-0990H	05-01-53-32; 05-01-53-154	Old Ridge Route built 1914; replaced by Highway 99 in 1933. Includes portions of wood railings, trash scatters, and dump sites, as well as Liebre Road Camp, used during construction and later maintenance of the road. Six historic inn and stopping sites on route recorded as separate archaeological sites.	Eligible
P-19-002072	CA-LAN-2072H	N/A	Small trash scatter: hole-in-top milk cans, unidentifiable can fragments, a Ball brand glass canning jar base, a brown glass fragment, and concrete fragments.	Unevaluated
P-19-002333	CA-LAN-2333H	N/A	Alamo Ranch, with two-story saltbox residence and attached shed, ca. 1910. Two fence lines, an outbuilding, and dirt road. Possibly removed for construction of the Los Angeles Aqueduct.	Unevaluated
P-19-002569	N/A	N/A	Cattle raising/loading site with fenced area, wood platform, water tank, loading platform, depression, and watering trough pipe.	Unevaluated
P-19-003081	N/A	05-01-53-214	Mining site, small rock cairn and four claim markers, rock-lined channel, about 20 placer excavations, stone structure dug into slope. Miscellaneous cans, square nails, wash basin, coffee pot, canteen, two metal sheets with hinges, likely sluice gates.	Unevaluated
P-19-003159	N/A	05-01-53-182	Four structural foundations on placer mining claim (Red Rose), patented 1928. Permit cancelled in 1969. Two of the foundations are cement, one is cement and rock, and one has a rock pier footing. Likely cabins, a garage, a light power plant building, possible outhouse. Ceramics, bolts, brackets, miscellaneous metal.	Unevaluated

Table 4.11-1. Previously Recorded Historic Cultural Resources (continued)

Primary No.	Trinomial	USFS No.	Description	NRHP Eligibility
P-19-003204	N/A	N/A	Trash dump: numerous assorted glass bottles, cone top and church key beer cans, sanitary cans, car parts, galvanized roofing, miscellaneous metal, and other domestic debris, may be associated with nearby homestead site.	Unevaluated
P-19-003216	N/A	N/A	Jet aircraft crash site, June 10, 1949: 16 aluminum structural fragments, five jet engine turbine blades, a fuel line connector.	Unevaluated
P-19-03577	N/A	05-01-53-0332	Metal can and glass scatter.	Unknown
P-19-003985	CA-LAN-3985	N/A	A 1956 oil test drilling site (documented in CA Division of Oil and Gas Records): large, depressed drilling sump cut into the bank, miscellaneous metal and rubber fragments, milled lumber, and three cement concentrations.	Unevaluated
P-19-186905	N/A	05-01-53-00283	Three dirt roads maintained by Angeles National Forest: Ruby Clearwater Road (6N24), Warm Springs-Fish Canyon Road (6N32.1), and Warm Springs Divide Road (7N13.2 and 7N13a). Roads 6N24 and 6N32.1 date to ca. 1920s, and Road 7N13.2/7N13a was constructed from 1931-1934 to access the Warm Springs Mountain Fire Lookout.	Unevaluated
P-19-188491	N/A	05-01-53-00340	Dirt road (5N29) maintained by the Angeles National Forest, ca. 1930s.	Unevaluated
P-19-190643	N/A	N/A	State Route 138, which runs east-west from Mount Anderson Junction to Gorman, ca. 1900. Three concrete culverts stamped with “1931” and a concrete road marker.	Unevaluated
N/A	CA-LAN-991H	05-01-53-33	A historic inn site along the Old Ridge Route. The site also has two dump sites.	Unevaluated

Table 4.11-1. Previously Recorded Historic Cultural Resources (continued)

Primary No.	Trinomial	USFS No.	Description	NRHP Eligibility
N/A	N/A	05-01-53-34	A historic inn site along the Old Ridge Route; the junction of the Old Ridge Route (8N04) and the Reservoir Summit - Pyramid Lake road (7N26) and an unnamed road (7N27). A tree plantation, cement reservoir, cement garage foundation, recent cistern, and a fenced in culvert storage yard exists.	Unevaluated
N/A	N/A	05-01-53-36	A historic inn site on the Old Ridge Route dating from about 1915-1934. There is one wall made of cemented round granitic boulders and cement steps. Artifacts include three dumping areas with rusted cans, broken colored glass, pipe, vehicle parts, and recent debris.	Unevaluated
N/A	N/A	05-01-53-37	A historic Forest Service campground area 1930s-1960s. There is a flat campsite bench on site. Artifacts include rusted cans, broken colored glass, some other rusted metals, and miscellaneous recent debris.	Unevaluated
N/A	N/A	05-01-53-38	A historical resort and inn site dating from 1914 to 1964. There are two cement foundations in poor condition. There are no artifacts.	Unevaluated
N/A	N/A	05-01-53-35	A historic fire lookout station and out buildings, 1930s-1960s. Features include a cement tower foundation, chunks of a garage foundation, and one outhouse pit. Artifacts include a rusted and broken water heater, pieces of tin siding, rusted cans and metal, and broken pieces of colored glass.	Unevaluated

Source: SCCIC
Key:
USFS = United States Forest Service
NRHP = National Register of Historic Places
SCCIC = South Central Coastal Information Center

Table 4.11-2. Previously Recorded Multicomponent Archaeological Sites

Primary No.	Trinomial	Description	NRHP Eligibility
P-19-000439	LAN-0439/H	Lithic scatter: hammerstones, cores, flake tools, and chalcedony, quartzite, chert, and fused shale flakes. Historic foundations.	Unevaluated
P-19-002401	LAN-2401/H	Prehistoric camp with two possible rock shelters, bedrock mortars with cupule rock art, milling slicks, lithic scatter with mano and chert flakes. Historic ranch ca. 1910, CCC camp ca. 1933, heavy equipment maintenance yard, and abandoned park. Scattered domestic and industrial debris.	Unevaluated

Source: SCCIC
Key:
NRHP = National Register of Historic Places
SCCIC = South Central Coastal Information Center

Table 4.11-3. Previously Recorded Historic Built Resources

Primary No.	Trinomial	USFS No.	Description	NRHP Eligibility
P-19-002105	CA-LAN-2105H	N/A	Los Angeles Aqueduct, 1907-1913, carries water from Owens River to San Fernando Valley. Portions reinforced in 1960s. Below-ground concrete siphons, above grade concrete-lined tunnels, concrete creek channels, concrete housings.	Listed on the NRHP
P-19-002132	CA-LAN-2132H	05-01-53-155	Los Angeles Aqueduct Transmission Line, 1917. Numerous four-leg steel towers support two, 3-line circuits. Runs from Powerplant 1 at San Francisquito Reservoir, to Olive Switching Station in San Fernando Valley. Has original access road, City Highline Road, still used to access line. Historic debris at some towers.	Unevaluated
P-19-190997	N/A	N/A	Concrete block and mortar structure on concrete aggregate foundation with composite roof, ca. 1950s, based on historic topographic maps and aerial photographs. The building is currently used by the California State Parks Law Enforcement.	Unevaluated

Source: SCCIC
Key:
USFS = United States Forest Service
NRHP = National Register of Historic Places
SCCIC = South Central Coastal Information Center

Table 4.11-4. Isolated Artifacts

Primary No.	USFS No.	Description	NRHP Eligibility
P-19-100480	05-01-53-00658-IAO-01	Quartz chopper tool with bifacial reduction marks.	N/A
P-19-100481	05-01-53-00658-IAO-02	Andesite core with reduction marks and cortex on one face.	N/A

Source: SCCIC
Key:
USFS = United States Forest Service
NRHP = National Register of Historic Places
SCCIC = South Central Coastal Information Center
N/A = not applicable

4.11.7 Potential Cultural Resources Based on Historical Maps

A review of historical USGS topographic quadrangles and BLM General Land Office (GLO) plats indicates that there are at least 100 to 125 potential historic-era sites or features (Licensees reviewed 25 historical maps that showed multiple potential resources) within the area examined by Licensees (Table 4.11-5). Potential historic sites are those places or features indicated in historic documentation, such as personal accounts or regional histories, or on historic-era maps for which the physical remains associated with these locations may still exist. Many of these potential resources are represented on more than one historic map, and others may also be shown on multiple maps but require further research to determine if that is the case. Thus, it is not possible to know at this stage of research exactly how many potential resources might still be present in the Project area. However, as with the previously identified archaeological sites, features and sites identified on historic-era maps and other documents illustrate the breadth of historic-period activity in the region. Potential historic-era sites or features include the road to Fort Tejon, Rancho La Liebre, houses, fields, structures, trails, roads, highways, a pipeline, a transmission line, and maintenance stations. The historic maps also show the locations of known historic resources, such as the Old Ridge Route highway. The locations of potential historic-era resources are provided on the confidential maps included in Appendix H, which contains privileged information.

Table 4.11-5. Potential Historic Resources

Data Source	Potential Resource
1856 T8N/R18W GLO plat	Tejon Road
1873 T8N/R17W GLO plat	Road to Tejon, Rancho La Liebre
1873 T8N/R18W GLO plat	Fort Tejon Road
1880 T6N/R17W GLO plat	Barron's House, trail, road
1880 T6N/R18W GLO plat	Trail to Fort Tejon
1880 T7N/R18W GLO plat	Bainbridge's House, Road to Fort Tejon, Thompson's House, road
1881 T8N/R17W GLO plat	Road to Tejon, Rancho La Liebre
1881 T8N/R18W GLO plat	Road
1889 T7N/R18W GLO plat	Bainbridge's House, trail, Road to Fort Tejon, Thompson's House, Barley field
1903 USGS Tejon, CA 1:25,000 Topographic Quadrangle	4 light-duty roads, 5 dirt roads, 9 structures
1910 T8N/R17W GLO plat	Rancho La Liebre
1914 T7N/R18W GLO plat	Cabin
1915 T6N/R16W GLO plat	Shed, house, field
1922 T6N/R16W GLO plat	Forest Service trail

Table 4.11-5. Potential Historic Resources (continued)

Data Source	Potential Resource
1931 USGS Redrock Mountain, CA 7.5-minute Topographic Quadrangle	2 roads, 2 trails, 2 structures
1943 USACE Neenach, CA 15-minute Topographic Quadrangle	State Route 138
1945 USACE Black Mountain, CA 1:31,680 Topographic Quadrangle	Highway 99, Southern California Edison transmission line, Liebre Gulch Maintenance Station, Highway Maintenance Station, Ridge Tavern, Caswells, 58 structures, 2 trails, 10 roads
1945 USACE Lebec, CA 7.5-minute Topographic Quadrangle	State Route 138, 6 dirt roads, Bailey Ranch, 1 structure, State Route 99, transmission line
1947 USACE Black Mountain, CA 7.5-minute Topographic Quadrangle	Highway 99, 2 trails, 5 dirt roads, Southern California Edison transmission line, Liebre Ranch maintenance station, 3 structures
1954 (PR 1974) USGS Liebre Mountain, CA 7.5-minute Topographic Quadrangle	Pipeline
1954 (PR 1974) USGS Liebre Mountain, CA 7.5-minute Topographic Quadrangle	Transmission Line
1958 (PR 1974) USGS Black Mountain, CA 7.5-minute Topographic Quadrangle	Hungry Valley Road
1958 (PR 1988) USGS Whitaker Peak, CA 7.5-minute Topographic Quadrangle	West Branch Los Angeles Aqueduct, pipeline, transmission line, Old Ridge Route
1958 (PR 1988) USGS Warm Springs Mountain, CA 7.5-minute Topographic Quadrangle	Warm Springs Necktie Trail
1965 USGS La Liebre Ranch, CA 7.5-minute Topographic Quadrangle	State Route 138, 4 dirt roads

Source: SCCIC; BLM (http://www.glorecords.blm.gov/default.aspx)
Key:
CA = California
GLO = General Land Office
USGS = United States Geological Survey
SCCIC = South Central Coastal Information Center
BLM = Bureau of Land Management

4.12 SOCIOECONOMIC RESOURCES

This section provides information regarding existing socioeconomic resources in the Project region. This section is divided into two main sub-sections. The first sub-section, Section 4.12.1, describes the socioeconomic resources and population characteristics in the region in which the Project is located. Section 4.12.1 is further divided into six subsections: Section 4.12.1.1 describes the population size; Section 4.12.1.2 describes the race and ethnicity; Section 4.12.1.3 describes the education; Section 4.12.1.4 describes the housing and household characteristics; Section 4.12.1.5 describes the labor force and income; and Subsection 4.12.1.6 describes industries in the Project region. The second subsection, Section 4.12.2, provides Project-specific information and is further divided into three subsections: Section 4.12.2.1 describes the staffing and annual fees paid by DWR to local entities for the Pyramid Lake Recreation Area; Section 4.12.2.2 describes the staffing and annual fees paid by DWR to local entities for SWP reaches within the proposed Project boundary; and Section 4.12.2.3 describes where and how the power and water is utilized.

4.12.1 <u>Project Area</u>

The Project is located south of the Tehachapi Mountains in Los Angeles County and the existing Project boundary covers 6,927.8 acres of land. Within the total acreage, there are 2,807.25 acres of federal lands. The majority of federal lands are managed by the ANF as part of the NFS. A small portion (about 17 acres) is administered by BLM. The Project is north of the census designated place (CDP) of Castaic, northwest of the City of Los Angeles, in close proximity to Interstate 5. Los Angeles County supports a variety of industrial and commercial activities and is the State's and the nation's most populated county (U.S. Census Bureau 2015). Los Angeles County has a diverse geographical profile that covers 4,752 square miles, including: 70 miles of coast on the Pacific Ocean; the San Gabriel Mountains with the highest peak at 10,064 feet (Mt. Baldy), and part of the Mojave Desert in the northern portion of Los Angeles County. This subsection describes the population size, race and ethnicity, education, housing and household characteristics, labor force and income, and industries for Los Angeles County.

4.12.1.1 Population

The population of Los Angeles County was approximately 9.8 million people in 2010, an increase of 3.1 percent from approximately 9.5 million people in the year 2000. California Department of Finance projections indicate that population growth in Los Angeles County is expected to continue increasing by approximately 11.3 percent, to over 10.9 million people by 2030 (Table 4.12-1), and the population density could exceed 2.6 thousand people per square mile by 2030. Urban areas within the county contain more concentrated population densities.

Table 4.12-1. Historic and Forecasted Population and Population Density

Los Angeles County	2000 Census	2010 Census	Percent Change (2000 through 2010)	2020 Projection	2030 Projection	Percent Change (2010 through 2030)
Population (people)	9,519,338	9,818,605	3.1	10,435,991	10,930,986	11.3
Population Density (people/square mile)[1]	2,346	2,420		2,572	2,694	

Sources: U.S. Census Bureau 2000, 2010; California Department of Finance 2014
Note:
[1]Los Angeles County projected population density calculated with 4,058 square mile land area.

There are 88 cities and over 100 unincorporated areas in Los Angeles County. The Project boundary is not located within any Los Angeles County cities. The City of Los Angeles is south of the Project boundary and is the most populous city in Los Angeles County, with a population of 3,792,621 and population density of 8,092 people per square mile in 2010. Other populated places south of the Project boundary include: City of Santa Clarita with a population of 176,320 and the CDP of Castaic, located directly south of the existing Project boundary, with a population of 19,015. Table 4.12-2 provides populations and population densities for CDPs and cities with populations greater than 10,000 people within 10 miles of the Project boundary.

Table 4.12-2. Selected Cities and Census Designated Places with a Population of 10,000 or More Within 10 Miles of the Existing Project Boundary, 2010

Cities and Census Designated Places	Population	Los Angeles County (percent)	Population Density (people per square mile)
Santa Clarita City	176,320	1.8	3,345
Castaic CDP	19,015	0.2	2,619
Stevenson Ranch CDP	17,557	0.2	2,760

Source: U.S. Census Bureau 2010
Key:
CDP = census designated place

Age

Consistent with state trends, a shift in the age distribution of residents can be observed in Los Angeles County. As shown in Table 4.12-3, the greatest number of individuals in Los Angeles County, 65.0 percent, fall between the ages of 18 and 64 and the proportion of this age group has not changed significantly since 2010. However, the populations of persons less than 18 years old significantly decreased and the age group of 65 years and older significantly increased between 2010 and 2014. These age groups within the County have a similar distribution as the state as a whole.

Table 4.12-3. Los Angeles County Age Groups, 2014

Population Age	Los Angeles County		California	
	2014 (percent of population)	2010 through 2014 (percent change)	2014 (percent of population)	2010 through - 2014 (percent change)
Persons under 5 years old	6.4	-3.0	6.5	-4.4
Persons 6 to 17 years old	16.4	-8.4	17.1	-6.0
Persons 18 to 64 years old	65.0	0.6	63.5	-0.2
Persons 65 years old and over	12.2	11.9	12.9	13.2

Source: U.S. Census Bureau 2015

4.12.1.2 Race and Ethnicity

The racial and ethnic makeup of Los Angeles County compared to the statewide makeup is presented in Table 4.12-4, below. The County's population is predominantly of Hispanic or Latino origin, and White Alone (not Hispanic or Latino) is the second largest group. In Los Angeles County, those of Hispanic or Latino origin make up a larger proportion of the population than in the state. Between 2010 and 2014, American Indians and Alaskan Natives had the largest percent increases in population, followed by Asians.

Table 4.12-4. Regional Race and Ethnicity, 2014

Race and Ethnicity	Los Angeles County		California	
	Population (percent)	Percent Change (2010 through 2014)	Population (percent)	Percent Change (2010 through 2014)
White alone, not Hispanic or Latino	26.8	-3.6	38.5	-4.0
Black or African American alone	9.2	5.7	6.5	4.8
American Indian and Alaska Native alone	1.5	114.3	1.7	70.0
Asian alone	14.8	8.0	14.4	10.8
Native Hawaiian and Other Pacific Islander alone	0.4	33.3	0.5	25.0
Hispanic or Latino	48.4	1.5	38.6	2.7

Source: U.S. Census Bureau 2015

4.12.1.3 Education

Education levels in Los Angeles County and California are displayed in Table 4.12-5, below. The population above the age of 25 that are high school graduates or higher is 76.6 percent in Los Angeles County, with 29.7 percent of the population having obtained a Bachelor's degree or higher. The education level in Los Angeles County is generally similar when compared to the state, although Los Angeles County has lower percentages of high school graduates and slightly lower percentages of individuals who have received a Bachelor's degree or higher (U.S. Census Bureau 2015).

Table 4.12-5. Regional Education, 2014

Education	Los Angeles County (percent)	California (percent)
High school graduate or higher (persons age 25 years and over)	76.6	81.2
Bachelor's degree or higher (persons age 25 years and over)	29.7	30.7

Source: U.S. Census Bureau 2015

4.12.1.4 Housing and Household Characteristics

Table 4.12-6 provides housing and household characteristics, including housing units, homeownership rate, median home value, and median household income for Los Angeles County and the state. Los Angeles County contains over 25 percent of the state's housing units and has higher median values and lower ownership rates than the state. The number of people per household is similar between Los Angeles County and the state, while median household incomes are lower in Los Angeles County than the state.

Table 4.12-6. Summary of Housing Units and Household Characteristics – Los Angeles County/State Comparison, 2014

Housing/Household	Los Angeles County	California
Housing units	3,482,516	13,900,766
Housing units, percent change (2010-2014)	1.09	1.61
Homeownership rate, percent	46.9	55.3
Median value of owner-occupied housing units	$420,200	$366,400
Households	3,230,383	12,542,460
Persons per household	3.01	2.94
Median household income	$55,909	$61,094

Source: U.S. Census Bureau 2015

4.12.1.5 Labor Force and Income

Labor force and income characteristics for Los Angeles County and the state are provided in Table 4.12-7. Los Angeles County contains over 25 percent of the civilian labor force in the state. The unemployment rate in Los Angeles County was 8.3 percent during 2014, which is higher than the state's average of 7.5 percent (California Employment Development Department 2015a, 2015b). Los Angeles County per capita income is less than per capita income in the state, while the percent of persons below poverty in Los Angeles County, as estimated by the U.S. Census Bureau in 2015, exceed the percent of persons in poverty in the state.

Table 4.12-7. Civilian Labor Force, Unemployment, Income, and Poverty – Los Angeles County and California, 2014

Year	Los Angeles County	California
Labor Force	5,025,900	18,811,400
Unemployment Rate, percent	8.3	7.5
Per capita income	$27,749	$29,527
Persons below poverty[1], percent	19.0	16.4

Sources: U.S. Census Bureau 2015; California Employment Development Department 2015a
Note:
[1]The U.S. Census Bureau uses a set of money income thresholds that vary by family size and composition to determine who is in poverty. If a family's total income is less than the family's threshold, then that family and every individual in it is considered in poverty. The official poverty thresholds do not vary geographically, but they are updated for inflation using the Consumer Price Index.

4.12.1.6 Industry

Los Angeles County's diverse geography, extensive natural resources, and economic and population centers provide unique opportunities for goods-producing, service-providing, and government industry sectors. Table 4.12-8 summarizes the percent of labor force and earnings by industry in Los Angeles County. Service-providing industries support the majority (75.4 percent) of the labor force within Los Angeles County, while government and goods-producing industries comprise 12.8 and 11.8 percent of the labor force, respectively.

4.12.2 Project-Specific Socioeconomic Information

As part of the Project, Pyramid Lake Recreation Area and SWP within the Project boundary contribute to the national and local economies. Revenues and expenditures for Pyramid Lake Recreation Area and the section of the SWP within the Project boundary are summarized below.

4.12.2.1 Pyramid Lake Recreation Area

The Pyramid Lake Recreation Area is an important recreational area in Los Angeles County and annual attendance totaled 105,094 visitors (96,898 day use and 8,196 night use) in 2014 (DWR 2014a). Fee collection and daily O&M are carried out by a recreation concessionaire that was permitted through the USFS in 2008 and through DWR in 2014. Table 4.12-9 provides revenues and expenditures for DWR, USFS, and the Parks Management Company in 2008. DWR received no revenue in 2008, because the concessionaire was permitted through USFS; in 2015 DWR received 10 percent of the permitted concessionaire's gross profit.

Table 4.12-8. Summary of Los Angeles County Industry Labor Force and Earnings, 2014

Industry	Labor Force (percent)	Earnings ($ millions)
Goods-Producing	11.8	29,656.6
Natural Resources and Mining	0.2	797.7
Construction	2.9	6,824.0
Manufacturing	8.7	22,035.0
Service-Providing	75.4	170,719.9
Trade, Transportation, and Utilities	18.9	36,139.1
Information	4.7	20,641.9
Financial Activities	5.0	19,460.1
Professional and Business Services	14.4	41,969.6
Education and Health Services	17.2	30,551.5
Leisure and Hospitality	11.2	16,025.9
Other Services	3.5	5,092.0
Unclassified	0.4	839.9
Government	12.8	35,012.6

Source: California Employment Development Department 2015c

Table 4.12-9. Summary of Pyramid Lake Recreation Facility Revenues and Expenditures, 2008

Recreation Facility Management Entity	Revenues	Expenditures
DWR	-	$ 68,333
USFS	$ 48,877	$ 74,914
Concessionaire	$ 439,893	unknown

Source: DWR 2015b
Key:
DWR = California Department of Water Resources
USFS = United States Forest Service

4.12.2.2 State Water Project Reaches Within the Project Boundary

SWP reaches within the proposed Project boundary contribute to the national and local economies through O&M activities and related employment. Table 4.12-10 presents operating expenditures, including labor and non-labor expenditures, for SWP reaches within the proposed Project boundary (Oso Pumping Plant discharge to Quail Lake [reach 29F], Quail Lake Outlet through Warne Powerplant [reach 29G], Pyramid Lake and Dam and VDL Visitors Center [reach 29H], Angeles Tunnel [reach 29J]). The number of full-time annual equivalent employees for these SWP reaches is approximately 16 employees (DWR 2014a).

Table 4.12-10. Operations Expenditures for State Water Project Reaches Within the Project, 2014

Operating Expenditures	$
Non-Labor Operating Expenditures[1]	1,986,391
Labor[2]	3,359,318

Source: DWR 2014a
Notes:
[1]Non-Labor operating expenses include: internal and external consultants, facility operations, general expenses, other items of expense, safety supplies, travel, capital outlays, and communications costs.
[2]Labor expenses include direct labor and labor assessment costs.

4.12.2.3 Use of Project Power and Water

Project power generation and local water deliveries contribute to socioeconomic resources by providing energy and water for local use. In addition, Pyramid Lake regulates SWP water for delivering to various contractors. Project power generation and local water deliveries are discussed in Section 3.0.

4.13 TRIBAL RESOURCES

This Section provides information regarding existing tribal resources. Besides this general introductory information, this Section includes one main sub-section, Section 4.13.1. Section 4.13.1 describes known or potential Project effects on Native American tribes and sacred sites, as well as, relevant and reasonably available information found by Licensees regarding Indian Trust Assets (ITA), TCPs, and agreements within the existing Project boundary and a 0.25-mile-wide buffer around the boundary. The buffer was examined to provide information regarding tribal resources in the general vicinity of the existing Project boundary and to allow for flexibility in Project planning. Tribal resources are primarily ITAs, TCPs, and agreements that may exist between tribes and other entities.

ITAs are legal interests in property held in trust by the United States for Indian tribes or individual Native Americans. The U.S. Secretary of the Interior, acting as the trustee, holds many assets in trust. ITAs can be real property, physical assets, or intangible property rights. Examples of ITAs are lands, including reservations and public domain allotments; minerals; water rights; hunting and fishing rights; other natural resources; and money or claims. While most ITAs are on reservations, they may also be found off-reservation. A characteristic of an ITA is that it cannot be sold, leased, or otherwise alienated without the United States government's approval. ITAs do not include things in which a tribe, or individual, has no legal interest. For example, off-reservation sacred lands or archaeological sites in which a tribe has no legal interest are not ITAs.

TCPs are explained and defined in Parker and King (1998:1) as follows:

> One kind of cultural significance a property may possess, and that may make it eligible for inclusion in the [National] Register, is traditional cultural significance. "Traditional" in this context refers to those beliefs, customs, and practices of a living community of people that have been passed down through the generations,

usually orally or through practice. The traditional cultural significance of a historic property, then, is significance derived from the role the property plays in a community's historically rooted beliefs, customs, and practices. Examples of properties possessing such significance include:

- A location associated with the traditional beliefs of a Native American group about its origins, its cultural history, or the nature of the world;
- A rural community whose organization, buildings and structures, or patterns of land use reflect the cultural traditions valued by its long-term residents;
- An urban neighborhood that is the traditional home of a particular cultural group, and that reflects its beliefs and practices;
- A location where Native American religious practitioners have historically gone, and are known or thought to go today, to perform ceremonial activities in accordance with traditional cultural rules of practice; and
- A location where a community has traditionally carried out economic, artistic, or other cultural practices important in maintaining its historic identity.

A TCP, then, can be defined generally as one that is eligible for inclusion in the NRHP because of its association with cultural practices or beliefs of a living community that (a) are rooted in that community's history, and (b) are important in maintaining the continuing cultural identity of the community.

Agreements are contracts between a tribe and private land owner or land-managing agency that provides tribes with access to a landowner or agency's property for fishing, gathering of traditional plants, or other tribal practices.

4.13.1 Potentially-Affected Native American Tribes and Sacred Lands

Licensees contacted the Native American Heritage Commission (NAHC) on June 16, 2015 to obtain a list of tribes and tribal individuals who may have an interest in the Project, and to request a search of the NAHC's files for a list of any known sacred lands that may be within the existing Project boundary or buffer. The NAHC provided the tribal contacts listed in Table 4.13-1 in a letter dated July 15, 2015.

In July 2015, all individuals and organizations included on the NAHC list were mailed letters of introduction to the Project and questionnaires to solicit information and concerns about the Project (Appendix B). Licensees are not aware of any other tribes or tribal members that may be interested in the Project relicensing.

The NAHC did not identify any sacred lands that may be within the existing Project boundary or buffer area.

4.13.1.1 Known Indian Trust Assets and TCPs

Research of tribal resources was conducted between June 23, 2015 and July 29, 2015. This included a records search at the South Central Coastal Information Center of the California Historical Resources Information System at California State University, Fullerton, as detailed in Section 4.10. Licensees reviewed cultural resources records, site location maps, historic General Land Office plats, NRHP listings including Determination of Eligibility lists, CRHR listings, OHP Historic Property Directory for Los Angeles County, California.

Additional research was conducted at the Los Angeles County Library and the BIA's GIS database to review any references or data relevant to the history, tribal occupation, tribal lands, or other ITAs within the existing Project boundary and buffer.

Although Licensees found numerous source documents regarding prehistoric tribal occupation and prehistoric archaeological resources, no documents were encountered that identified ITAs, TCPs, or agreements as defined above.

Table 4.13-1. Tribal Contacts Provided by the Native American Heritage Commission

Barbareno/Ventureno Band of Mission Indians Raudel Joe Banuelos, Jr. 331 Mira Flores Court Chumash Camarillo, CA 93012	Barbareno/Ventureno Band of Mission Indians Kathleen Pappo 2762 Vista Mesa Drive Rancho Pales Verdes, CA 90275
Barbareno/Ventureno Band of Mission Indians Julie Lynn Tumamait-Stennslie, Chair 365 North Poli Avenue Ojai, CA 93023	Coastal Band of the Chumash Nation Michael Cordero, Chairperson P.O. Box 4464 Santa Barbara, CA 93140
Fernandeno Tataviam Band of Mission Indians Rudy Ortega Jr., President 1019 2nd Street San Fernando CA 91403	Gabrieleno Band of Mission Indians - Kizh Nation Andrew Salas, Chairperson P.O. Box 393 Covina, CA 91723
Gabrielino Tongva Indians of California Tribal Council Robert F. Dorame, Tribal Chair/Cultural Resources P.O. Box 490 Bellflower, CA 90707	Gabrielino/Tongva Nation Sam Dunlap, Cultural Resources Director P.O. Box 86908 Los Angeles, CA 90086
Gabrielino/Tongva Nation Sandonne Goad, Chairperson 106 1/2 Judge John Aiso Street Los Angeles, CA 90012	Gabrielino/Tongva San Gabriel Band of Mission Indian Anthony Morales, Chairperson P.O. Box 693 San Gabriel, CA 91778
Gabrielino-Tongva Tribe Bernie Acuna, Co-Chairperson 1999 Avenue of the Stars, Suite 1100 Los Angeles, CA 90067	Gabrielino-Tongva Tribe Conrad Acuna 1999 Avenue of the Stars, Suite 1100 Los Angeles, CA 90067

Table 4.13-1. Tribal Contacts Provided by the Native American Heritage Commission (continued)

Gabrielino-Tongva Tribe Linda Candelana, Co-Chairperson 1999 Avenue of the Stars, Suite 1100 Los Angeles, CA 90067	Randy Guzman-Folkes 4676 Walnut Avenue Simi Valley, CA 93063
LA City/County Native American Indian Commission Ron Andrade, Director 3175 West 6th Street, Rm. 403 Los Angeles, CA 90020	Melissa M. Parra-Hernandez 119 North Balsam Street Oxnard, CA 93030
PeuYoKo Perez 5501 Stanford Street Ventura, CA 93003	Carol A. Pulido 165 Mountainview Street Oak View, CA 93022
San Fernando Band of Mission Indians John Valenzuela, Chairperson P.O. Box 221838 Newhall, CA 91322	Santa Ynez Tribal Elders Council Freddie Romero, Cult. Preserv. Consultant P.O. Box 365 Santa Ynez, CA 93460
Tongva Ancestral Territorial Tribal Nation John Tommy Rosas, Tribal Admin. 712 Admiralty Way, Suite 172 Marina Del Rey, CA 90292	Patrick Tumamait 992 El Camino Corte Ojai, CA 93023

Source: NAHC 2015