Chapter 3
Existing and Future Conditions in the Study Area

One of the most important elements of any water resources evaluation is defining existing resource conditions in the affected environment, and how these conditions may change in the future. The magnitude of change not only influences the scope of the problems, needs, and opportunities, but the extent of related resources that could be influenced by possible actions taken to address them. Accordingly, this chapter describes existing and likely future conditions for resources within the study area. Defining the existing and likely future conditions is critical in establishing the basis for comparing potential alternative plans consistent with NEPA and CEQA guidance.

This chapter discusses existing and future physical, biological, cultural, and socioeconomic conditions. The discussion of existing and future conditions in this chapter will focus on the primary study area, but will also provide information about water resources facilities and water deliveries in other portions of the study area. The primary and extended study areas are defined in Chapter 1.

Existing Conditions

This section describes existing conditions in the study area, including existing infrastructure, the physical environment, biological environment, cultural environment, and socioeconomic resources.

Existing Area Infrastructure

This section describes existing conditions for the Friant Division, Friant Dam and Millerton Lake water control facilities, recreation facilities, and other infrastructure in the primary study area.

Friant Division of the Central Valley Project

The reservoir facilities at Millerton Lake are part of the Friant Division of the CVP, and their operation affects flow in the San Joaquin River. Friant Dam is operated to supply water to agricultural and urban areas in the eastern San Joaquin Valley and to provide flood protection to downstream areas. The Friant Division provides water to over 1 million acres of irrigable land on the east side of the southern San Joaquin Valley, from near the Chowchilla River in the north to the Tehachapi Mountains in the south. Principal features of the Friant Division were completed in the 1940s, including Friant Dam and Millerton

Lake, and the Madera and Friant-Kern canals, which convey water north and south to agricultural and urban water contractors. Minimum storage in Millerton Lake for canal diversion is about 130 TAF (135 TAF for the Friant-Kern Canal, 130 TAF for the Madera Canal), resulting in active conservation storage of about 390 TAF.

The limited active conservation storage and the requirement for flood space reservation result in little opportunity for carryover storage. Annual water allocations and release schedules are developed with the intent of drawing reservoir storage to minimum levels by the end of September. When demands are lower, or inflow is greater than typical, end-of-year storage may be above minimum levels, resulting in incidental carryover storage. With the exception of flood operations, water released from Friant Dam to the San Joaquin River is limited to the amount necessary to satisfy riparian water rights along the San Joaquin River between Friant Dam and Gravelly Ford.

Friant Dam and Millerton Lake

Friant Dam is a concrete gravity dam that impounds Millerton Lake on the San Joaquin River. It is located on the border between Fresno and Madera counties, near the community of Friant, about 20 miles northeast of Fresno. Friant Dam, owned and operated by Reclamation, was constructed between 1939 and 1942. Three small saddle dams that close low areas along the reservoir rim are located on the south side of the reservoir. At the top of active storage, elevation 580.6 feet above mean sea level (msl) (elevation 580.6), the reservoir has a storage capacity of 520 TAF. Water deliveries, principally for irrigation, are made through outlet works to the Friant-Kern and Madera canals, which were completed in 1949 and 1944, respectively. Physical data pertaining to Friant Dam and Millerton Lake are presented in Table 3-1.

The spillway consists of an ogee overflow section, chute, and stilling basin at the center of the dam. The spillway is controlled by one 18-foot-high by 100-foot-wide drum gate, and two comparably sized Obermeyer gates. Outlets to the Madera Canal are located on the right abutment; outlets to the Friant-Kern Canal are located on the left abutment. A river outlet works is located to the left of the spillway within the lower portion of the dam.

Three powerhouses, owned and operated by the Friant Power Authority (FPA), are located on the downstream side of Friant Dam. A powerhouse on each canal generates hydroelectricity as water is released to the Friant-Kern and Madera canals for delivery. A third powerhouse, located at the base of the dam adjacent to the spillway, generates hydroelectricity as water is released to the San Joaquin River. The combined capacity of the three powerhouses is 30 MW.

Table 3-1. Pertinent Physical Data – Friant Dam and Millerton Lake

General			
Drainage Areas		**Unimpaired Flows of Friant Dam**	
Friant Dam	1,638 square miles	Mean annual runoff (1873-1977)	1,790,300 acre-feet
Mono Creek at Lake Thomas A. Edison	95.2 square miles	Average flow	2,470 cfs
South Fork San Joaquin River at Florence Lake	171 square miles	Min mean daily inflow (Oct. 10, 1977)	0 cfs
		Max mean daily inflow (Dec. 23, 1955)	61,700 cfs
Big Creek at Huntington Lake	80.5 square miles	Max instantaneous inflow (Dec. 23, 1955)	97,000 cfs
North Fork Willow Creek at Bass Lake	50.4 square miles		
Stevenson Creek at Shaver Lake	29.1 square miles	Max mean daily outflow (June 6, 1969)	12,400 cfs
San Joaquin River at Mammoth Pool Reservoir	1,003 square miles	Min mean daily outflow (Oct. 20, 1940)	5.5 cfs
San Joaquin River at Redinger Lake	1,295 square miles	Spillway design flood	
San Joaquin River at Kerckhoff Diversion	1,461 square miles	Peak inflow	197,000 cfs
San Joaquin River at Mendota	3,943 square miles	Peak outflow	158,500 cfs
Friant Dam and Millerton Lake[1]			
Friant Dam (concrete gravity)		**Millerton Lake**	
Elevation, top of parapet	587.6 feet above msl	Elevations	
Freeboard above spillway flood pool	3.25 feet	Minimum operating level[2]	468.7 feet above msl
Elevation, crown of roadway	583.8 feet above msl	Top of active storage capacity	580.6 feet above msl
Max height, foundation to crown of roadway	319 feet	Spillway flood pool	587.6 feet above msl
Crest Length		Area	
Left abutment, nonoverflow section	1,478 feet	Minimum operating level	2,108 acres
Overflow river section	332 feet	Top of active storage capacity	4,905 acres
Right abutment, nonoverflow section	1,678 feet	Spillway flood pool	5,085 acres
Total length	3,488 feet	Storage capacity	
Width of crest at elevation 581.25	20.0 feet	Minimum operating level[2]	130,740 acre-feet
Total concrete in dam and appurtenances	2,135,000 yd^3	Top of active storage capacity	524,250 acre-feet
		Spillway flood pool	559,300 acre-feet
Spillway (gated ogee)		**Outlets**	
Crest length		River outlets (110-inch dia. w/ 96-inch hollow jet valves)	
Gross	332 feet	Number and elevation	4 @ 382.6 feet above msl
Net	300 feet	Capacity at minimum pool	12,400 cfs
Crest elevation	562.6 feet above msl	Capacity at top of active storage	16,400 cfs
Discharge capacity (height = 18.0 feet)	83,160 cfs	Diversion outlets, Madera Canal (91-inch dia. w/ 86-inch needle valve)	
Crest gates (1 drum and 2 Obermeyer)		Number and elevation	2 @ 448.6 feet above msl
Number and size	3 @ 100 feet by 18 feet	Diversion outlets, Friant-Kern Canal (110-inch dia. w/ 96-inch hollow jet valve)	
Top elevation when lowered	562.6 feet above msl	Number and elevation	4 @ 466.6 feet above msl
Top elevation when raised	580.6 feet above msl		
Friant-Kern Canal		**Madera Canal**	
Length	152 miles	Length	35.9 miles
Operating capacity below Friant Dam	4,000 cfs	Capacity below Friant Dam	1,000 cfs
Operating capacity at terminus of canal	2,000 cfs	Capacity at Chowchilla River	625 cfs

Notes:

[1] Elevations given are in North American Vertical Datum (NAVD) 1988.

[2] Minimum operating level generally corresponds with elevation of Friant-Kern Canal outlets.

Source: USACE, 1955 (revised 1980), with elevations revised to NAVD 1988.

Key:

cfs = cubic feet per second
Dec. = December
dia. = diameter
elevation xxx = elevation in feet above mean sea level
hp = horsepower
kW = kilowatt
msl = mean sea level
Oct. = October
yd^3 = cubic yard

Recreation Facilities and Other Reservoir Area Infrastructure

Lands around Millerton Lake have been developed for recreational, residential, and power development purposes. The general locations of facilities and developed lands around Millerton Lake are shown in Figure 1-2.

The Millerton Lake SRA, managed by the DPR, contains numerous recreation facilities, including 10 camping areas, six boat ramps, a privately operated marina, 11 picnic and day-use areas, five trails, and parking, telephone, and toilet facilities.

The SJRGMA, administered by the BLM, is situated upstream from the SRA. It contains a replicated Native American village, trails, a footbridge across the San Joaquin River, and a primitive campground. The most prominent trail is the San Joaquin River Gorge Trail. Information regarding use of recreation facilities and public access within the Millerton Lake SRA and SJRGMA is found in later sections.

The Fresno County Courthouse was removed from an area now within Millerton Lake at the time of Friant Dam construction, and now overlooks the lake from a site on the south side of the reservoir. Several residential areas have been established around Millerton Lake. Three residential developments are located in Fresno County (Lakeview Estates, Winchell Bay, and Sky Harbor); one major development (Hidden View Estates) is located in Madera County. Each of these residential areas includes developed and undeveloped parcels. Other residential sites include two homes in the Temperance Flat area.

Several roads in the Millerton Lake area provide access to residential areas and recreation facilities. Millerton Road skirts the south side of the reservoir, connecting the community of Friant with Auberry Road. Winchell Cove Road and Sky Harbor Road extend from Millerton Road north into residential areas. Sky Harbor Road continues to the South Fine Gold picnic area within the SRA. Madera County Road 206 and Road 145 on the north side of the lake lead to recreational facilities in the SRA. County Road 216 provides access from north of Millerton Lake to the Hidden View residential area near the confluence of Fine Gold Creek and Millerton Lake.

Two Pacific Gas and Electric (PG&E) powerhouses, the Kerckhoff Powerhouse and Kerckhoff No. 2 Powerhouse, are located within 1 mile of the upstream end of Millerton Lake (Figure 1-2). Water is diverted from Kerckhoff Lake at Kerckhoff Dam and conveyed through tunnels and penstocks to serve the powerhouses. The Kerckhoff Powerhouse was commissioned in 1920, has a generation capacity just under 40 MW, and is located on the San Joaquin River at River Mile (RM) 284.5, about a mile upstream from the upper limit of Millerton Lake. The Kerckhoff No. 2 Powerhouse was commissioned in 1983, with a capacity of 155 MW, and discharges directly to the upstream portion of Millerton Lake at RM 282.5.

Flood Management

Friant Dam is the principal flood storage facility on the San Joaquin River, with a dedicated flood management pool of 170 TAF during the flood season of October through March. Under present operating rules, up to 85 TAF of the flood storage required in Millerton Lake may be provided by an equal amount of space in Mammoth Pool. During flood conditions, Friant Dam is operated to maintain releases to the San Joaquin River at or below a flow objective of 8,000 cfs. Several flood events in the past few decades resulted in flows greater than 8,000 cfs downstream from Friant Dam and, in some cases, flood damages resulted. Other flood management facilities of the San Joaquin River basin include levees along the San Joaquin River, Chowchilla Canal Bypass, and Eastside Bypass; levees along the lower portions of the Fresno River and Ash and Berenda sloughs; Bear Creek; and the Merced, Tuolumne, and Stanislaus rivers.

Physical Environment

Elements of the physical environment in the upper San Joaquin River basin are described in this section, and include topography, geology and soils, climate, geomorphology, sedimentation and erosion, hydrology, water quality, groundwater resources, air quality, and noise.

Topography

Regional topography consists of the nearly level floor of the San Joaquin Valley rising abruptly to moderately steep, northwest-trending foothills with rounded canyons. Millerton Lake is set in the lower foothills of the Sierras and extends from a relatively broad open portion near Friant Dam to a long, narrow reach upstream into the upper San Joaquin River. Elevations in the immediate area of Millerton Lake range from about elevation 310 at Friant Dam to over elevation 2,100 at the upper end of the reservoir.

Farther east, the terrain becomes steeper and the canyons become more incised. The canyons were cut by southwest- to west-flowing rivers and associated large tributaries. The topography of the San Joaquin River basin rises to over elevation 12,000 in the upper watershed, located in the Sierra Nevada.

Geology and Soils

The Investigation study area is located along the western border of the central portion of the Sierra Nevada Province at its boundary with the eastern edge of the Great Valley province of California. The Sierra Nevada batholith comprises predominately intrusive rocks, including granite and granodiorite, with some metamorphosed granite and granite gneiss. Intrusive Sierra Nevada batholith rocks underlie most of Millerton Lake and the Temperance Flat dam sites. Occasional remnants of lava flows and layered tuff are present in the area at the highest elevations.

Friant Dam is founded on metamorphic rocks consisting of quartz biotite schist intruded by aplite and pegmatite dikes and by inclusions of dioritic rocks. Erosion has resulted in thin colluvial cover (Reclamation, 2002). The San Joaquin River above Millerton Lake passes through medium-fine-grained metamorphosed granodiorite. Surface weathering has produced some decomposed granite and soils. Coarse-grained granitic dikes are abundant in this region (PG&E, 1986).

The primary study area for the Investigation is in the Upland Soils Physiographic Region of the Central Valley. Upland soils are found on hilly to mountainous topography on the perimeter of the Central Valley and are formed in place through the decomposition and disintegration of the underlying parent material.

Four soil associations are dominant in the primary study area. Temperance Flat and Millerton Bottoms are flanked by the Ahwahnee-Vista Association to the north and by the similar Ahwahnee-Auberry Association to the south. These associations are very similar, differing in the Auberry Series, which has finer textured subsurface horizons and consequently is characterized by slower drainage and runoff. In addition, the Trimmer-Trabuco Association lies along the southwest portion of the reach. These soils are rocky loam and loam with depths ranging from a few inches to nearly 7 feet. The Trabuco Series has hard clay subsoil and as a result, these soils have slow internal drainage. The association has medium to very rapid runoff and low to moderately low permeability.

The San Joaquin River upstream from Millerton Bottoms is in a region dominated by the Ahwahnee-Auberry Association in the south and by the Coarsegold-Trabuco Association in the north below Kerckhoff Dam. The Coarsegold-Trabuco Association is formed on metasedimentary rocks and granite. These soils are fine-loamy in texture and range from less than 2 feet to nearly 7 feet in depth to weathered bedrock. The association exhibits medium to very rapid runoff with moderately low permeability (USDA, 2006).

Climate

The climate of the San Joaquin River Valley is arid to semi-arid with dry, hot summers and mild winters. Summer temperatures on the valley floor often exceed 100 degrees Fahrenheit (°F) for extended periods of time, while winter temperatures only occasionally fall below freezing. Higher elevation portions of the watershed have distinct wet and dry seasons. Most of the precipitation falls from November to April, with rain at the lower elevations and snow in the higher regions. On the valley floor, average annual precipitation decreases from north to south, ranging from 14 inches in Stockton to 8 inches at Mendota.

Geomorphology

The narrow and steep-sided Big Bend area, also referred to as upper Millerton Lake, is immediately downstream from Temperance Flat. The shoreline in much of this portion of the reservoir is steep-sided and rocky, with little vegetation. Temperance Flat is the only substantial area in upper Millerton Lake with a gently sloping shoreline, shallow water, and well-developed shoreline vegetation. The stretch of the river downstream from the Kerckhoff powerhouses, flowing into Temperance Flat, is referred to as Millerton Bottoms. Big Sandy Creek and a few small, unnamed tributaries provide minor flow contributions to Millerton Lake in this reach.

The San Joaquin River upstream from Temperance Flat lies in a steep and narrow canyon that is particularly steep in the upper portion, and is known as the Patterson Bend reach. The 9-mile reach of the San Joaquin River between Kerckhoff Dam and Millerton Lake has a bedrock channel with an overall average gradient of about 1 percent, many long narrow pools, and an occasional steep cascade. The river gorge has a steep eastern side and steeper western side, capped extensively on the western side, and somewhat less extensively on the eastern side, by volcanic tables (PG&E, 1986). Several small, ephemeral streams enter the San Joaquin River in this reach. The river margins in this reach are steep and rocky and flood flows frequently scour the channel.

Sedimentation and Erosion

The substrate in the streams and river originating from direct erosion and mass wasting of resistant granite in the upper San Joaquin River watershed is generally composed of large boulders, cobbles of 4 inches or larger diameter, and fine sand, with a small number of intermediate size gravels (SCE, 2003). Since natural and cut slopes in decomposed granite erode readily and produce these coarse materials, soil erosion potential is high (FERC, 2002). In the past, sluicing to remove sediments from Kerckhoff Lake resulted in extremely high levels of sediment in the San Joaquin River downstream from Kerckhoff Dam, but flood flows in high water years may have flushed these sediments from the river into Millerton Lake. The lack of favorable conditions for chemical weathering in the watershed results in the absence of fine-grained silts and clays. Land disturbing activities, such as road building and timber harvesting, have the greatest potential to increase erosion, resulting in sedimentation in watercourses (SCE, 2003).

Hydrology

This section describes the existing hydrology of the primary study area and portions of the extended study area, including the San Joaquin River and Millerton Lake.

San Joaquin River The San Joaquin River originates in the Sierra Nevada at an elevation of over 12,000 feet and flows into the San Joaquin Valley at Friant Dam. Large areas of high elevation watershed supply snowmelt run off during the late spring and early summer months, which is the main contributor to flow in the upper San Joaquin River. Downstream from Friant Dam, the river flows westward toward the center of the valley floor, where it turns sharply northward and flows through the San Joaquin Valley to the Delta. Along the valley floor, the San Joaquin River receives additional flow from the Merced, Tuolumne, and Stanislaus rivers and numerous smaller tributaries.

Upper San Joaquin River flows have been greatly affected by storage and releases of power projects, including the SCE Big Creek Project, the PG&E Crane Valley Project, and the PG&E Kerckhoff Project. In addition to hydropower generation, reservoirs associated with these projects provide storage, flood management capacity, and recreational opportunities.

The California Data Exchange Center (CDEC) maintains estimates of unimpaired flow (flow that would occur at a specific location if upstream facilities were not in place) at various locations in the upper San Joaquin River basin. Annual unimpaired runoff from the upper San Joaquin River basin (at Friant Dam) varies widely, ranging from about 362 TAF in 1977 to 4,642 TAF in 1983, with an average of 1,818 TAF.

The reach of the San Joaquin River downstream from Friant Dam and upstream from the confluence with the Merced River was historically fed by runoff from the upper San Joaquin River. During the past 100 years, development in the region resulted in groundwater overdraft conditions, causing the river to lose much of its flow in this reach through percolation. However, implementation of the SJRRP is restoring flow in this reach, as described in more detail under the Likely Future Conditions section. In the reach between Friant Dam and Gravelly Ford, flow is influenced by releases from Friant Dam, with minor contributions from agricultural and urban return flows. Releases from Friant Dam to the San Joaquin River since 1941 are generally limited to minimum releases to satisfy water rights and provide instream flows above Gravelly Ford, and flood management releases.

Millerton Lake Millerton Lake is formed behind Friant Dam and has a capacity of 520 TAF. At full pool, the reservoir has a maximum depth of 287 feet. Above Friant Dam, the San Joaquin River drains an area of approximately 1,676 square miles. Several reservoirs in the upper portion of the San Joaquin River watershed, including Mammoth Pool and Shaver Lake, are used primarily for hydroelectric power generation. Operation of these reservoirs affects the inflow to Millerton Lake.

Water Quality

Most of Millerton Lake becomes thermally stratified during spring and summer months. Complete mixing of the water column likely occurs during winter months. Water temperatures in Kerckhoff Lake rarely exceed 68ºF. Summer water temperatures in the San Joaquin River below Kerckhoff Dam often exceed 75ºF because of low streamflow and warming of the FERC-mandated releases from Kerckhoff Dam. During summer, cold water outflows from the

Kerckhoff and Kerckhoff No. 2 powerhouses, which bypass an 8- and 9.5-mile portion of the San Joaquin River through tunnels from Kerckhoff Lake, travel downstream to the upper portion of Millerton Lake. The colder, denser river inflow submerges at a location referred to as the "plunge point," and continues to flow downstream below the warmer reservoir surface layer (Ford, 1990; PG&E, 2001). The distance in the reservoir to the plunge point is a function of the volume and temperature of San Joaquin River inflow, storage elevation of Millerton Lake, and water temperature of the reservoir surface layer. When inflow is high, the plunge point is often located near the upper end of Temperance Flat (PG&E, 1990).

Water quality in the San Joaquin River varies considerably along the river's length. Above Millerton Lake and downstream towards Mendota Pool, water quality is generally excellent. The upper reaches of the rivers draining to the San Joaquin River basin originate in large drainage areas high on the west side of the Sierra Nevada. The water in these rivers is generally soft, with low mineral concentrations. Water is nutrient- and mineral-poor due to the insolubility of the granite substrate.

As the San Joaquin River flows from the Sierra Nevada foothills below Friant Dam across the eastern valley floor, mineral concentrations steadily increase, largely as a result of depleted freshwater flows, M&I wastewater discharges, salt loads in agricultural drainage and runoff, and loads of other constituents associated with agricultural irrigation and production (DWR, 2005). These constituents include nutrients, selenium, boron, organophosphate pesticides, such as diazinon and chlorpyrifos, and toxicity of unknown origin.

Downstream from the primary study area, the reach from Gravelly Ford to Mendota Pool (about 17 miles) has been frequently dry historically, except during flood releases. However, the Settlement will increase releases from Friant Dam compared to historical operations to ensure that the reach between Friant Dam and the Merced River confluence has continuous flow dedicated to environmental purposes, which will improve water quality in this reach.

During the irrigation season, most of the water released from the Mendota Pool to the San Joaquin River is imported from the Delta via the Delta-Mendota Canal, and generally has higher concentrations of total dissolved solids (TDS) than water in the upper reaches of the San Joaquin River. Most of the water released from the Mendota Pool to the San Joaquin River is diverted at or above Sack Dam for agricultural uses. Historically, the San Joaquin River has been often dry between Sack Dam and the confluence with Salt Slough. From Salt Slough to Fremont Ford, most of the flow in the San Joaquin River is derived from irrigation return flows carried by Salt and Mud sloughs. This reach typically has the poorest water quality of any reach of the river. As the San Joaquin River flows downstream from Fremont Ford, water quality generally improves at successive confluences, specifically at those with the Merced, Tuolumne, and Stanislaus rivers.

Groundwater Resources

Within the primary study area, the majority of groundwater occurs in fractured bedrock. Localized alluvial material and weathered bedrock have potential to provide groundwater in the area, but large volumes of these materials were not identified within the Auberry-Prather area during a regional study of groundwater resources in eastern Fresno County (Fresno County, 2006).

Figure 3-1 shows the locations of groundwater subbasins underlying the San Joaquin Valley within the primary and extended study areas. Groundwater quality throughout the region is suitable for most urban and agricultural uses. Local water quality impairments do exist for such constituents as TDS, nitrate, boron, chloride, and organic compounds (DWR, 2003).

Air Quality

Air quality in the San Joaquin Valley Air Basin (SJVAB) is regulated by the San Joaquin Valley Air Pollution Control District (SJVAPCD), which consists of Merced, Madera, Fresno, Kern, Kings, San Joaquin, Stanislaus, and Tulare counties. The entire SJVAB is designated nonattainment with respect to the national 8-hour and State 1-hour ozone (O_3) standards, national and State and particulate matter (PM) standards of 10 microns in aerometric diameter or less (PM^{10}) and 2.5 microns or less ($PM^{2.5}$). Urban areas of Fresno, Modesto, and Stockton are "nonattainment" for the national and State carbon monoxide (CO) standards (ARB, 1996).

Noise

Noise levels in densely populated areas of the State are influenced predominantly by the presence of limited-access highways carrying extremely high volumes of traffic, particularly heavy trucks. Noise in rural areas, where traffic generally is low to moderate, is measured at considerably lower decibels. Noise at Millerton Lake is generally affected by the presence of boats and personal watercraft.

Figure 3-1. San Joaquin Valley Groundwater Subbasins

Biological Environment

Elements of the aquatic and terrestrial biological environment in the upper San Joaquin River basin are described in this section. The discussion focuses on habitat and species, including special-status species.

Aquatic and Fishery Resources

The following sections discuss existing aquatic and fishery resources habitat and species in the primary study area.

Habitat Under current reservoir operations, Millerton Lake water levels change by 1 foot or more per day almost 50 percent of days, and change by 2 feet or more about 10 percent of days. Extreme water-level fluctuation in reservoirs resulting from reservoir management priorities is perhaps the most important environmental factor affecting reservoir fish population productivity. The direct and indirect effects of fluctuating water levels are also responsible for other fishery management issues, such as limited cover habitat, limited littoral habitat, and shoreline erosion.

Riparian vegetation along most of the San Joaquin River from Kerckhoff Dam to Millerton Lake is poorly developed because the river margins are steep and rocky, and flood flows frequently scour the channel. Some riparian vegetation occurs at the confluence of small streams in the upper portion of this reach.

Most of Millerton Lake becomes thermally stratified during spring and summer months and, therefore, potentially supports a two-stage fishery, with cold-water species residing in deep water and warm-water species inhabiting surface waters and shallow areas near shore. When thermal stratification occurs, the largest temperature difference in Millerton Lake can be observed, particularly in the summer months, when the surface temperature can reach as high as 80°F while the temperature at the bottom of the reservoir stays as low as 50°F. During late fall and winter months, the differences in temperatures between the surface and bottom of the reservoir may vary as little as 3°F. Shallow shoreline areas, particularly in protected coves, are likely to warm and cool more quickly in response to changes in air temperatures and solar heating than the rest of the reservoir, although water temperatures of tributary streams may also affect these areas when inflows are substantial.

Species Most of the commonly occurring species in Millerton Lake are introduced game or forage species (Table 3-2). The principal game species are spotted bass, largemouth bass, smallmouth bass (collectively referred to as black bass), bluegill, black crappie, and striped bass. The principal forage species for most of the game fishes is threadfin shad. Rainbow trout, also an important game species, is frequently abundant in the upper San Joaquin River reach between Millerton Lake and Kerckhoff Dam. Several native nongame species have been collected from the reservoir, including Sacramento sucker, Sacramento pikeminnow, Sacramento blackfish, hitch, hardhead, and white sturgeon. However, most of the native species have been extirpated in recent years (Mitchell, pers. com., 2006). Aquatic species reported in the primary study area are listed in Table 3-2.

Table 3-2. Fishes Occurring Within the Investigation Primary Study Area

Common Name	Scientific Name	Study Area Distribution	Native or Introduced
Hardhead	*Mylopharodon conocephalus*	San Joaquin River	Native
Kern brook lamprey[1]	*Lampetra hubbsi*	San Joaquin River	Native
Sacramento sucker	*Catostomus occidentalis*	Millerton Lake & San Joaquin River	Native
Sacramento pikeminnow	*Ptychocheilus grandis*	Millerton Lake & San Joaquin River	Native
Sacramento blackfish	*Orthodon microlepidotus*	Millerton Lake	Native
White sturgeon	*Acipenser transmontanus*	Millerton Lake	Native
Striped bass	*Morone saxatilis*	Millerton Lake	Introduced
Largemouth bass	*Micropterus salmoides*	Millerton Lake	Introduced
Spotted bass	*Micropterus punctulatus*	Millerton Lake	Introduced
Smallmouth bass	*Micropterus dolomieui*	Millerton Lake	Introduced
Bluegill	*Lepomis macrochirus*	Millerton Lake	Introduced
Black crappie	*Pomoxis nigromaculatus*	Millerton Lake	Introduced
Rainbow trout	*Oncorhynchus mykiss*	San Joaquin River	Native
American shad	*Alosa sapidissima*	Millerton Lake	Introduced
Threadfin shad	*Dorosoma pretense*	Millerton Lake	Introduced
Hitch	*Lavinia exilicauda*	Fine Gold Creek & Millerton Lake	Native
Green sunfish	*Lepomis cyanellus*	Fine Gold Creek, Millerton Lake & San Joaquin River	Introduced

Note:
[1] Presence of Kern brook lamprey is uncertain.

American shad, which was introduced to Millerton Lake in the 1950s, has marginal value as a sport fish in Millerton Lake, but is highly sought after as a sport fish by anglers in some regions of California and other states, and is an important prey item for adult striped bass (California Striped Bass Association, pers. com., 2006). The Millerton Lake population of American shad is the only known successfully spawning, landlocked population. Because of its unique status, the population has attracted scientific interest and has been intensively studied in connection with PG&E's FERC licensing studies for the Kerckhoff No. 2 Hydroelectric Project (PG&E, 1986; 2001).

The San Joaquin River between Millerton Lake and Kerckhoff Dam has spawning habitat for American shad and striped bass. Native fish species in the reach include hardhead, Sacramento pikeminnow, Sacramento sucker, and rainbow trout. Nonnative fish species include smallmouth bass and green sunfish. Kern brook lamprey, endemic to the east side of the San Joaquin Valley, has been reported as potentially present in the San Joaquin River between Kerckhoff Dam and Millerton Lake, although its current status in the area is uncertain (Wang, 1986). In addition to fish, beds of the large, freshwater pearlshell clam (*Margaritifera* spp.) have been found on the river bottom in this reach but the distribution and abundance of this clam are poorly known. The clam is listed as a "Special Animal" by DFG, with its status in California classified as uncertain.

No aquatic species in the primary study area are Federally or State-listed as threatened or endangered. Three species have special Federal and/or State status because they are relatively rare or are declining in abundance and/or distribution: hardhead, hitch, and Kern brook lamprey.

Terrestrial Biological Resources

The following sections discuss existing terrestrial biological resource habitat and species in the study area.

Habitat Vegetation around Millerton Lake is a mosaic of habitat types, specifically annual grassland, oak woodland, and foothill pine oak woodland. Nonnative annual grassland is common on the north side of the reservoir near Friant Dam, and grades into oak woodland and foothill pine oak woodland pine to the east. The south side of Millerton Lake near Friant Dam supports more forest land than the north side but also contains small patches of grassland and urban areas. Foothill pine oak woodland is found throughout the primary study area, especially in ravines and on north- and east-facing slopes. It intergrades with blue oak woodland, which is more frequent on drier, less shaded sites, most commonly occurring on the north side of Millerton Lake. Interior live oak woodland occurs at the higher elevation limits of the primary study area on steep and rocky, north-facing slopes and becomes more abundant just outside of the primary study area. Buckbrush chaparral is the most common shrub-dominated habitat type in the study area; bush lupine scrub also occurs in the area.

Various riparian communities occur in the area, dominated by species that include white alder, sycamore, willow, cottonwood, and buttonbrush, and nonnative species such as Himalayan blackberry, fig, and Spanish broom. Riparian vegetation occurs along the San Joaquin River and its intermittent and ephemeral tributaries.

Historically, the area has been affected by manmade and natural disturbances. A number of nonnative species have been intentionally or inadvertently introduced in the course of human settlement in the region, including invasive plants and game fish and wildlife species. Cattle grazing, a traditional land use managed by BLM, is pervasive on public and private lands in the area. Ecosystems in the basin have been extensively affected by fires, and many plant and wildlife species are fire-adapted. Historical records indicate that over half of the upper San Joaquin River watershed had burned before the 1950s. Since then, fire suppression has decreased the number of fires in the study area to infrequent, random events triggered by natural causes (lightning).

Species A number of rare and listed plant species are known to occur in the primary study area. These include Ewan's larkspur, Michael's piperia, tree anemone, and Madera leptosiphon. Two plant species, the elderberry and California pipevine, which serve as hosts for invertebrates of interest, are also known to occur in the area. California pipevine is the obligate host plant for the pipevine swallowtail, a butterfly species of management concern in the primary study area because it is one of only two known nonmigratory populations. The elderberry (*Sambucus* sp.) shrub is the host plant of the valley elderberry longhorn beetle, Federally listed as threatened.

The primary study area hosts a diverse wildlife community, both resident and seasonal. A relatively diverse community of reptile and amphibian species exists in the study area. The presence of the nonnative bullfrog has changed, and continues to dramatically alter, the extant reptile and amphibian community through predation and because of its ability to out-compete native species. The western pond turtle, a California Species of Special Concern, is known to occur in several portions of the primary study area. Bullfrogs have specifically been cited as a factor in western pond turtle decline in many areas because of their predation of hatchling turtles. The Federally listed California tiger salamander has also been reported in the vicinity of the primary study area, and Critical Habitat has been designated for this species near, but outside of, the primary study area. Limited areas of potential breeding habitat for California tiger salamander have been identified in the San Joaquin River Gorge. These are primarily stock ponds dominated by nonnative species.

The bird community in the primary study area has a number of specialist species that are primarily limited to specific habitat types, while other generalist species range throughout the area using a number of habitats. For example, some species are associated with water and riparian habitats, while others are more independent of available water. Bald eagles, recently Federally delisted and currently State-listed, use roost trees near open water for foraging. Bald eagles are known to winter around Millerton Lake, and a pair has recently been observed nesting in the primary study area. Several species associated with riparian habitats, including the least Bell's vireo and willow flycatcher, have been known to occur historically in the primary study area, but have not been recently documented. As in the reptile and amphibian community, a number of nonnative birds are present in the primary study area that influence the native bird community through competition (e.g., European starlings) and nest parasitism (e.g., brown-headed cowbird). Cowbird brood parasitism has specifically been identified as a major factor in the decline of least Bell's vireo.

The mammalian community has been affected by considerable habitat change associated with livestock grazing; increased residential development; the impact of recreational activity, such as noise from boating and recreational users and the increased number of trails into more remote areas used by hikers, mountain bikers, and hunters; and suppression of the natural fire regime, which maintains suitable habitat structure and elements. A number of special-status bat species have potential to occur in the primary study area, and suitable roost sites occur throughout the area. Other special-status species that may occur in the primary study area include the ringtail, American badger, and San Joaquin pocket mouse.

Important game species also occur in the primary study area, specifically mule deer, California quail, wild turkey, and feral pigs. The region provides winter range and migratory routes for the San Joaquin deer herd. Hunting of these species contributes substantially to the local economy.

Socioeconomic Resources

This section describes socioeconomic resources in the study area, including water resources, power/energy, land use, traffic and transportation, and recreation and public access. This section will focus on socioeconomic resources of the primary study area, but include the extended study area where relevant.

Water Resources

The east side of the San Joaquin Valley includes numerous streams and rivers that drain the western slope of the Sierra Nevada Mountains and flow into the Central Valley. During the past 50 years, water resources of all major rivers have been developed through construction of dams and reservoirs for water supply, flood damage reduction, and hydropower generation. Table 3-3 summarizes the major reservoirs in the eastern San Joaquin Valley and their purposes. With the exception of the San Joaquin River, the table lists only the largest reservoir on each river. Figure 3-2 shows the reservoirs upstream from Friant Dam in the upper San Joaquin River basin.

Table 3-3. Reservoirs on the East Side of the San Joaquin Valley

Name	River or Creek	Owner	Storage (TAF)	Year Built	Operational Objectives				
					FDR	WS	HP	RF	WQ
Reservoirs in the Upper San Joaquin River Watershed									
Millerton	San Joaquin	Reclamation	520	1942	X	X		X[1]	
Kerckhoff	San Joaquin	PG&E	4	1920			X	X	
Redinger	San Joaquin	SCE	35	1951			X	X	
Florence	South Fork San Joaquin	SCE	64	1926			X	X	
Huntington	Big Creek	SCE	89	1917			X	X	
Shaver	Stevenson Creek	SCE	135	1927			X	X	
Thomas Edison	Mono Creek	SCE	125	1954			X	X	
Mammoth Pool	San Joaquin	SCE	123	1960			X	X	
Reservoirs in Other San Joaquin Valley Watersheds									
New Melones	Stanislaus	Reclamation	2,420	1978	X	X	X	X	X
Don Pedro	Tuolumne	MID/TID	2,030	1970	X	X	X	X	
Lake McClure	Merced	MID	1,025	1967	X	X	X	X	
Eastman	Chowchilla	USACE	150	1975	X	X			
Hensley	Fresno	USACE	90	1975	X	X			
Pine Flat	Kings	USACE	1,000	1954	X	X			
Kaweah[2]	Kaweah	USACE	143	1962	X	X			
Success[2]	Tule	USACE	82	1961	X	X			
Isabella	Kern	USACE	568	1953	X	X			

Notes:

[1] Per the San Joaquin River Settlement (*NRDC et al. v. Kirk Rodgers et al.*, 2006), interim restoration flows from Friant Dam will in begin in late 2009, reintroduction of fall- and/or spring-run Chinook salmon will occur by December 31, 2012, and full restoration flows will begin on January 1, 2014.

[2] Enlargement of Kaweah and Success reservoirs has been authorized. Existing capacity listed.

Key:

Owners

MID = Merced Irrigation District
MID/TID = Modesto Irrigation District/Turlock Irrigation District
PG&E = Pacific Gas and Electric
Reclamation = U.S. Department of the Interior, Bureau of Reclamation
SCE = Southern California Edison
USACE = U.S. Army Corps of Engineers

Operational Objectives

FDR = Flood damage reduction (these reservoirs have dedicated flood storage space)
HP = Hydropower generation
RF = Downstream river instream flow requirements, as mandated by operating agreements or licenses (e.g., Federal Energy Regulatory Commission, Reclamation)
TAF = thousand acre-feet
WQ = Sacramento-San Joaquin Delta water quality
WS = Water supply for irrigation, domestic, municipal, and industrial uses

Figure 3-2. Reservoirs Upstream from Friant Dam

Groundwater is a major source of agricultural and urban water supplies in the extended study area. Expansion of agricultural practices between 1920 and 1950 caused declines in groundwater levels in many areas of the San Joaquin River hydrologic region. Along the east side of the region, declines in groundwater levels have ranged between 40 and 80 feet since predevelopment conditions (1860) (Williamson et al., 1989). Groundwater levels declined substantially in the Madera County area, which depends heavily on groundwater for irrigation (Williamson et al., 1989). The cities of Fresno and Visalia are largely dependent on groundwater supplies, with Fresno being the second largest city in the United States predominantly reliant on groundwater (DWR, 2003). Typical groundwater production conditions for each subbasin are listed in Table 3-4 based on information from DWR Bulletin 160-98 (1998). At a 1995 level of development, annual average groundwater overdraft is estimated at about 240 TAF per year in the San Joaquin River hydrologic region and at about 820 TAF per year in the Tulare Lake hydrologic region (DWR, 1998). Historical groundwater use has resulted in land subsidence in the southwest portion of the region.

Table 3-4. Production Conditions in San Joaquin Valley Groundwater Subbasins

Subbasin Number[1]	Subbasin Name[1]	Extraction (TAF/year)[2]	Well Yields (gpm)[1]	Pumping Lifts (feet)[2]
San Joaquin River Hydrologic Region				
5-22.02	Modesto	230	1,000 – 2,000	90
5-22.03	Turlock	450	1,000 – 2,000	90
5-22.04	Merced	560	1,500 – 1,900	110
5-22.05	Chowchilla	260	750 – 2,000	110
5-22.06	Madera	570	750 – 2,000	160
5-22.07	Delta-Mendota	510	800 – 2,000	35 – 150
Tulare Lake Hydrologic Region				
5-22.08	Kings	1,790	500 – 1,500	150
5-22.09	Westside	210	1,100	200 – 800
5-22.10	Pleasant Valley	100	35 – 3,300	350
5-22.11	Kaweah	760	100 – 2,500	125 – 250
5-22.12	Tulare Lake	670	300 – 1,000	270
5-22.13	Tule	660	50 – 3,000	150 – 200
5-22.14	Kern County	1,400	1,200 – 1,500	200 – 250

Sources:
[1] *DWR. 2003. Bulletin 118-03. October.*
[2] *DWR. 1998. Bulletin 160-98. November.*

Key:
gpm = gallons per minute
TAF = thousand acre-feet

Central Valley Project The CVP, approved by President Franklin Roosevelt on December 2, 1935, is the largest surface water storage and delivery system in California, with a geographic area covering 35 of the State's 58 counties. The project includes 18 reservoirs with a combined storage capacity of approximately 11 MAF; eight powerhouses and two pump-generating plants, with a combined generation capacity of approximately 2 million kilowatts (kW); and approximately 500 miles of major canals and aqueducts. Figure 3-3 shows locations of major CVP and SWP facilities. Table 3-5 lists major CVP water storage facilities.

Figure 3-3. Major Central Valley Project and State Water Project Facilities

Table 3-5. Central Valley Project Water Storage Facilities

Storage Facility Name	CVP Division	CVP Storage Capacity (acre-feet)
Clair Engle Lake	Trinity River	2,447,700
Lewiston Lake	Trinity River	14,660
Whiskeytown Lake	Trinity River	241,100
Spring Creek Reservoir	Trinity River	5,900
Shasta Lake	Shasta	4,552,005
Keswick Reservoir	Shasta	23,800
Red Bluff Diversion	Sacramento River	3,920
Black Butte Reservoir	Sacramento River	143,700
Folsom Lake	American River	976,960
Lake Natoma	American River	9,030
New Melones Lake	East Side	2,420,000
San Justo Reservoir	San Felipe	9,906
Millerton Lake	Friant	520,500
San Luis Reservoir	West San Joaquin	2,040,600
O'Neill Forebay	West San Joaquin	56,400
Los Banos Reservoir	West San Joaquin	34,560
Little Panoche Reservoir	West San Joaquin	5,580
Contra Loma Reservoir	Delta	2,100

Source: Reclamation. 2008b. Central Valley Operations Office, Report of Operations. January.

Central Valley Project Operations CVP operations are divided into nine divisions. Operations north of the Delta include the Trinity, Shasta, Sacramento River, and American River divisions, known collectively as the Northern CVP System. Those south of the Delta, the Delta, West San Joaquin, and San Felipe divisions, are known collectively as the Southern CVP System. Operations of the Eastside and Friant divisions of the CVP differ from the divisions in the Northern and Southern CVP systems in that their water deliveries are not linked to Delta pumping operations.

Northern and Southern Central Valley Project Contractors and Contract Types The Northern CVP and Southern CVP supply irrigation, M&I, and refuge water to more than 250 long-term water contractors in the Central Valley, Santa Clara Valley, and Bay Area. For most water users, water service contracts represent a supply supplemental to local sources, including groundwater. Northern and Southern CVP water service contracts total 3,326 TAF/year (DWR and Reclamation, 2007).

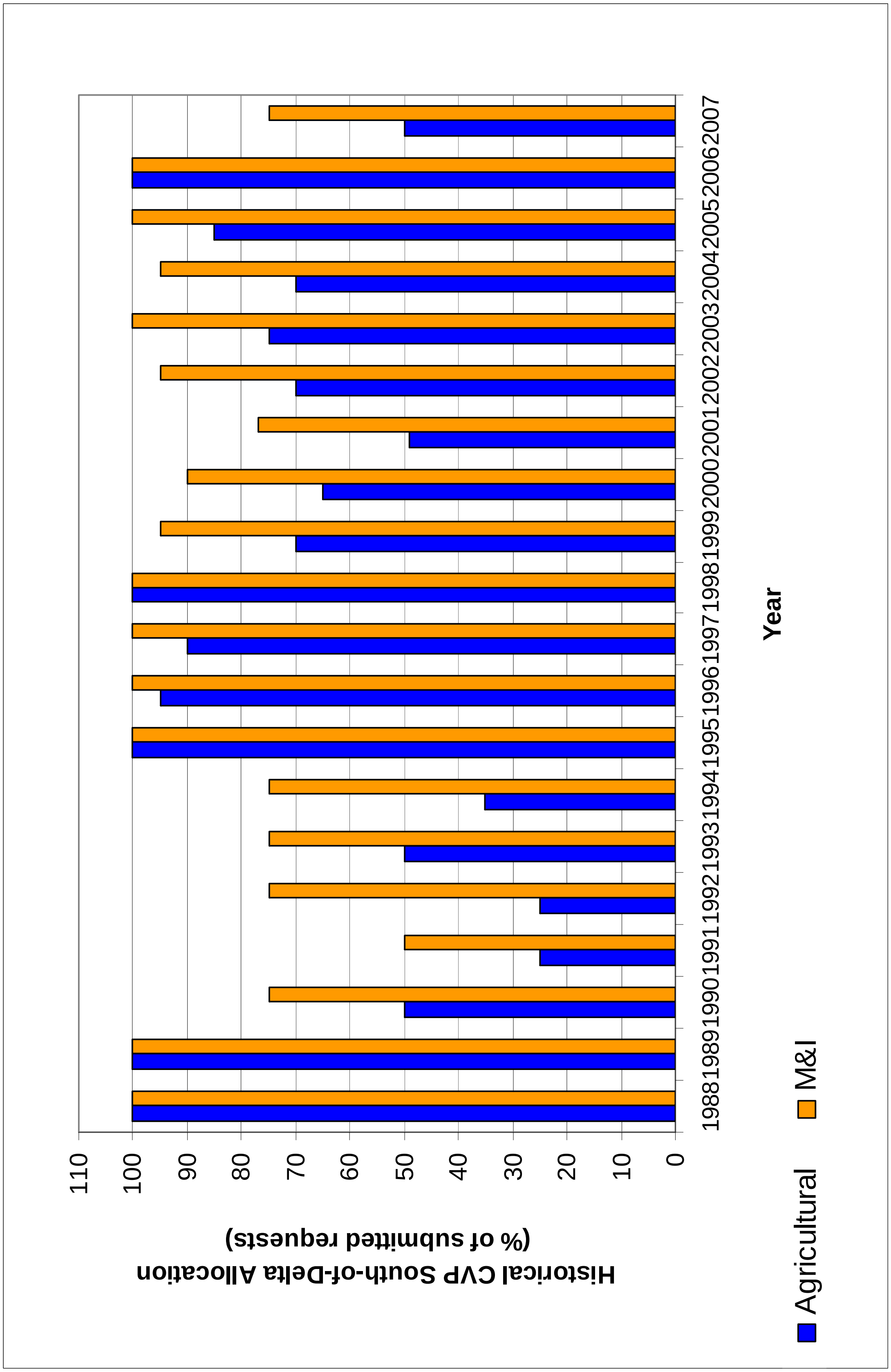
During development of the CVP, the United States entered into two types of long-term agreements with many major water right holders: the Sacramento River Settlement Contractors, and San Joaquin River Exchange Contractors. Sacramento River Settlement Contractors primarily claim water rights on the Sacramento River. Because of the major influence of Shasta Dam operations on flows in the Sacramento River, these water right claimants entered into contracts with Reclamation. Most of the agreements established the quantities of water the contractors are allowed to divert from April through October without payment to Reclamation, and a supplemental CVP supply allocated by Reclamation. CVP contracts with the Sacramento River Settlement Contractors total 2,194 TAF/year (DWR and Reclamation, 2007).

The San Joaquin River Exchange Contractors are contractors who receive CVP water from the Delta via the Mendota Pool. Under exchange contracts, the parties agreed not to exercise their San Joaquin River water rights in exchange for a substitute CVP water supply from the Delta. These exchanges allow water to be diverted from the San Joaquin River at Friant Dam for use by water service contractors in the eastern San Joaquin Valley and Tulare Lake basin. CVP contracts with the San Joaquin River Exchange Contractors total 840 TAF/year (DWR and Reclamation, 2007).

Water Deliveries The CVP irrigates about 3.25 million acres of farmland, supplies water to more than 2 million consumers, and is also the primary source of water for much of California's wetlands. Annually, the CVP has the potential to supply about 6.2 MAF for agricultural uses, 0.5 MAF for urban uses, and 0.3 MAF for wildlife refuges. The Northern and Southern CVP systems allocated an annual average of 5,734 TAF between 1998 and 2007 (Reclamation, 2008b; DWR and Reclamation, 2007).

When deficiencies in the ability of the system to deliver full contract amounts occur, deliveries are reduced by varying percentages based on demand type (e.g., refuges, settlement contracts, and CVP contracts). For north-of-Delta (NOD) and SOD operations, priority deliveries include water for wildlife refuges and water required by the CVP Exchange and Settlement Contractors. Discretionary deliveries, which can be shorted considerably depending on the type of water year, include agricultural and M&I water service contractors both north and south of the Delta. Figure 3-4 shows the historical CVP SOD allocations for M&I and agricultural uses from 1988 through 2007 (Reclamation, 2008b).

Water supply reliability is a key component of the CVP. The CVP's water supply depends on rainfall, snowpack, runoff, reservoir storage, pumping capacity from the Delta, and regulatory and environmental constraints on project operations. Since 2000, CVP water deliveries have been limited because of insufficient supply, lack of conveyance capacity, and/or operational constraints on Delta pumping resulting from either endangered species protection or implementation of CVPIA actions using a portion of the CVP yield (Reclamation and DWR, 2004).



Source: Reclamation. 2008b. Central Valley Operations Office, Water Allocations, Water Allocations_(Historical): Summary of Water Allocations.

Figure 3-4. Historical Central Valley Project Allocations for South of Delta M&I and Agricultural Uses from 1988 Through 2007

Friant Division Operations The Friant Division encompasses Friant Dam and Millerton Lake, and the Madera and Friant-Kern canals, which convey water north and south, respectively, to agricultural and urban water contractors. Friant Dam is operated as an annual reservoir, meaning all water supplies available in a given year are allocated with the expectation of delivery. River releases are made to satisfy downstream water rights and contract diversions. Under current conditions, specific releases are not made to the San Joaquin River to maintain fishery conditions downstream from Friant Dam. Consequently, Millerton Lake is not operated with objectives to manage the release of water at desired temperatures or provide carryover for use in subsequent years.

Contractors and Contract Types The Friant Division was designed and is operated to support conjunctive water management in an area that was subject to groundwater overdraft before construction of Friant Dam. The area supplied by the Friant Division remains in a state of groundwater overdraft today. Reclamation employs a two-class system of water allocation to take advantage of water during wetter years. Figure 3-5 shows the locations and acreage of the 28 long-term Friant Division water service contractors. Table 3-6 lists the total Friant Division contract amounts for each contractor.

Class 1 contracts, which are based on a firm water supply, are generally assigned to M&I and agricultural water users who have limited access to good quality groundwater. Lands served by Class 1 contracts primarily include upslope areas planted in citrus or deciduous fruit trees. During project operations, the first 800 TAF of annual water supply are delivered under Class 1 contracts.

Class 2 water is a supplemental supply and is delivered directly for agricultural use or for groundwater recharge, generally in areas that experience groundwater overdraft. Class 2 contractors typically have access to good quality groundwater supplies and can use groundwater during periods of surface water deficiency. Many Class 2 contractors are in areas with high groundwater recharge capability and operate dedicated groundwater recharge facilities.

In addition to Class 1 and Class 2 water deliveries, Reclamation Reform Act of 1982 water is provided in Section 215 of the Act, which authorizes the delivery of unstorable irrigation water that would be released in accordance with flood management criteria or unmanaged flood flows. Delivery of Section 215 water has enabled groundwater replenishment at levels higher than otherwise could be supported with Class 1 and Class 2 contract deliveries.

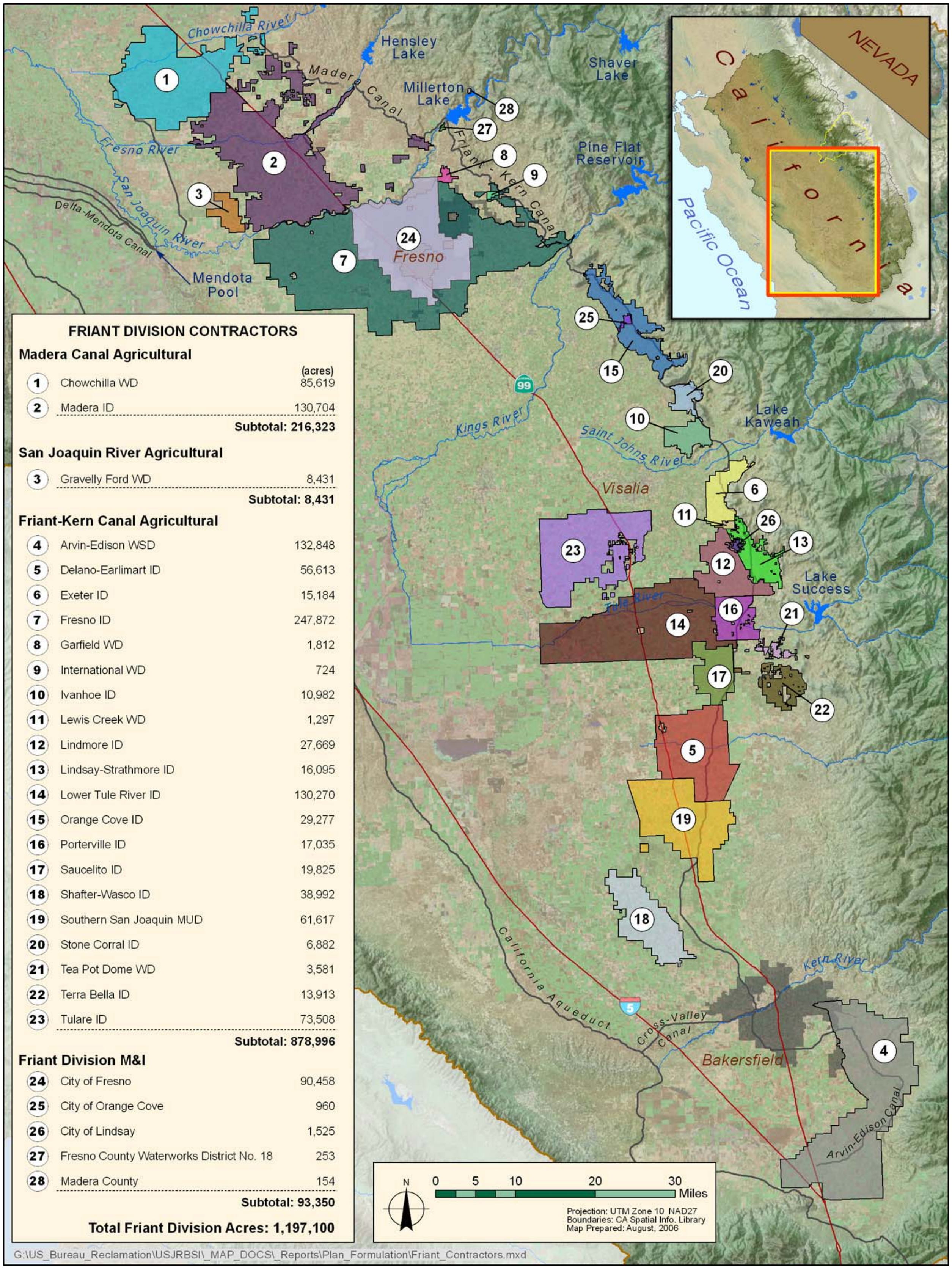


Figure 3-5. Friant Division Contractors

Table 3-6. Total Friant Division Long-Term Contracts

Contract Type/Contractor	Class 1 (acre-feet)	Class 2 (acre-feet)	Cross-Valley (acre-feet)
Friant Division Agriculture			
Madera Canal Agricultural			
Chowchilla WD	55,000	160,000	
Madera ID	85,000	186,000	
Total Madera Canal Agricultural	**140,000**	**346,000**	
San Joaquin River Agricultural			
Gravelly Ford WD	0	14,000	
Total San Joaquin River Agricultural	**0**	**14,000**	
Friant-Kern Canal Agricultural			
Arvin-Edison WSD	40,000	311,675	
Delano-Earlimart ID	108,800	74,500	
Exeter ID	11,500	19,000	
Fresno ID	0	75,000	
Garfield WD	3,500	0	
International WD	1,200	0	
Ivanhoe ID	7,700	7,900	
Lewis Creek WD	1,450	0	
Lindmore ID	33,000	22,000	
Lindsay-Strathmore ID	27,500	0	
Lower Tule River ID	61,200	238,000	
Orange Cove ID	39,200	0	
Porterville ID	16,000	30,000	
Saucelito ID	21,200	32,800	
Shafter-Wasco ID	50,000	39,600	
Southern San Joaquin MUD	97,000	50,000	
Stone Corral ID	10,000	0	
Tea Pot Dome WD	7,500	0	
Terra Bella ID	29,000	0	
Tulare ID	30,000	141,000	
Total Friant-Kern Canal Agricultural	**595,750**	**1,041,475**	
Total Friant Division Agricultural	**735,750**	**1,401,475**	
Friant Division M&I			
City of Fresno	60,000		
City of Orange Cove	1,400		
City of Lindsay	2,500		
Fresno County Waterworks District No. 18	150		
Madera County	200		
Total Friant Division M&I	**64,250**		
Total Friant Division Contracts	**800,000**	**1,401,475**	
Cross-Valley Canal Exchange			
Fresno County			3,000
Tulare County			5,308
Hills Valley ID			3,346
Kern-Tulare WD			40,000
Lower Tule River ID			31,102
Pixley ID			31,102
Rag Gulch WD			13,300
Tri-Valley WD			1,142
Total Cross-Valley Canal Exchange			**128,300**

Source: Friant Water Users Authority Informational Report, n.d. Information on Friant Division Water Deliveries.

Key:
ID = Irrigation District
M&I = municipal and industrial
MUD Municipal Utility District
WD = Water District
WSD Water Storage District

Water Deliveries Historically, the Friant Division has delivered an average of about 1,300 TAF of water annually. Since 1949, Reclamation has made annual releases of 117 TAF from Friant Dam to the San Joaquin River to meet downstream water right diversions above Gravelly Ford. Additional flows occur during years when releases are made to the San Joaquin River for flood management purposes.

Figure 3-6 shows the historical allocation of water to Friant Division contractors. As shown, annual allocation of Class 1 and Class 2 water varies widely in response to hydrologic conditions. It is important to note that average allocation percentages in the future would likely be less than the historical data presented because of implementation of the Settlement (which will be discussed in a subsequent section of this chapter).

From 1957 through 2007, annual allocations of Class 1 water were typically at or above 75 percent of contract amounts, except in 3 extremely dry years. In this same period, full allocation of Class 2 water supplies occurred in about one-fourth of the years. During the extended drought from 1987 through 1992, no Class 2 water was available and Class 1 allocations were below full contract amounts, except in 1 year. During this and other historical drought periods, water contractors relied heavily on groundwater to meet water demands.

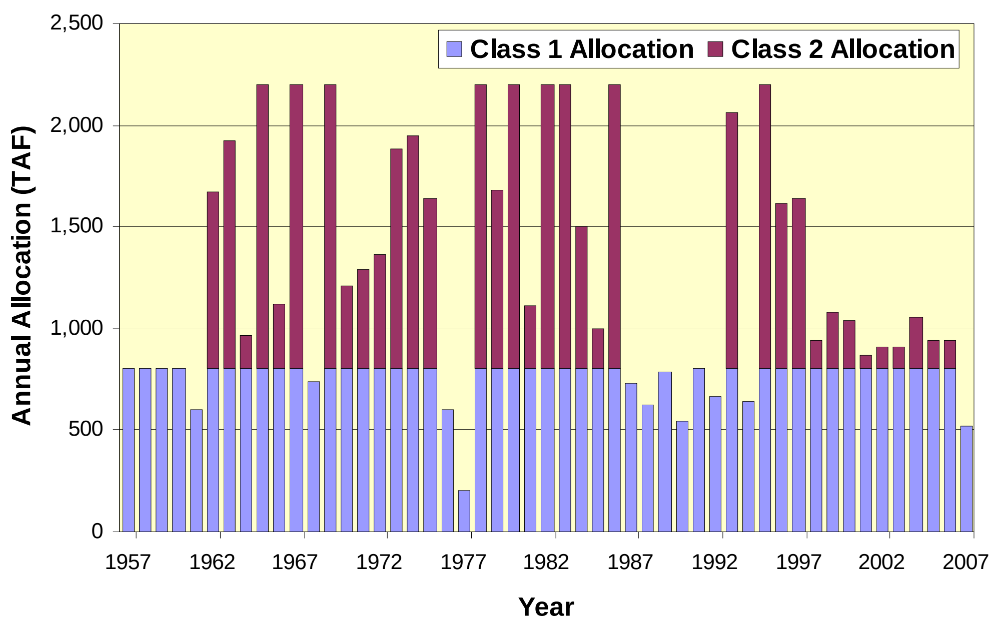


Figure 3-6. Historical Allocation to Friant Division Contractors

In addition to the Class 1, Class 2, and conjunctive management aspects of Friant Division operations, a productive program of transfers between districts takes place annually. This program provides opportunities to improve water management within the Friant Division service area. In wet years, water surplus to one district's need can be transferred to other districts with the ability to recharge groundwater. Conversely, in dry years, water is returned to districts with little or no groundwater supply, thereby providing an ongoing informal groundwater banking program within the Friant Division.

The Cross-Valley Canal, a locally financed facility completed in 1975, enables delivery of water from the California Aqueduct to the east side of the southern San Joaquin Valley near the City of Bakersfield. A complex series of water purchase, transport, and exchange agreements allows the exchange of equivalent amounts of water between Arvin-Edison Water Storage District, near Bakersfield, and eight entities with contracts for CVP water exported from the Delta. When conditions permit, water is delivered to Arvin-Edison from the California Aqueduct in exchange for water that would have been delivered from Millerton Lake.

State Water Project The SWP, planned and operated by DWR, was originally designed to deliver irrigation water to Southern California and to large San Joaquin Valley farms. It provided water to farmers in the San Joaquin Valley that were ineligible for CVP water because of acreage limitations in Federal reclamation law. Funding for the SWP was authorized by the California Legislature in 1959 and approved by the voters in 1960 through the Burns-Porter Act. Construction of the first SWP facilities, Oroville Dam and Reservoir, actually began in May 1957 because of emergency appropriations in response to previous flooding. The SWP provides water to 23 million Californians and 755,000 acres of irrigated farmland (DWR, 2008b). SWP deliveries are allocated 70 percent to M&I use and 30 percent to agricultural use (DWR, 2008c).

The SWP includes 32 storage facilities, reservoirs, and lakes; 17 pumping plants; three pumping-generating plants; five hydroelectric powerhouses; and about 660 miles of open canals and pipelines (DWR, 2008b). The locations of major SWP facilities are shown in Figure 3-3. The SWP's 20 major reservoirs have a total water storage capacity of 5.8 MAF. Storage capacities for SWP water storage facilities are provided in Table 3-7. Major SWP aqueducts include the North Bay and South Bay aqueducts, the California Aqueduct, and the West and Coastal branches of the California Aqueduct. Project water supply comes from storage at Oroville Reservoir and high runoff flows in the Delta.

Table 3-7. Major State Water Project Storage Facilities

Storage Facility Name	SWP Contracting Agency Region	SWP Storage Capacity (acre-feet)
Antelope Lake	Upper Feather River	22,600
Frenchman Lake	Upper Feather River	55,500
Lake Davis	Upper Feather River	84, 400
Lake Oroville	Oroville	3,537,600
Thermalito Afterbay	Oroville	57,000
Thermalito Diversion Pool	Oroville	13,400
Thermalito Forebay	Oroville	11,700
Bethany Reservoir	South Bay	5,100
Clifton Court Forebay	South Bay	31,300
Lake Del Valle	South Bay	77,100
Los Banos Reservoir	San Luis	34,600
O'Neill Forebay	San Luis	29,500[1]
San Luis Reservoir	San Luis	1,062,183[1]
Kern Water Bank Fan Element	South San Joaquin	1,000,000
Castaic Lake	West Branch	324,000
Elderberry Forebay	West Branch	33,000
Pyramid Lake	West Branch	171,200
Quail Lake	West Branch	7,600
Lake Perris	East Branch	131,000
Silverwood Lake	East Branch	75,000

Source: DWR. 2006b. Management of the California State Water Project Bulletin 132-05. December.

Note:
[1] Does not include Central Valley Project storage.

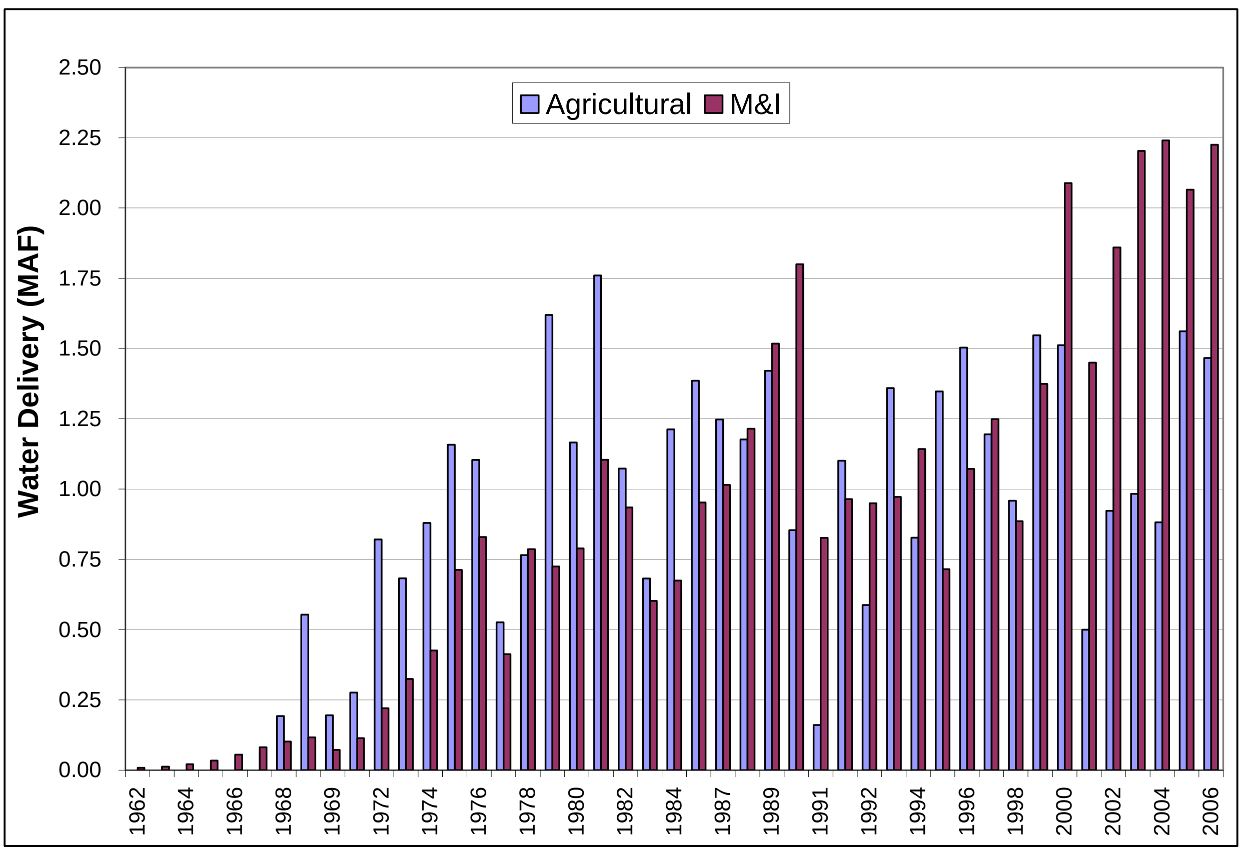
Key:
SWP = State Water Project

Contractors and Contract Types The SWP delivers water under long-term contracts to 29 public water agencies throughout the State, including the San Joaquin Valley, Tulare basin, and Southern California service areas. The public water agencies, in turn, either deliver water to water wholesalers or retailers or deliver it directly to agricultural and urban water users. Five contractors use SWP water primarily for agricultural purposes (mainly in the southern San Joaquin Valley), and the remaining 24 use the water primarily for municipal purposes.

The SWP has contracted a total of 4.23 MAF for average annual delivery. About 2.5 MAF/year are contracted for the Southern California Transfer Area, nearly 1.36 MAF/year for the San Joaquin Valley, and the remaining 370 TAF/year for the San Francisco Bay, the Central Coast, and Feather River areas.

The contracts between DWR and the 29 SWP water contractors define the terms and conditions governing the water delivery and cost repayment for the SWP. SWP contract types include Table A, Article 21, Article 56, and carryover water. The Table A amount is the maximum contractual amount that SWP contractors can request each year, and is given the first priority of delivery. Under shortage conditions, the current SWP policy is to equally impact all Table A water contractors.

Water Deliveries Figure 3-7 shows annual SWP water deliveries since the inception of the SWP. Between 1997 and 2006, annual water deliveries to SWP contractors averaged 2.92 MAF/year, and as little as 1.8 MAF/year in dry years (although the SWP was built with a capacity to deliver about 4.2 MAF of water per year) (DWR, 2008b). From 2000 through 2006, annual requests of Table A water by SWP Contractors were only met during 2006. Only 39 percent of requested Table A water allocations were delivered in 2001, which was a historically dry year. Water supply reliability for the SWP depends on many issues, including possible future regulatory standards in the Delta, population growth, water conservation and recycling efforts, and water transfers (DWR, 2008d). Two important factors that are anticipated to impact future water supply reliability to SWP contractors are pumping restrictions and climate change (DWR, 2008d).



Source: DWR. 2006b. Bulletin 132-05 (Data Provided by Paul Mendoza).

Figure 3-7. State Water Project Annual Water Deliveries

Power/Energy

The San Joaquin River watershed upstream from Millerton Lake is extensively developed for hydroelectric generation. In this area, PG&E and SCE own and operate several hydropower generation facilities, as shown in Figure 3-8. Hydropower also is generated by the FPA at the Friant Power Project; water is released from Friant Dam to the Friant-Kern Canal, Madera Canal, and San Joaquin River. In total, the upper San Joaquin River basin has 19 powerhouses with an installed capacity of almost 1,300 MW, which represents approximately 9 percent of the hydropower generation capacity in California. Table 3-8 summarizes generation capacity, date of installation, and reported annual energy generation for the PG&E Kerckhoff Project powerhouses located just upstream from Millerton Lake. As indicated by minimum and maximum values, annual energy generation varies widely.

Demographics

Based on U.S. Census 2000 data, Fresno and Madera counties have lower population densities than the California average (U.S. Census Bureau, 2008). In 2006, Hispanics made up 48 and 49 percent of the total populations of Fresno and Madera counties, respectively. Both counties have lower income levels, higher poverty levels, and lower education levels than State averages.

Employment and Labor Force

The unemployment rate for Fresno County was 9.9 percent in December 2007; Madera County’s unemployment rate was 8.5 percent during the same period. These rates are both higher than the December 2007 unemployment rate for California (5.9 percent) and the Nation (4.8 percent) (California Employment Development Department, 2008). The total number of jobs increased in both counties between December 2006 and December 2007. In Fresno County, the greatest growth occurred in the trade, transportation, and utilities sectors, with the majority of the jobs concentrated in the retail trade. The government sector was responsible for the greatest job increase in Madera County during the same period (California Employment Development Department, 2008).

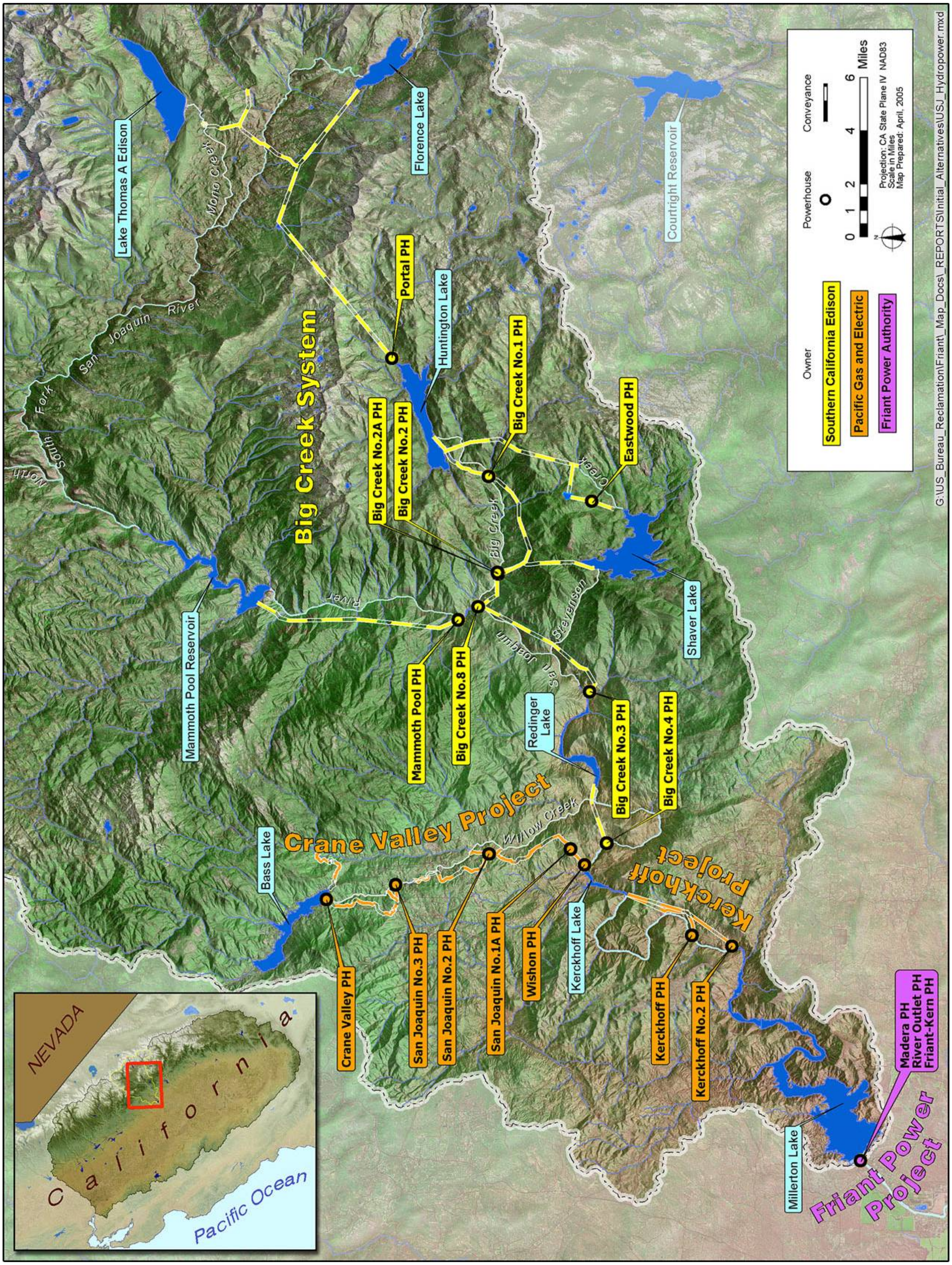


Figure 3-8. Existing Hydropower Facilities at and Upstream from Friant Dam

Table 3-8. Recent Hydroelectric Generation at PG&E Kerckhoff Project Powerhouses

Item	Pacific Gas and Electric Company	
	Kerckhoff Powerhouse	Kerckhoff No. 2 Powerhouse
Number & Type of Units	3 – Francis	1 – Francis
Capacity (MW)	38	155
Year Constructed	1920	1983
Reported Annual Generation (MWh)[1]		
1994	10,348	275,752
1995	115,930	803,490
1996	52,273	696,653
1997	72,350	695,775
1998	75,657	735,830
1999	31,959	410,567
2000	37,632	482,279
2001	10,768	316,602
2002	19,639	368,396
2003	18,850	423,974
2004	15,833	362,974
2005	51,662	670,639
2006	55,192	640,116
Minimum 1994-2006	**10,348**	**275,752**
Maximum 1994-2006	**115,930**	**803,490**
Average 1994-2006	**43,699**	**529,465**

Note:
1 Exclusive of plant use, data source is annual FERC Form 1.
Key:
FERC = Federal Energy Regulatory Commission
MW = megawatt
MWh = megawatt-hour

Lands

The primary study area, all within Fresno or Madera counties, is composed predominantly of publicly owned lands, although it also comprises private lands, including lands specifically set aside for conservation purposes. Land management in the primary study area is shown in Figure 3-9. Land use categories across private properties in the primary study area include pasture, agricultural miscellaneous, vacant residential, and single family residential.

Lands in the lower portion of Millerton Lake, near Friant Dam, are either within the Millerton Lake SRA, managed by DPR, or parcels that are privately held. Several residential areas have been established around Millerton Lake and include a total of more than 440 parcels. Further upstream from Friant Dam, most of the lands surrounding Millerton Lake are managed by Reclamation or DPR. Lands are also managed by DFG. Private properties in the area include the Sierra Foothill Conservancy (McKenzie Preserve at Table Mountain), some undeveloped parcels, and a few residences. Most lands along the San Joaquin River from Millerton Lake to Kerckhoff Dam are managed by BLM as the SJRGMA. Private lands in this area include parcels associated with the PG&E power facilities, and vacant agricultural land used for cattle grazing.

The Fine Gold Creek watershed appears to be largely undeveloped and grazed by cattle. Some scattered single-family homes, related farm structures, and access roads are present in the area. About 175 privately owned parcels, ranging in size from less than 1 to 280 acres, are located within the Fine Gold Creek watershed area encompassed by the primary study area for the Investigation. Within the lower portion of the Fine Gold Creek watershed, the Sierra Foothill Conservancy owns and manages the 718-acre Austin & Mary Ewell Memorial Preserve on Fine Gold Creek. The Sierra Foothill Conservancy holds a conservation easement for the preserve in favor of DFG to protect Fine Gold Creek and Willow Creek, preserve sensitive plant and wildlife species of the Central Valley floor and Sierra Nevada Foothills, and to maintain existing wildlife corridors (WCB, 2005).

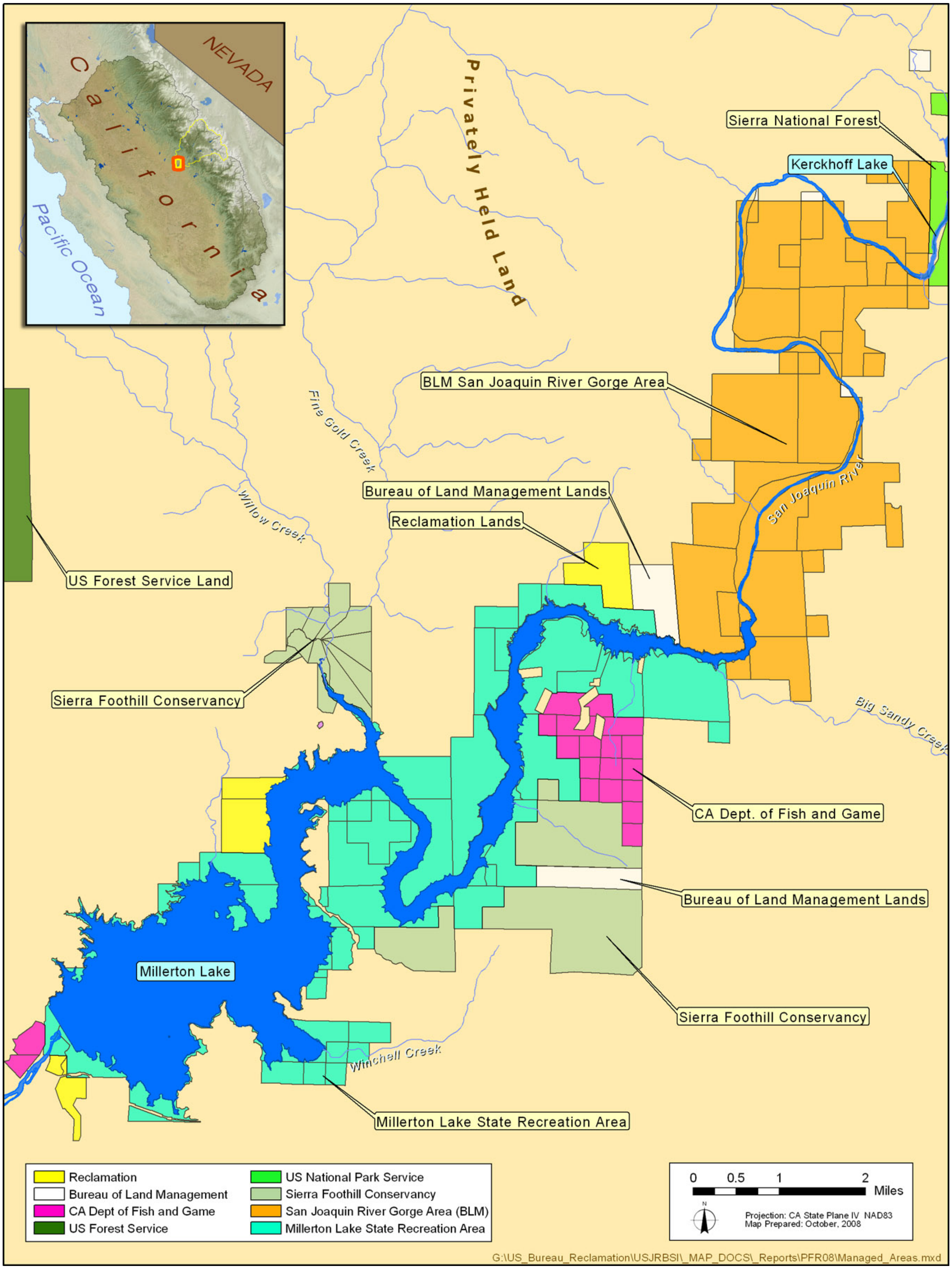


Figure 3-9. Land Management in the Primary Study Area

Traffic and Transportation

Wellbarn Road, extending to Spearhead Road from Auberry Road, provides access to Temperance Flat. Smalley Road, which spurs off Auberry Road, provides the main access to the SJRGMA and to the PG&E powerhouses, Kerckhoff and Kerckhoff No. 2. Smalley Road, a paved road, also provides access to the Kerckhoff Powerhouse switchyard, BLM primitive campground, and San Joaquin River Trail.

Powerhouse Road and Bridge connect Fresno and Madera counties across Kerckhoff Lake. Extending from Auberry Road in Fresno County to Road 222 in Madera County, the road and bridge provide access to Wishon Powerhouse for PG&E staff in Fresno County, and to schools in Fresno County for residents in the North Fork area.

Recreation and Public Access

This section provides detailed descriptions of the recreation uses in two publicly managed areas.

Millerton Lake State Recreation Area The Millerton Lake State SRA contains about 10,500 acres in total and is one of the most popular recreation areas in the San Joaquin Valley. Millerton Lake, the centerpiece of the SRA, is more than 15 miles in length, has a surface area of about 4,900 acres, and a shoreline of about 63 miles at top of active storage.

From 1996 to 2006, the SRA received an average of 440,000 visits per year, with the highest use occurring in May, June, and July. Motorboating, sailing, water skiing, jet skiing, swimming, and fishing are the primary activities. Shoreline activities include picnicking, hiking, biking, camping, and nature watching. Fall and spring are the most popular periods for activities such as hiking and mountain biking and some types of angling. Special recreation events that have been held at the lake include sailing regattas, water-ski competitions, and triathlons.

The SRA provides several recreation facilities to support these activities, most of which are located on the gently sloping southern and northern shores of the lower portion of the reservoir, closest to population centers. Facilities include boat ramps, picnic areas, campgrounds, a marina, and an historic courthouse. Year-round, visitors can take advantage of several trails for hiking, biking, and equestrian use. In addition to developed facilities, both the North Shore and South Shore areas offer a substantial amount of vehicular and pedestrian shoreline access within the fluctuation zone of the reservoir. These areas are used as informal beaches by both land-based and boating visitors and attract many visitors throughout summer. Several popular swim areas are marked with buoy lines to exclude boats.

Angling is a popular activity from both the shore and boats, with several popular game species available, including largemouth, smallmouth, and spotted bass; striped bass; rainbow and brown trout; and catfish, crappie, and bluegill. Angling is typically done in spring and early summer on the shoreline of Millerton Lake, when the lake is high enough to reach into the SJRGMA, and on the accessible portions of the river. The fishing season is open year-round and occasionally bass fishing tournaments are held on the lake.

Wildlife viewing within the SRA is enhanced by the biological diversity of the area and the variety of plant and animal species present. The lake has the largest population of wintering bald eagles in the San Joaquin Valley. Nesting bald eagle pairs have been sighted in the area along with resident golden eagles and many migratory birds that pass through the area. Other wildlife in the area includes deer, coyote, mountain lion, cottontail rabbit, and opossum.

San Joaquin River Gorge Management Area Located 5 miles northwest of Auberry, the BLM SJRGMA covers approximately 6,700 acres of land on both the north and south sides of the San Joaquin River. The area ranges from 750 feet to 2,200 feet in elevation, and is characterized by the rugged and steep-walled river canyon surrounded by hills covered with chaparral and oak woodland. The SJRGMA has experienced a rapid increase in visitation, from historical levels of about 20,000 recreation visits per year, to 60,000 to 70,000 visits the last few years. The SJRGMA offers several educational and recreational facilities, concentrated in the Squaw Leap area on the south side of the river, accessible via Smalley Road from Auberry. Various trails are available for hiking, mountain biking, and horseback riding. Other features of interest in the SJRGMA include three whitewater boating runs and the Millerton Lake Caves along Big Sandy Creek, which are situated just above the high water mark of Millerton Lake.

Hunting of game species is permitted in the SJRGMA. The hunting season lasts for 4 to 5 months in fall and winter for deer, bear, and pigs; turkeys are hunted in spring. No target shooting is available on these lands. The wide variety of flora and fauna in the SJRGMA provides many opportunities for nature study and appreciation. In the northern portion of the management area, no vehicle access exists and the river is accessible only on foot or via boat.

Cultural Environment

This section describes existing historic, prehistoric, and ethnographic cultural resources conditions in the primary study area for the Investigation. The extent of the primary study area for cultural resources evaluations during plan formulation encompasses the current top of active storage capacity elevation of Millerton Lake (elevation 580.6) to the maximum potentially affected area for all of the initial surface water storage alternatives locations, including the potential reservoir pool and a buffer around the pool equal to 50 feet vertically, or 0.25-mile laterally, whichever is less. In total, the primary study area for cultural resources evaluations during plan formulation includes 13,472 acres.

Based on combined records search results, 33 cultural resources studies have been conducted within the primary study area. These studies comprise two overviews (one that includes a reconnaissance survey), one historical structure report, 27 survey reports, one combined survey/testing report, and two eligibility-related documents. A total of 17.8 percent (2,401.4 acres) of the primary study area for cultural resources evaluations has been surveyed for archaeological resources, with the extent varying widely within the primary study area. As a result, the study area has not been subject to either comprehensive inventory or systematic sample surveys.

Archaeological and Historical Structures

The current inventory of cultural resources is largely the product of archaeological surveys, and hence it is biased toward sites, as opposed to the built environment. Sixty archaeological sites are documented within the primary study area. These include 48 prehistoric sites, six historic-era sites, and six sites with both components. Three isolates have also been recorded, including two historic-era stone walls and one prehistoric biface. Sites are considered localities where prior inhabitants of the region conducted extensive activities as opposed to isolates, which represent brief moments in time where, by and large, inconsequential activities took place. Isolated finds are considered categorically not eligible for nomination to the National Register of Historic Places (NRHP) and will not be discussed further. None of the 60 archaeological sites within the primary study area are currently listed on the NRHP. In addition, eight historic-era structures have been formally recorded within the primary study area, including five buildings, two water tanks, and Friant Dam.

The study area encompasses portions of the Squaw Leap Archaeological District, within the SJRGMA managed by BLM. The district was determined to be eligible by the Keeper of the National Register on May 5, 1980, but never formally listed. The final district boundary comprises two discontinuous areas: an upland meadow area on the Madera County side of the river and a plateau area on the Fresno County side. The Squaw Leap Archaeological District was defined based on its ability to contribute to prehistoric research issues, and includes 20 sites that are mainly bedrock milling locations, along with some residential sites. About 700 acres of this district and 11 sites are situated within the primary study area for cultural resources evaluations.

Prehistoric Resources The local prehistoric record in the study area is poorly understood because archaeological investigations within the primary study area have been largely limited to surveys. Since the primary study area lies at the interface of the Central Valley and the western Sierra Nevada, it is important to recognize the potential role that occupants of the Central Valley may have played in creating the archaeological record of this lower foothill region, and the primary study area in particular (Fredrickson and Grossman, 1973; Rosenthal et al., in press). Based on more detailed studies in the general region, it appears that much of the documented prehistoric record dates to the last 3,000 years (Moratto, 1972; 1984).

Within the primary study area for cultural resources evaluations, a total of 54 recorded sites have evidence of prehistoric occupation. These include 35 bedrock milling localities, 17 residential sites (defined by the presence of midden deposits), one lithic scatter, and one lithic scatter/bedrock milling locality. Many of the residential sites have surface evidence of house pits as well as bedrock milling features, while bedrock milling sites typically contain numerous milling elements on multiple outcrops.

Twenty of the prehistoric sites, including five residential sites, were documented along the margins of Millerton Lake downstream from Fine Gold Creek, within an area that was intensively surveyed. Only three prehistoric sites are documented along Millerton Lake near RM 274 to RM 279. The stretch of the primary study area immediately upstream from RM 279 to Kerckhoff Powerhouse contains 24 documented sites, including 11 sites that are part of the NRHP-eligible Squaw Leap Archaeological District. No prehistoric sites are documented further upstream. Minimal surveys in the Fine Gold Creek watershed documented three prehistoric sites.

An additional 19 recorded prehistoric sites lie below the current top of active storage capacity of Millerton Lake and above the low water level elevation of 500 feet (Theodoratus and Crain, 1962), including 13 bedrock milling sites, four residential sites, and one lithic scatter. An additional two sites, large prehistoric residential sites recorded by Hewes (1941) in the 1930s, were fully inundated by Millerton Lake.

Historic-Era Resources The 200-year-long historic-era in the lower foothills began in the early 1800s with initial contact between Native Americans and Europeans (first the Spanish and then other European explorers). Subsequently, prospectors rushed to the lands of the southern Sierra to find gold. Temperance Flat was one of the primary gold mining districts within the general area. Then the region began to experience urban development, as goods were funneled to the various mining districts. In the latter half of the nineteenth century and early twentieth century, the region witnessed the rise of ranching, agricultural, and rural settlements. Another notable regional development near the onset of the twentieth century was the rise of hydroelectric power companies and facilities.

A recent evaluation of Reclamation-owned buildings and structures constructed prior to 1957 in the Millerton Lake SRA near Friant Dam, and downstream from the reservoir, represents the only known study of historic-era buildings within the survey area (JRP, 2003). Eight structures were formally recorded during the study, including five buildings, two water tanks, and Friant Dam. Friant Dam and its associated outlet gates are the only historical structures recommended as eligible for listing on the NRHP.

The historic-era sites and historic-era components in the primary study area include six mining locales, two residential sites, two artifact scatters, and two Native American sites with indications of historic-era occupation. None of these 12 historic-era sites have intact standing structures.

Two of the historic-era sites are located near Millerton Lake and south of Fine Gold Creek. Only one site was recorded in the area along Millerton Lake between RM 274 and RM 279. Six historic-era sites are formally recorded immediately upstream from near RM 279 to Kerckhoff Powerhouse. In addition, Theodoratus and Crain (1962) described, but did not formally record, eight historic-era mining localities in the Temperance Flat area. Six of these localities (including several arrastras and building remnants) appear to be within the study area, mostly on the Madera County side of the river. These mining sites were given only approximate locations (to the quarter-quarter section) and, hence, cannot be integrated into this study. Based on review of known sites in the Temperance Flat area, none appears to have been formally recorded during later surveys in the area. No historic-era sites are documented further upstream along the San Joaquin River to Kerckhoff Dam.

Native American Resources

The San Joaquin River defines a topographic, political, and cultural frontier in the primary study area, where a variety of religious, economic, historic, and other values can be identified for Native American groups. Ethnohistorical investigations indicate that at the end of the prehistoric era and into the historic era, the primary study area was at the territorial boundary, or within a zone of overlapping use, for several Native American populations. Principal among these are various tribes of Foothill Yokuts (Spier R., 1954; Spier L., 1978a) and bands of Nim or Western Mono (Gayton, 1948; Spier L., 1978b). Other groups who may have used this area include Valley Yokutsan tribelets (Wallace, 1978) and the Southern Sierra Me-Wuk (Smith, 1978). Therefore, the study area was a contested landscape when Euro-Americans arrived during the latter half of the nineteenth century (Stammerjohan, 1979).

Sixteen groups, including those listed by the Native American Heritage Commission (NAHC), represent Native American interests in the study area: the Big Sandy Rancheria of Western Mono Indians; Choinumni Tribe; Cold Springs Rancheria of Mono Indians; Dumna Tribal Government; the Dumna Wo-Wah Tribal Government; Dunlap Band of Mono Indians; North Fork Mono Tribe; North Fork Rancheria; Nototonme/North Valley Yokut Tribe, Inc.; Picayune Rancheria of the Chukchansi Indians; Santa Rosa Rancheria; Sierra Nevada Native American Coalition; Southern Sierra Miwuk Nation; Table Mountain Rancheria; Tule River Tribe; and the Traditional Choinumni Tribe.

Based largely on ethnohistoric literature, 22 mostly named, historic-era Native American villages have been identified in the general region that includes the primary study area. The NAHC reviewed its sacred lands file and identified a sacred land filing within the primary study area; its location is confidential.

Initial interviews with local Native Americans have provided preliminary insight into their perspectives on the primary study area. Some of the Native Americans interviewed said that the entire study area of all reservoir alternatives from the river up to the maximum pool lines, and higher up the hill slope and cliff side, was important, including village sites, burial grounds, gathering areas, religious areas, and especially the landscape.

Native American experts who supplied information for the Investigation were largely unwilling to identify important locations within the primary study area during plan formulation. Some individuals pointed out general areas of sensitivity. No information was provided to identify the sensitivity or resource concerns within these locales (e.g., burial grounds, ancient villages, locations of important ceremonies, resource gathering areas) and all specified locations are currently treated with equal weight. These areas, depicted as large circles on maps, provide initial insight into the magnitude of modern Native American resources within the primary study area.

Forty-two sensitive areas were identified by Native Americans as of August 1, 2006, including six directly adjacent to the study area, six within the current boundaries of Millerton Lake, and 30 within the primary study area, for cultural resources evaluations. Six areas of sensitivity are located near the margins of Millerton Lake downstream from Fine Gold Creek. None are noted further upstream in the project area until above RM 279. From near RM 279 to the Kerckhoff Powerhouse, 14 areas of sensitivity were identified. Five sensitive areas are within the area along the San Joaquin River upstream to Kerckhoff Dam.

Indian Trust Assets

Indian Trust Assets (ITA) are legal interests in property held in trust by the United States for Federally recognized Indian tribes or individual Indians. The most common assets are Indian reservations, rancherias, and public domain allotments. An Indian trust has three components: (1) the trustee, (2) the beneficiary, and (3) the trust asset. ITAs can include land, minerals, Federally reserved hunting and fishing rights, Federally reserved water rights, and instream flows associated with Indian trust land.

Actions that could affect ITAs include interference with the exercise of a reserved water right; degradation of water quality where there is a water right; impacts to fish and wildlife where there are hunting or fishing rights; or noise near a land asset where the noise adversely impacts uses of the reserved land.

No Indian reservations are located within the primary study area. The nearest reservations include the Table Mountain Rancheria near Friant, Big Sandy Rancheria of Western Mono Indians near Auberry, and Cold Spring Rancheria of Mono Indians near Tollhouse. The location and number of public domain allotments within the region are unknown.

Likely Future Conditions

This section describes the changes in the environment (physical, biological, socioeconomic, and cultural) expected in the primary and extended study areas, assuming that no Federal (or State) actions are implemented to develop and manage additional water supplies in the upper San Joaquin River basin to address the stated planning objectives (described in Chapter 2). This section begins with a discussion of likely future conditions to be used in the Investigation. Identification of the magnitude of potential water resources and related problems, needs, and opportunities in the primary and extended study areas is based not only on the existing conditions described in this chapter, but also on an estimate of how these conditions may change in the future.

Two regulatory requirements were considered in describing environmental resources in the primary and extended study areas and for use in identifying the relative effects of alternative plans on these resources:

- **National Environmental Policy Act –** This act requires comparisons between the assumed "No-Action" Alternative and proposed actions. For the Investigation, the NEPA condition is important for developing an EIS to meet the requirements of NEPA.

- **California Environmental Quality Act –** This act requires comparisons between assumed "No-Project" conditions and proposed actions. A demarcation date of 2004 was established for the Investigation to address the intent of CEQA requirements.

The likely future condition includes actions reasonably expected to occur in the future. This includes projects and actions that are currently authorized, funded, and permitted. Predicting future changes to the physical, biological, socioeconomic, and cultural environments in the primary and extended study areas is complicated by implementation of the SJRRP, as well as ongoing programs and projects primarily related to CALFED and the CVPIA. Several ecosystem restoration, water quality, water supply, and levee improvement projects are likely to be implemented in the future. Collectively, these efforts may result in changes to San Joaquin River habitat and water quality, Delta water quality, water supply, and levees.

For the purposes of the Investigation, the future without-project conditions include SJRRP completion of river restoration construction and the release of full Restoration Flows, but do not include any specific projects or actions under the Water Management Goal of the Settlement. As information regarding implementation of the SJRRP is developed, these assumptions will be revised accordingly in subsequent Investigation documents.

Several projects are being implemented or are expected to be implemented in the future in the primary and extended study areas. Table 3-9 lists projects either being implemented or expected to be implemented, and an explanation of how each project is being considered for the Investigation. This list of projects will be described and will continue to be refined as the feasibility study progresses.

Table 3-9. Projects Considered in Likely Future Conditions

Project (lead agency or organization)	Without-Project Future Conditions	Cumulative Impacts Analysis
San Joaquin River Restoration Program (Reclamation)	X[1]	X[2]
Millerton Lake State Recreation Area Resource Management Plan (Reclamation and DPR)[3]		X
San Luis Drainage Reevaluation Program (Reclamation)		X
Water Use Efficiency (CALFED)[3]	X[4]	
South Delta Improvements Program (Reclamation and DWR)	X[5]	
2004 OCAP (Reclamation)	X	
Arvin-Edison South Canal Expansion (Arvin-Edison Water Storage District)	X	
Upgrade of Shafter-Wasco Irrigation District Interconnection Facilities (Shafter-Wasco Irrigation District)	X	
Cross-Valley Canal Expansion	X	
Big Creek Hydroelectic System Alternative Licensing Process (SCE)		X
Environmental Water Account (Reclamation and DWR)	X	
Friant Dam Fish Water Release Powerhouse (FPA and Orange Cove Irrigation District)[3]		X
CVP Contract Renewals (Reclamation)	X	
Further Implementation of CVPIA (b)(2) Water Accounting (Reclamation)	X	
Fresno County HCP (Fresno County)		X
New Land Development Projects (various)		X

Notes:
[1] Includes Restoration goal actions.
[2] Includes Water Management goal actions.
[3] Also considered as a potential management measure to address planning objectives and opportunities of the Investigation.
[4] Includes Common Assumptions.
[5] Water operations modeling performed for the Investigation to date assumes 6,680 cfs pumping capacity at Banks Pumping Plant.

Key:
cfs = cubic feet per second
DPR = California Department of Parks and Recreation
DWR = California Department of Water Resources
HCP = Habitat Conservation Plan
OCAP = Operations Criteria and Plan
Reclamation = U.S. Department of the Interior, Bureau of Reclamation
SCE = Southern California Edison Company

Various other projects and programs are expected to be implemented in the future, including CVP contract renewals and further implementation of CVPIA(b)(2) water accounting, and land development plans and projects in the primary and extended study areas. There are several other potentially relevant developing studies and priorities that are not currently included in the Investigation likely future conditions, including Delta Vision recommendations, the Bay-Delta Conservation Plan, and Delta conveyance. Other emerging concerns and trends such as climate change may also influence the likely future conditions.

The remainder of this chapter describes some of the future changes in physical, environmental, socioeconomic, and cultural conditions expected to occur in the primary and extended study areas.

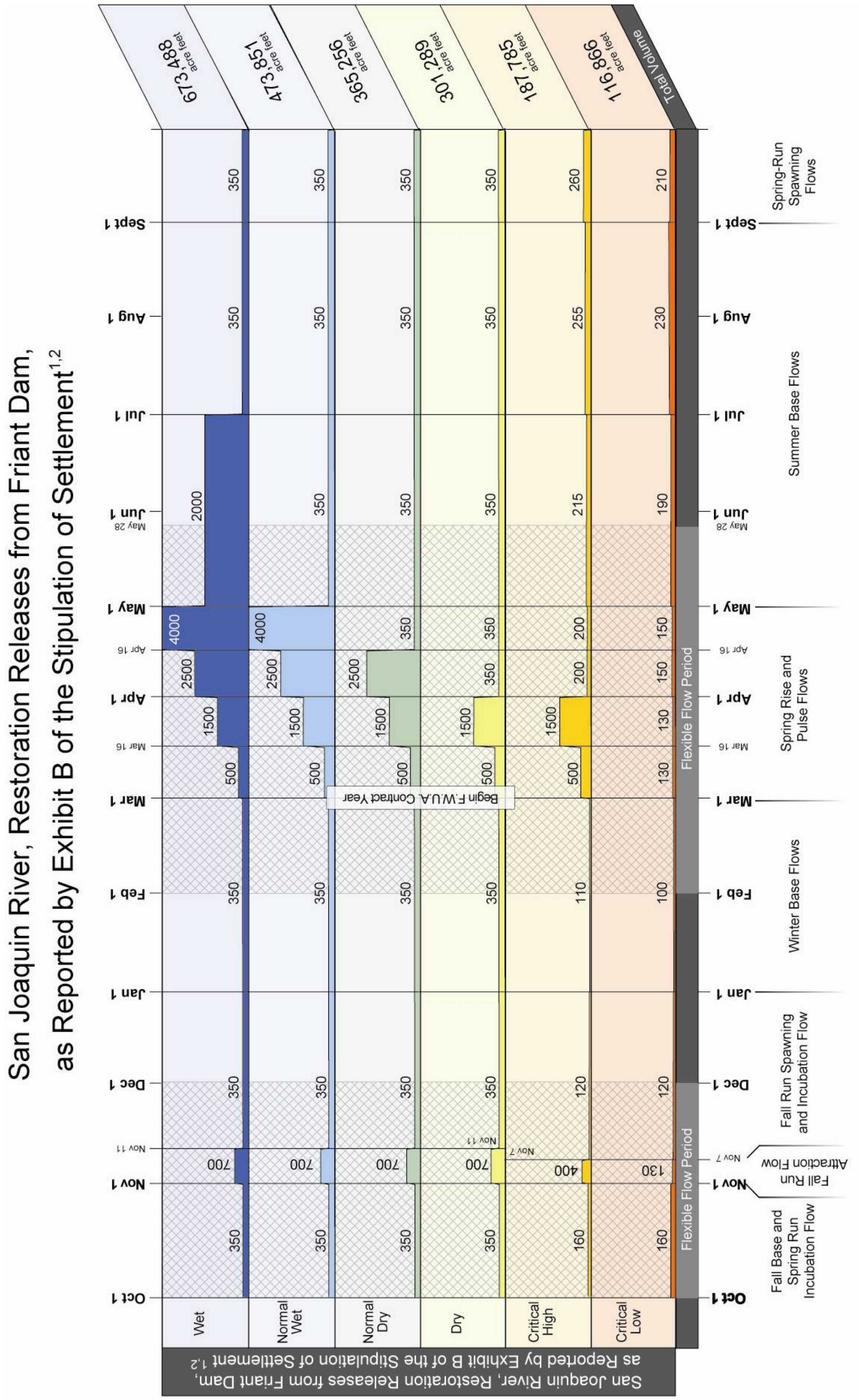
Physical Environment

Implementation of the SJRRP will result in changes in hydrologic conditions in the San Joaquin River below Friant Dam through changed releases to the San Joaquin River. The Settlement includes a set of six different Restoration Flow hydrographs that vary in shape and volume according to annual unimpaired runoff in the basin (SJRRP, 2007a). Graphically, the Restoration Flow regimes for all year-types are shown in Figure 3-10, representing period-identified constant flow values for a potentially daily varying or ramped flow regime. Average annual flood releases from Friant Dam are also anticipated to decrease through implementation of SJRRP actions. Water year-type definitions are currently under refinement, but the most recent definitions are as follows, based on annual October-through-September unimpaired flow below Friant Dam:

- Wet, equal to or greater than 2,500,000 acre-feet
- Normal-wet, equal to or greater than 1,450,000 acre-feet
- Normal-dry, equal to or greater than 930,000 acre-feet
- Dry, equal to or greater than 670,000 acre-feet
- Critical-high, equal to or greater than 400,000 acre-feet
- Critical-low, less than 400,000 acre-feet

Physical changes to the San Joaquin River from Friant Dam to the Merced River are expected to be implemented through the SJRRP. These changes include levee modifications associated with improving habitat conditions in the San Joaquin River, and channel capacity changes to accommodate Restoration Flows.

Physical conditions in the primary study area are expected to remain relatively unchanged in the future. No changes to area topography, geology, or soils are foreseen. Without major physical changes to the river systems upstream from Friant Dam (which are unlikely), hydrologic conditions would probably remain unchanged. Some speculation exists that regional hydrology would be altered should there be substantial changes in global climatic conditions. Scientific work by others in this field of study is continuing.



1 - NRDC v Rodgers, Stipulation of Settlement, CIV NO. S-88-1658 - LKK/GGH, Exhibit B, September 13, 2006
2 - Hydrographs reflect assumptions about seepage losses and tributary inflows which are specified in the settlement

Figure 3-10. San Joaquin Restoration Program Hydrograph at Friant Dam – All Year-Types

A serious consequence of long-term groundwater overdraft in the San Joaquin and Tulare Lake hydrologic regions is land subsidence, or a drop in the natural land surface. Land subsidence results in a loss of aquifer storage space and may cause damage to public facilities such as canals, utilities, pipelines, and roads. With additional flows discharged from Friant Dam due to the Settlement, and continued increased demands on the groundwater system without new surface water supplies, continued groundwater overdraft is expected in the future.

Much effort has been expended to control the levels and types of herbicides, fungicides, and pesticides that can be used in the environment. Further, efforts are underway to better manage the quality of runoff from urban environments to major stream systems. Water quality conditions in the future without-project conditions upstream from Friant Dam are expected to generally remain unchanged and similar to existing conditions. However, with implementation of the San Luis Drainage Feature Reevaluation selected alternative, SJRRP actions, and various TMDLs, water quality conditions downstream from Friant Dam in the future are expected to improve over existing conditions.

Most of the air pollutants in the primary and extended study areas would continue to be influenced by both urban and agricultural land uses. As the population continues to grow, with about 4 million additional people expected in the Central Valley by 2030, and agricultural lands converted to urban centers, a general degradation of air quality conditions could occur.

Biological Environment

As described earlier, the SJRRP will include plans to implement Settlement goals, including the Restoration Goal to restore and maintain fish populations in "good condition" in the mainstem San Joaquin River below Friant Dam to the confluence of the Merced River, including naturally reproducing and self-sustaining populations of salmon and other fish (NRDC et al., 2006). Additional efforts are underway by numerous agencies and groups to restore various biological conditions throughout the study area. Accordingly, major areas of wildlife habitat, including wetlands and riparian vegetation areas, are expected to be protected and restored. However, as population and urban growth continues and land uses are converted to urban centers, wildlife and plants dependent on native habitat types may be adversely affected.

Through the efforts of Federal and State wildlife agencies, populations of special-status species in the riverine and nearby areas are estimated to generally remain as under existing conditions. Although increases in anadromous and resident fish populations in the San Joaquin River are likely to occur through implementation of projects such as the SJRRP, some degradation may occur through actions that reduce San Joaquin River flows or elevate water temperatures.

Socioeconomic Resources

California's population is estimated to increase from about 34 million in 2000 to about 47.5 million by 2020 (DWR, 1998). In the San Joaquin River basin, the population is expected to nearly double from about 1.8 million to nearly 3.0 million by 2020 (DWR, 1998). Population increases in Fresno and Madera counties are expected to be much higher than the State average through 2050. The Fresno County population is predicted to grow at a rate of 49 percent between 2000 and 2020; the Madera County population is predicted to increase by 71 percent in the same period (California Department of Finance, 2007). The ongoing rapid rate of urbanization in the region would generate major land and water use challenges for the entire San Joaquin Valley.

Increases in population would increase demands for electric, natural gas, and wastewater utilities; public services such as fire, police protection, and emergency services; and water-related and communication infrastructure. The increase in population, and the aging "baby boomer" generation would increase the need for health services. The region's superior outdoor recreational opportunities and moderate housing cost are expected to attract increasing numbers of retirees from outside the region and the State. An increasing population would produce employment gains, particularly in retail sales, personal services, finance, insurance, and real estate. Recreation is expected to remain an important element of the community and regional economy.

Anticipated increases in population growth in the Central Valley would also increase demands on water resources systems for additional and reliable water supplies, energy supplies, water-related facilities, recreational facilities, and flood management facilities. Table 3-10 summarizes estimated water demands (applied water), supplies, and potential shortages for 2020 levels of demand in the Sacramento River and San Joaquin River basins and for California. As shown in the table, estimated future shortages of water supplies in drought years are expected to be substantial. Increases in population and water demand are expected to continue well beyond the planning horizon of the Investigation.

Potential water shortages under 2020 demands, however, may be greater than shown in Table 3-10. With implementation of the Settlement, the Restoration Flows will be treated as required releases and consequently will affect the amount of water available for Friant Division deliveries, although Friant Division contract amounts will remain unchanged. Diversions to the Friant-Kern and Madera canals will be reduced with implementation of the Settlement. Total canal diversions for existing operations are simulated to average 1,344,000 acre-feet per year during the 1922 through 2004 period of analysis, while canal diversions with Settlement Restoration Flow conditions are simulated to average 1,136,000 acre-feet per year (SJRRP, 2007a). This indicates that an annual average reduction in canal diversions of 208,000 acre-feet per year would occur with the Settlement compared to current operations. The Settlement does not include specific actions to achieve the Water Management Goal, nor does it specify quantities of water supply to be replaced.

Table 3-10. Estimated Water Demands, Supplies, and Shortages for 2020

Item	Sacramento and San Joaquin Hydrologic Basins – Two-Basin Total		State of California	
	Average Year	Drought Year	Average Year	Drought Year
Population (million)	6.8		47.5	
Urban Use Rate (GPCPD)	274	288	226	233
Acres In Production (million)	4.1		9.2	
Agricultural Use (AFPA)	3.6	3.9	3.4	3.5
Applied Water (MAF)				
Urban	2.1	2.2	12.0	12.4
Agricultural	14.4	15.5	31.5	32.3
Environmental	9.3	6.1	37.0	21.3
Total	***25.8***	***23.9***	***80.5***	***66.0***
Water Supply (MAF)				
Surface Water	20.7	16.0	65.0	43.3
Groundwater	4.9	6.2	12.7	16.0
Recycled/Desalted	0	0	0.4	0.4
Total	**25.6**	**22.2**	**78.1**	**59.7**
Shortage (MAF)	**0.2**	**1.7**	**2.4**	**6.3**

Source: DWR. 1998. California Water Plan Update, DWR Bulletin 160-98. November.

Key:
AFPA = acre-feet per acre
GPCPD = gallons per capita per day
MAF = million acre-feet

The reduction in canal diversions mirrors the increase in total river releases. On a long-term average basis, the increases in river releases would be met with a comparable reduction in canal diversions. Releases to the San Joaquin River include minimum release requirements and flood releases.

Table 3-11 expresses simulated deliveries with Restoration Flows in terms of total system water deliveries by year-type. An average annual delivery of 1,073,000 acre-feet is for the Restoration Flow condition (SJRRP, 2007a).

It is anticipated that implementing Settlement Restoration Flows would affect water levels at Millerton Lake. The effects of these changes on recreation use at Millerton Lake have not been evaluated to date.

It is anticipated that implementing Settlement Restoration Flows would affect FPA power generation at Friant Dam, but would not affect power generation at PG&E or SCE powerhouses upstream from Millerton Lake. Based on preliminary monthly hydropower modeling simulations, average annual power generation for the Friant Power Project would be about 71 gigawatt-hours/year, compared to a historical average (1986 through 2003) of about 79 gigawatt-hours/year.

In April 2006, Orange Cove Irrigation District filed an application with FERC to augment the generating capacity of a small turbine on a river outlet diversion to a fish hatchery by using Restoration Flow releases from Friant Dam. In March 2008, Orange Cove Irrigation District informed FERC of a partnership with the FPA to construct the new powerhouse. The proposal adds 1.8 MW in capacity, although this may increase in the future. This potential increase in generation from the Investigation has not been evaluated to date.

Table 3-11. Average Friant Dam Simulated Water Deliveries by Year-Type

Year Type	Total System Water Deliveries (TAF)		
	Existing	Future Without-Project	Change in Deliveries
Wet	1,904	1,739	-165
Normal-Wet	1,564	1,276	-288
Normal-Dry	1,032	828	-204
Dry	715	564	-151
Critical-High	462	336	-126
Critical-Low	259	257	-2
All Yrs Avg.	**1,281**	**1,073**	**-208**

Source: SJRRP. 2007a. Water Operations Existing and Future Without-Project Conditions Draft Technical Memorandum. December.

Note:
Values are reported for contract-year (March-February) period.

Key:
Avg. = average
TAF = thousand acre-feet
Yrs = years

Cultural Resources

The cultural resources currently situated between the high-water and low-water levels of Millerton Lake would continue to be impacted by erosion due to reservoir fluctuations. These archaeological sites, and others situated around the perimeter of the existing reservoir, and other accessible locations within the primary study area (both documented and undocumented), would continue to be subject to collection and occasional inadvertent impacts from recreation. The Native American community members would continue their ceremonies within the primary study area and would be able to maintain their traditional spiritual connection to the primary study area. They would also continue to gather plant and animal species from historically important areas. Similarly, conditions related to the cultural environment downstream from Friant Dam are unlikely to change considerably, other than potential changes that may result from implementing SJRRP actions, which are yet to be determined.

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