CHAPTER 2.0

AFFECTED ENVIRONMENT

This chapter describes existing conditions and future without-project conditions in the study area. The future without-project conditions are the expected physical, environmental, and social conditions in the study area if no flood control project is constructed. The without-project condition is the condition against which flood protection plans are formulated and evaluated and also serves as the environmental baseline for assessing effects of the alternatives.

For purposes of assessing the environmental consequences of the project alternatives and the study area will consist of the subareas described below.

L. L. Anderson Dam. The area encompassing and immediately adjacent to the L. L. Anderson Dam spillway and the segment of the Middle Fork of the American River just downstream of the dam.

Folsom Reservoir Area. The area encompassing (1) Folsom Dam and Reservoir and the stilling basin downstream from the dam, (2) the residential development surrounding the dam and reservoir, and (3) the footprint of the reservoir (including the downstream portions of the North and South Forks of the American River), which would be subject to periodic changes in surface elevation.

Lower American River. The area encompassing (1) the American River Parkway (Parkway), including Lake Natoma, and (2) the flood plain of the Lower American River from Folsom Dam downstream to the confluence with the Sacramento River.

Downstream from the American River. The area encompassing (1) the Sacramento River downstream from the mouth of the Natomas Cross Canal, (2) the Yolo Bypass and the lands immediately adjacent to the bypass, (3) the Sacramento Weir and Bypass and adjacent lands, and (4) the Sacramento–San Joaquin Delta (Delta), the roughly triangular area bounded by the City of Sacramento on the north, Pittsburg on the west, Tracy on the south, and Stockton on the east.

2.1 Facilities and Projects

2.1.1 Folsom Dam and Reservoir

Folsom Dam is on the main stem of the American River, approximately 29 miles upstream from the Sacramento River. It is a multipurpose project operated by the Bureau as part of the CVP. The dam regulates runoff from approximately 1,860 square miles of drainage area and has a total (full-pool) capacity of approximately 975,000 acre-feet. The top of the conservation pool is at an elevation of 466 feet, the top of dam elevation is at 480.5 feet, and the top of the spillway crest is at 418 feet. The current maximum surcharge flood control pool is at 475.4 feet. The objective release for flood control from the dam to the Lower American River is 115,000 cubic feet per second (cfs). This amount constitutes the basic capacity of the Lower American River; it is the largest sustained, nondamaging flow.

Given a specified event, Table 2-1 provides information on the number of hours the pool would occupy the indicated elevation bands. This table will allow comparison of the durations experienced under the 'existing condition' with those for each of the raise alternatives.

The top of the flood control pool at Folsom Reservoir is 470 feet. The designated flood space varies between 400,000 and 670,000 acre-feet. With the current Emergency Spillway Release Diagram (ESRD), the maximum allowable water surface is at a pool elevation of 475.4 feet (also referred to as the spillway design flood).

Water is released from eight gated outlets at the lower level of the dam, five main spillway gates, and three auxiliary spillway gates (used only in emergencies). Releases are restricted by both the capacity of the discharge structures and limits on the increases in release rates. The maximum capacity of the low-level outlets is approximately 35,000cfs. During a flood event, the reservoir begins to fill once inflows exceed outflows. The outflow rates would remain at 115,000 cfs (objective release) until water levels in the reservoir reach the spillway crest and releases can be made from the main spillway gates. The objective release flow is the largest sustained nondamaging flow that can be conveyed through the Lower American River channel. The operation plan restricts the maximum rate of increase in flows to 15,000 cfs per hour until outflow reaches 115,000 cfs. As inflows continue to increase, more water is released from the spillways to protect the dam. A maximum of 160,000 cfs can be released on a limited emergency basis without causing a downstream levee failure and flooding in the Sacramento area.

As shown in Table 2-1, Folsom Reservoir, with its current operations rules, can attenuate a flood event with between a 1-in-100 to 1-in-150 chance of occurring in any one year.

Operations. Folsom Dam was constructed with a seasonally designated flood control storage space of 400,000 acre-feet. However, the Water Resources Development Act (WRDA) of 1996 authorized an interim agreement between the Bureau and Sacramento Area Flood Control Agency (SAFCA) to change the flood control storage available in the reservoir to a variable space ranging from 400,000 to 670,000 acre-feet, depending on the amount of creditable vacant space in several existing upstream reservoirs in the basin. The Bureau and SAFCA are working on finalizing this agreement.

Under reoperation, a flexible rule curve operation is used. This operation includes varying the flood control space required in Folsom Reservoir through the crediting of actual incidental space available in reservoirs upstream from Folsom Dam. Eighteen reservoirs exist in the American River Basin above Folsom. Flood control is not a project function of any of these reservoirs. Of the 18 reservoirs, only five have enough storage space to allow for a measurable influence on flood operation. These five reservoirs are French Meadows, Hell Hole, Loon Lake, Union Valley, and Ice House.

The drainage basins above the reservoirs have captured and stored a minimum of 12 percent of the unregulated runoff to Folsom Dam during the critical period of major flood events. The percentage of flows and, consequently, the distribution of space in the upstream reservoirs that is considered for credit at Folsom Reservoir are based on historical runoff during major floods. Their drainage basins cannot be relied on to generate additional flows because of

TABLE 2-1. Existing Hydrologic Conditions at Folsom Reservoir during Various Flood Events

Flood Recurrence Interval	50-year	100-year	150-year	200-year	250-year	500-year
Probability of exceeding event in any year	2%	1%	0.67%	0.5%	0.4%	0.2%
Peak Inflow (cfs)	274,859	353,537	405,215	444,574	476,705	585,925
Peak Outflow (cfs)	115,000	124,610	200,540	328,440	407,910	535,020
Duration release is greater than or equal to objective release (hrs)	0	23	47	69	74	99
Maximum Reservoir Stage (ft)	470.57	472.51	474.01	474.66	475.19	477.86
Duration stage is greater >466<470 (hrs)	36	45	44	38	32	41
Duration stage is greater >470<478[1](hrs)	11	23	20	18	18	26
Duration stage is greater >478<482 (hrs)	0	0	0	0	0	0
Duration stage is greater >482<487 (hrs)	0	0	0	0	0	0

[1] Elevations 478 feet, 482 feet, and 487 feet are design pools for the various raise alternatives. Given a specified event, this table provides information on the number of hours the pool would occupy the indicated elevation bands. This table will allow comparison of the durations experienced under the 'existing condition' with those for each of the raise alternatives.

the relatively small drainage area above these upstream reservoirs, their location and elevation in the American River Basin, the historical distribution of floods, and other factors. The snow level and existing snowpack, both directly related to elevation, affect the effectiveness of space available in the upstream reservoirs during any given flood event. Typically, the snow level during major storms occurs at or above 5,000 feet.

The maximum creditable upstream space was determined to be 200,000 acre-feet. This creditable space is divided among three of the upstream reservoirs: French Meadows (45,000 acre-feet), Hell Hole (80,000 acre-feet), and Union Valley (75,000 acre-feet). Any additional space does not benefit Folsom Dam operation during a major flood event because the drainage basins above these reservoirs do not generate a significantly greater volume during the critical period of a major flood event.

Release Capacity. Folsom Dam has limited capability to make flood releases until the reservoir is nearly three-fourths full. Currently, lower level outlets can release only 35,000 cfs when the lake level is below the spillway crest. After the water surface is above the spillway crest, releases up to the downstream channel capacity of 115,00 cfs (objective release) can be made, depending on water surface and reservoir inflow.

If the water surface continues to rise, releases would increase flow to the emergency release flow of 160,000 cfs. If the reservoir continues to rise to surpass the top of the flood control surcharge space at the 470-foot elevation, the release would increase to prevent the overtopping of the gates.

Dam Safety. Folsom Dam’s existing spillway capacity is inadequate to protect the dam from an extreme flood event. The probable maximum flood (PMF) is the largest flood that can reasonably be expected to occur in the basin. The Corps and the Bureau have revised the PMF based on new hydrology guidance and information about snowmelt as observed in the 1997 floods. The PMF results in an inflow to Folsom Dam of approximately 1,000,000 cfs. Currently, the dam can pass 70 percent of the PMF. Determination of Folsom Dam’s capacity to safely pass the PMF is dependent on operational assumptions such as antecedent reservoir conditions and how many gates are open. Criteria used by the Corps for routing PMF through Folsom Dam are documented in the Hydrology section in the Engineering Appendix. A contributing factor to the PMF is failure of L. L. Anderson Dam (French Meadows Reservoir). This is a water supply and recreation dam owned by Placer County Water Agency. If L. L. Anderson Dam were modified to pass the PMF, the resultant PMF at Folsom Dam would be reduced to 900,000 cfs. Folsom Dam would pass 85 percent of the PMF if L. L. Anderson Dam were modified and Folsom modifications were in place.

Studies indicate that existing Folsom Dam and Reservoir operations would only be able to safely contain and pass about 70 percent of the volume of reservoir inflow during the PMF. The PMF is a designated worst-case flood where peak inflow to Folsom Reservoir would be approximately 1,000,000 cfs and could cause Folsom Dam to fail. Widespread flooding would occur in the Sacramento and downstream areas in the event a PMF were to occur. Inadequate spillway capacity at the L. L. Anderson Dam at French Meadows Reservoir, located on the Middle Fork of the American River about 40 miles upstream of Folsom Reservoir, is an existing factor that exacerbates dam safety issues at Folsom Dam. In the event of a PMF, it is assumed that L. L. Anderson Dam would also have a high probability to fail and would account for a significant portion of the predicted peak inflow to Folsom Reservoir. French Meadows Reservoir has a storage capacity of approximately 136,000 acre-feet and a spillway capacity of about 13,000 cfs.

The Corps' Waterways Experiment Station conducted seismic stability analyses of all features of the Folsom project in the 1980's. A series of eight reports were published between 1987 and 1989 indicating that a seismic stability deficiency existed at Mormon Island Auxiliary Dam. All other features of the project were declared stable considering a Maximum Credible Earthquake (MCE) of Magnitude 6.5, occurring at a distance of 15 km on the East Branch of the Bear Mountains Fault Zone. This earthquake was estimated to generate rock outcrop ground motion parameters of 0.35 g peak acceleration, 20 cm/sec peak velocity, and a duration of ground motion above 0.05 g of 16 seconds. Extensive liquefaction of the dredged alluvium foundation under Mormon Island Auxiliary Dam was anticipated from this level of shaking.

To remediate the Mormon Island Auxiliary Dam foundation, several construction contracts were awarded and ground modification was performed between 1990 and 1994. Dynamic compaction was used to densify the upstream foundation and stone columns were constructed to densify and improve drainage of the downstream foundation. The seismic stability of the Mormon Island Auxiliary Dam was dramatically improved by this work, however, the Bureau is currently studying the deepest portions of the upstream foundation where density may still be inadequate to preclude significant strength loss during the design earthquake. A decision on the need for additional ground improvement is pending. The final dynamic analysis of the remediated Mormon Island Auxiliary Dam by the Corps is pending the outcome of the Bureau studies.

Folsom Dam's inability to pass the PMF is recognized as a dam safety problem by the Corps, the Bureau, and the California State Division of Safety of Dams.

2.1.2 Folsom Dam Roadway

The dam roadway was designed and built to service the dam; it was not intended for the current traffic levels. After the road was built, however, use of the road was expanded to provide access to lake area recreation facilities. Encroaching urban development has made the dam an important traffic link from areas east of the dam and north of Folsom to developing areas to the east. Folsom and surrounding areas depend on this roadway for daily use. The Folsom Dam Roadway is designed to accommodate vehicle loading of 11,000 vehicles per day (VPD). This level of use meets the City of Folsom's maximum level of service (LOS) criteria for intersections and highways in the city. Current vehicle loading is 16,000 VPD and is expected to increase to approximately 18,300 VPD by 2005. The existing annual maintenance cost for the roadway is $28,000.

Public traffic across the dam impedes dam operation and maintenance (O&M) work and exposes the dam to vandalism, terrorist attacks, and toxic spills. The Bureau regards the public traffic across the dam as a safety and security problem.

2.1.3 American and Sacramento River Levee System

Most of the levees surrounding the Sacramento urban area were first constructed to protect farmlands and an emerging city. Plate 2-1 shows the existing levee system. These levees were significantly upgraded between 1916 and 1958 and further upgraded in the early 1990s. The American River levee system is designed to contain the objective release of 115,000 cfs for an extended period. Additional levee stabilization is being done. This work will increase the reliability of levees during emergency releases, but is not designed to increase the objective release. Features of the Federal Sacramento River Flood Control Project that are important to the current discussion consist of levee work along both banks of the Lower American River, the Natomas East Main Drainage Canal (NEMDC), Arcade Creek, Dry Creek, Pleasant Grove Creek Canal, Natomas Cross Canal, and the Sacramento River, as well as the Sacramento and Yolo Bypasses. The American River Flood Control Project consists of approximately 40 miles of levee along both banks of the American River. The American River Flood Control District maintains these levees.

Bank erosion is a continuing problem in the Lower American River. Even if a new flood protection project is constructed, lateral erosion will cause additional loss of important riparian habitat along the river and eventually undermine the levee system. Additional bank protection is being constructed, and the Corps is making repairs under the Sacramento River Bank Protection Project authority.

2.1.4 Emergency Preparedness Plans

The Federal government, the State of California, and local cities and counties have a series of emergency response and preparedness planning actions that address floods or the threat of flooding. Corps involvement includes planning and providing advice in advance of a potential flood and providing emergency assistance that includes repairing levee breaks, placing rock revetment along levees, placing material on levees to prevent overtopping, constructing additional protection levees, and providing sandbags.

The State of California, through the State-Federal Flood Operations Center, monitors weather and river information and other data around the clock during the rainy season and provides early flood warnings to local, State, and Federal agencies. At the same time, the State Office of Emergency Services (OES) and county OES staff monitor flood information and prepare to provide aid where needed. The OES network includes fire departments, law enforcement agencies, and highway and road departments.

Sacramento and Yolo Counties and the City of Sacramento have multihazard emergency preparedness plans that include procedures to be followed during flooding. The city and county of Sacramento plans are updated periodically to allow better provision of services to local residents should a major flood occur, including departmental operations, business recovery plans, energy plans, and protection of critical public facilities. City and county staff members receive ongoing training to ensure that they are practiced in their emergency functions. In addition, the city has developed a Comprehensive Flood Management Plan to better protect citizens and property in the event of a major flood. Sacramento is the first municipality in the country to create a plan of this kind. The various elements of the Comprehensive Flood Management Plan focus on two threats posed by a flood disaster: the threat to public safety and the threat to property. Plan elements that address protection of public safety include those relating to emergency preparedness, evacuation, hazardous materials, protection of critical facilities, and guidelines for new development in flood plains. Plan elements that address protection of property include those relating to protection of critical facilities, guidelines for new development, and flood insurance. The Comprehensive Flood Management Plan provides for public safety apart from flood protection, while allowing potential economic losses to be balanced against protection costs.

2.2 Topography and Climate

The American River basin above Folsom Dam is very rugged, with rocky slopes, V-shaped canyons, and few flat valleys or plateaus. Elevations range from 10,400 feet at the headwaters to about 25 feet at the confluence of the American and Sacramento Rivers. The basin slope averages 80 feet per mile. The upper third of the basin is alpine and has been intensely glaciated and is characterized by bare peaks and ridges, considerable areas of granite, and scattered areas of trees. The middle third is dissected by canyons, which have reduced the interstream areas to narrow ribbons of relatively flat land. The lower third consists of low rolling foothills and flood plain areas near the confluence with the Sacramento River.

The climate of the study area is characterized by cool, wet winters and hot, dry summers. Most of the seasonal rainfall occurs in two or three of the winter months. Precipitation varies throughout the area, ranging from 16 to 20 inches on the valley floor to about 70 inches in the higher mountains above Folsom Dam and Reservoir. Annual precipitation in the study area occurs almost entirely during the winter storm season (November to April). Precipitation usually falls as rain at 5,000 feet or lower elevation and as snow at higher elevations. However, some storms may produce rain at the highest elevations of the basin. Conversely, at rare intervals, snow may fall at the valley floor.

Air temperatures within the vicinity of the study area vary according to season and topography. In the valley, temperatures are high in summer and moderate in winter. In the mountains, temperatures are generally lower at higher elevations, resulting in moderate summers and severe winters.

The prevailing wind direction in the Lower American River Basin is from the south and southeast during April–September and from the north during October–March. The most important storms affecting the study area usually originate in the vicinity of the Aleutian Islands. The normal trajectory of these storm fronts is to the south and east, from the Pacific to the West Coast. In the summer, this frontal zone is far to the north, and the accompanying precipitation seldom reaches as far south as California. Therefore, the prevailing air in summer in the vicinity of the study area is generally stable, and thunderstorms rarely occur. From October to April, however, the frontal zone moves southward and bringing precipitation to the area.

2.3 Hydrology and Hydraulics

2.3.1 Folsom Reservoir

Folsom Dam and Reservoir together constitute a multipurpose water project constructed by the Corps and operated by the Bureau as part of the CVP. Folsom Dam regulates runoff from a drainage area of about 1,875 square miles. Folsom Reservoir has a normal full-pool storage capacity of 975,000 acre-feet, with a seasonally designated flood control storage space of 400,000 acre-feet. An interim agreement between SAFCA and the Bureau allows a variable flood storage space ranging from 400,000 to 670,000 acre-feet. The reservoir provides flood protection for the Sacramento area; water supplies for irrigation, domestic, municipal, and industrial uses; power generation; and a wide range of water-related recreational opportunities. In addition, Folsom Dam and Reservoir control the water quality in the Delta and maintain flows that balance the needs of wildlife habitat, anadromous and resident fish species, and recreational use in and along the Lower American River.

2.3.2 American River Basin Hydrology

The American River Basin covers an area of approximately 2,000 square miles and has an average annual unregulated runoff of 2.7 million acre-feet. Annual runoff has varied in the past from 900,000 acre-feet to 5,000,000 acre-feet. Plate 2-2 provides a comparison of unregulated flows in the Lower American River with expected flows in the river under existing conditions. During a flood event with a 1-in-2 chance of occurring in any year, unregulated flows would be expected to reach 40,000 cfs and would reach only 25,000 cfs under existing conditions. Flows during events with between a 1-in-18 and 1-in-120 chance of occurring in any year would peak at approximately 115,000 cfs under existing conditions and would range between 160,000 cfs and 375,000 cfs if unregulated.

The American River Basin, including all its tributaries, is divided into three subbasins, North Fork American River, South Fork American River, and Lower American River. The Lower American River begins at Folsom Dam and flows through Sacramento to the Sacramento River. The Natomas East Main Drainage Canal is the only significant contributor of flow to the Lower American River. The North Fork American River Basin has 1,318 miles of naturally occurring waterways with 28 dams within the basin. The average precipitation is 58.72 inches per year in the North Fork of the American River. The South Fork American River Basin has 1,143 miles of naturally occurring waterways with 29 dams within the basin. The average precipitation is 49.5 inches per year along the South Fork of the American River. The Lower American River Basin has 380 miles of naturally occurring waterways with 8 dams located within the basin. The average precipitation in the Lower American River is 20.83 inches per year. The runoff from precipitation and snow melt from the North, Middle and South Forks drain into Folsom Lake. Folsom Dam controls the flows at the confluence of the south and middle forks.

Flood-producing runoff occurs primarily during the months of October–April and is usually most extreme between November and March. From April to July, the rain/flood season is followed by a period of moderately high runoff from snowmelt. Runoff from snowmelt usually does not result in flood-producing flows. However, the snowmelt runoff is ordinarily adequate to fill Folsom Reservoir's empty space, which is reserved for flood control during the winter months.

2.3.3 Sacramento River

The Sacramento River begins in the northern portion of the State and flows southward, through the City of Sacramento, into the Delta. The drainage area of the Sacramento River upstream from Sacramento is approximately 23,500 square miles, with flows regulated at Shasta Reservoir. The Sacramento River accounts for approximately 62 percent of the inflow to the Delta.

2.3.4 Sacramento–San Joaquin Delta

The Delta covers an area of 1,150 square miles and has an average annual inflow of approximately 23,000,000 acre-feet, with historic inflow ranging from a low of 9,000,000 acre-feet to a high of 72,000,000 acre-feet. The Sacramento, San Joaquin, and Mokelumne Rivers are the major tributaries to the Delta. The Delta covers an area of 1,150 square miles, comprising parts of Alameda, Contra Costa, Sacramento, San Joaquin, Solano, and Yolo Counties. Most of the flow into the Delta comes from the Sacramento River, which provides approximately 62 percent of average annual Delta flow. The San Joaquin River contributes 15 percent of Delta flow, and the remaining flow is provided by the Yolo Bypass (14 percent), eastside streams (5 percent), and Delta precipitation (4 percent).

2.3.5 Historic Floods

Sacramento was established in the 1840s at the confluence of the Sacramento and American Rivers. Flooding was fairly common in the early days of the community. Folklore and newspaper accounts mention at least nine major floods before 1890. The losses throughout the valley caused by these early floods were large. Over the years, a complex system of levees, upstream dams and reservoirs, and related facilities was built to help reduce flooding. The most significant of these facilities include elements of the CVP, Sacramento River Flood Control Project, American River Flood Control Project, and several local projects and plans.

Folsom Dam and Reservoir were designed and constructed in the late 1940s to mid-1950s to protect urban Sacramento from a flood that would result from the largest rainstorm of record in the region occurring directly over the drainage basin at a time when ground and snow cover conditions are moderately conducive to high runoff. Because the largest rainstorm of record at that time was the storm of 1937, Folsom Dam was designed to safely pass that event centered in the American River basin. The "maximized" 1937 flood was estimated to have a peak inflow of 340,000 cfs and a 6-day volume of 978,000 acre-feet.

At least nine large floods have occurred in the Lower American and Sacramento River basins since Folsom Dam became operational. These floods occurred in 1955, 1963, 1964, 1969, 1970, 1980, 1982, 1986, and 1997.

The 1986 storm was produced by a warm, Hawaiian-born storm that caused rainfall in Sacramento during February 14–18 to reach 9.62 inches, 54 percent of the annual average rainfall. To accommodate the resulting runoff, releases from Folsom Dam were increased, eventually reaching 130,000 cfs, which is 15,000 cfs over the objective release. Significant levee damage occurred along the Lower American River. Emergency repair work was required at several locations along the Garden Highway and in the Pocket area of Sacramento. Had these storms lasted much longer, major sections of levee likely would have failed, causing probable loss of life and billions of dollars in damages.

Hydrologic studies since 1986 show that Folsom Dam and Reservoir and the flood control levees do not provide as much protection as previously thought. The 1986 storm had a 1-in-67 chance of occurring in any year. Without the "incidental" storage space available in several of the water and power reservoirs in the Upper American River basin, the 1986 flood would have overwhelmed the flood control system. Revised flow-frequency curves for the American River Basin were developed as a result of this event.

In January 1997, a major flood approximately equal in magnitude to the 1986 flood of record occurred. The December 26, 1996, through January 3, 1997, event generated the flood of record for this century in many northern California river basins. This flood established a new benchmark for the runoff from rain-on-snow for the American River watershed. The extraordinary factors that precipitated high runoff were the extreme saturation of the soil, deep snow cover, high water content of the snow, and warm temperatures during the heaviest precipitation periods. The resulting flood, in the American River basin above Folsom Reservoir, produced the greatest recorded 1-day volume and came close to duplicating the greatest 3-day volume (February 1986 event) since detailed runoff records started in 1905.

2.3.6 Revised Hydrology

The occurrence of two "storms of record" within the last 11 years prompted a reevaluation by the Corps of the rain floodflow-frequency estimates for the American River at Fair Oaks. Generally accepted statistical procedures and methodologies, as defined in Bulletin 17B, were used. Based on this latest statistical analysis, the 1-percent-chance exceedance 3-day flow is 9 percent greater than the flow estimated during the previous analysis performed after the 1986 flood.

Shortly after release of the above reevaluation, the results of the Corps' flow-frequency analysis prompted questions, comments, and debates among various agencies and public groups. In response, the Corps requested the National Research Council (NRC) to perform an independent scientific assessment of flow-frequency relationships for the American River. Information contained in both the Corps' office report, dated February 3, 1998, and the February 1999 NRC analysis (National Research Council 1999) was considered in developing the adopted flow-frequency curve.

The NRC produced the report "Improving American River Flood Frequency Analyses, Prepublication Report, NRC, February 2, 1999." The NRC evaluated the critical 3-day duration, which has the greatest impact on operation of the existing flood control system (Folsom Dam and the downstream levees), as well as plan formulation for the American River Basin and most other Sacramento Basin tributaries. The NRC obtained an alternative to the Corps estimate of the 3-day inflow-frequency curve by (1) using an estimate of the historic 1862 event to extend the systematic period of record 1904–1998, (2) employing an expected moments algorithm instead of the Bulletin 17B historic weighting procedure to incorporate the 1862 event in the analysis, and (3) estimating the regional skew as -0.1.

The 1862 event is significant because it was known to be one of the largest floods observed in the Sacramento Valley. Inclusion of this event in the database used for the frequency analysis provides a potentially valuable extension of the effective record length. At best, because of the uncertainty in estimating the 1862 event, this historic information should be used only to ascertain whether the station statistics are consistent with statistics developed from the potential range in values of the 1862 event. It has been shown that statistics derived using various estimates of the 1862 event are consistent with the station statistics. Therefore, because there is no significant statistical difference, station statistics derived from the relatively accurate and verifiable estimates of the systematic record were adopted.

The NRC recommended that the frequency curve not be extended beyond the 0.5-percent-chance exceedance frequency. However, the extension of the frequency curve is necessary for the Corps to finalize the analysis of flood damage reduction alternatives for the American River below Folsom Dam. The NRC further recommended extending the curve to less frequent events by simulating hypothetical events with watershed models to capture the maximum runoff potential for the basin.

In reviewing the NRC recommendations, the Corps decided that a frequency curve using the 1862 event and the regional skew of –0.1 obtained from Bulletin 17B would not be as reliable as a frequency curve obtained using the 93-year period of record available at the American River at Fair Oaks gage. Also, the Corps did not develop watershed modeling studies to accomplish this extension. The Corps extended the frequency curve beyond the 0.5-percent level from station statistics for risk and uncertainty purposes.

The PMF is used to determine the hydrologic safety of dams. State-sponsored and Federally sponsored dam projects use the PMF for the design of spillway capacities. The PMF is the flood discharge that would result from the most severe combination of critical meteorologic and hydrologic conditions that are reasonably considered possible in a region. The PMF does not have a frequency assigned to it. All prior PMF estimates for basins in California have equaled or exceeded the 0.1-percent-chance exceedance event for peak, 1-day, and 3-day volumes taken from calculated frequency curves.

In October 1996, the Bureau determined a new PMF for the American River basin based on a new probable maximum storm (PMS) using Hydrometeorological Report No. 58 (National Weather Service, 1998). The Corps reviewed the Bureau's revised PMF document and generally agreed with the findings and determinations. However, following the flood of January 1997, the Corps computed a new mean 3-day PMF flow incorporating the Bureau's PMS (Table 2-2). The Corps revised the PMF, incorporating rain-on-snow loss rates modeled from the January 1997 event. The resulting mean 3-day flow is greater than the 0.1-percent-chance exceedance event when compared to the flow-frequency curves presented in this report. The minimum exceedance probability accepted by the NRC for a PMF event is 0.1-percent-chance exceedance.

TABLE 2-2. Probable Maximum Flood Mean 3-Day Flow American River above Folsom

Source of Data	Maximum 3-Day Volume	
	Mean Depth (inches)	**Mean Day (cubic feet per second)**
U.S. Bureau of Reclamation (1996) Hydrometeorological Report No. 58	24.45	408,000
U.S. Army Corps of Engineers (1997, incl. Jan ’97 flood) Hydrometeorological Report No. 58	29.07	485,000
Flow-Frequency Curve 0.1 Percent Flow	28.40	474,000

Notes: The probable maximum storm mean basin precipitation is 29.62 inches.

Net loss for the January 1997 storm was 0.70 inch for 4 days. Net loss for 3 days was derived by taking 75 percent of that value which is 0.53 inch (after rounding).

2.4 Geology, Seismology, and Soils

2.4.1 Geology

L. L. Anderson Dam. Fractured granite bedrock dominates the study area setting, with alluvial material mixed with large and small granite boulders at the spillway escape channel exit on the middle fork of the American River.

Folsom Reservoir and Lower American River. The study area is situated in the lower portion of the American River Basin, which straddles the margin between the Sierra Nevada foothills and the eastern Sacramento Valley. The Sierra Nevada represents the core of an ancient chain of volcanoes, similar to the geologically younger Cascade Range, exhumed by faulting and dissected by erosion. The Sacramento Valley is a structural trough bounded on its western margin by the complexly folded and faulted California Coast Ranges.

The lower portion of the American River basin, including Folsom Dam and Reservoir, lies primarily within the Foothills Metamorphic Belt, which consists of volcanic and sedimentary rocks that have undergone varying degrees of regional metamorphism. These metavolcanic and metasedimentary strata are as much as several hundred million years old. In the study area, they are intruded by diorites of the Mesozoic Penryn and Rocklin plutons, which form the western shore of Folsom Reservoir, and by gabbroic rocks of the Mesozoic Pine Hill Intrusive Complex, southeast of the reservoir (California Department of Conservation 1987).

The eastern edge of the Sacramento Valley is flanked by uplifted and tilted sedimentary strata, which overlie rocks of the Foothills Metamorphic Belt and are in turn overlain on the west by younger alluvium. The oldest of these sedimentary units in the immediate study area is the Eocene marine Ione Formation, which crops out between Folsom Reservoir and Citrus Heights. In the study area, the Ione Formation is largely concealed beneath a veneer of mid-Tertiary alluvial and fluvial deposits, some of which contain abundant material of volcanic origin, and all of which reflect progressive erosion of the uplifting Sierra. The Sacramento Valley itself contains a deep alluvial fill; fresh alluvium continues to be deposited with each floodflow, particularly in the bypasses (U.S. Army Corps of Engineers et al. 1996).

2.4.2 Seismicity

A fault is defined as a fracture in the earth's crust along which movement is occurring or has occurred in the geologic past. Over time, cumulative movement leads to the displacement of materials along the fracture. Fault movement occurs in two ways. Slow, gradual, and relatively continuous movement is referred to as creep. Sudden, catastrophic movement that releases a substantial amount of stored energy in a few seconds is referred to as an earthquake. Both have the potential to cause structural damage to buildings and other infrastructure, such as utilities and flood protection features. Hazards associated with seismic activity include groundshaking, surface rupture, settlement, liquefaction, and seiche.

- Groundshaking refers to ground motion that results from the release of stored energy during an earthquake.

- Surface rupture refers to tears or breaks in the ground surface as a direct result of fault movement. Though surface rupture commonly occurs during earthquakes, and in particular during large earthquakes, it can also result from creep.

- Settlement refers to the compaction of soils and alluvium caused by groundshaking. The amount of settlement that occurs during an earthquake depends on the magnitude of the event and the nature of the materials in the subsurface. Settlement may range from a few inches to several feet (U.S. Army Corps of Engineers 1998).

- Liquefaction occurs when soil or unconsolidated sediment loses its internal cohesion and behaves as a liquid; liquefaction can occur as a result of seismic shock and may lead to various types of ground failure. Liquefaction is most likely to occur in low-lying areas where the substrate consists of poorly consolidated to unconsolidated water-saturated sediments or similar deposits of artificial fill. Portions of Sacramento County at risk for liquefaction include downtown Sacramento and parts of the Delta. Liquefaction may pose a hazard to levees in some areas (U.S. Army Corps of Engineers 1998).

- A seiche is an earthquake-induced wave within an enclosed or restricted body of water, such as a lake, reservoir, or channel. A seiche can result from an earthquake with an epicenter miles away from the affected water body. Seiches can cause a body of water to overtop and damage its levees and dams and may lead to inundation of surrounding areas (U.S. Army Corps of Engineers 1998).

The Alquist-Priolo Earthquake Fault Zoning Act (Alquist-Priolo) (California Code of Regulations, Title 14, Division 12) defines any fault that has experienced surface displacement within the past 11,000 years as active and hence a potential threat. Alquist-Priolo delineates earthquake fault zones along the surface traces of faults recognized as active; within an earthquake fault zone, specific geologic investigations must be carried out before new construction can be approved. Furthermore, under Alquist-Priolo, any fault that cannot be demonstrated to be inactive (to have undergone no movement in the last 11,000 years) must be treated as an active fault for construction and development purposes. No Alquist-Priolo-zoned faults exist in the study area (California Department of Conservation 1997).

2.4.3 Soils

Published soil data indicate that soils in the study area are not subject to structural loss of strength (e.g., collapse or quick failure) or to excessive shrinking and swelling (U.S. Soil Conservation Service 1974, 1980, 1993). In general, they are not corrosive. However, water-saturated alluvium may be subject to liquefaction if exposed to seismic groundshaking.

2.5 Water Supply

Folsom Reservoir, the principal reservoir in the American River basin, is operated by the Bureau as a unit of the CVP. The CVP provides water for agricultural, urban, and wildlife uses in the Central Valley and in portions of the San Francisco Bay Area. Deliveries from the CVP total approximately 7 million acre-feet annually.

Folsom Reservoir has a storage capacity of approximately 975,000 acre-feet. Releases from the reservoir for downstream deliveries and for Delta operations generally are highest from May through September. Water supply demands from the American River total approximately 140,000 acre-feet from Folsom Reservoir or, upstream, 20,000 acre-feet from Lake Natoma at the Folsom South Canal and 105,000 acre-feet from the Lower American River.

2.5.1 Central Valley Project

The CVP was authorized by Congress in 1937 to serve water supply, hydropower-generation, flood control, navigation, fish and wildlife, recreation, and water quality control purposes. The CVP is now operated by the Bureau to store and transfer water from the Sacramento, San Joaquin, and Trinity River basins to the Sacramento and San Joaquin Valleys.

The CVP service area is about 430 miles long, extending through much of California's Central Valley, from the Trinity and Shasta Reservoirs in the north to Bakersfield in the south. The CVP also includes the San Felipe Unit, which delivers water to the Santa Clara Valley. The CVP currently has contracts to deliver 7.1 million acre-feet annually. In 1988, CVP deliveries totaled about 5.3 million acre-feet, or about 75 percent of its total contract deliveries of 7.1 million acre-feet. These deliveries included almost 1.9 million acre-feet to the Sacramento River service area, 285,000 acre-feet to the American River service area, and about 3.1 million acre-feet to the Delta Export service area.

The CVP is operated as an integrated system to meet multiple authorized purposes. Minimum fishery releases are made from Nimbus Dam to the Lower American River in accordance with State Water Resources Control Board (SWRCB) Water Rights Decision 893 (D-893). SWRCB increased the D-893 minimum release schedule in its Decision 1400 (D-1400). This decision was applied to the water rights permit for Auburn Dam and does not apply to operation of Folsom and Nimbus Dams at this time. However, the Bureau operates Folsom and Nimbus Dams to meet the recommended Anadromous Fish Restoration Program (AFRP) flows for the Lower American River.

2.5.2 State Water Project

Twenty-eight agencies throughout California have contracted with the State Water Project (SWP) for an annual total of 4.2 million acre-feet of water. During drought conditions, existing SWP facilities have only supplied less than 2.4 million acre-feet. In view of this shortage, additional facilities that will increase the water reserve within this system have been planned. Conveyance facilities to improve transfer of water across the Delta have been authorized but not yet built.

The initial SWP facilities, completed in 1973, include 18 reservoirs, 17 pumping plants, eight hydroelectric powerplants, and 550 miles of aqueducts and pipelines. Water from the Feather River watershed and the Delta is captured and conveyed to areas of need in the San Francisco Bay Area, the San Joaquin Valley, and southern California. Parts of the project have been serving Californians since 1962.

2.5.3 American River Watershed

The American River watershed is contained within Sacramento, El Dorado, and Placer Counties. Water demands within the watershed result from agricultural, municipal, and industrial land uses. The primary sources of water supply for the study area are groundwater and surface water. Principal sources of surface water in the region are the American, Sacramento, and Cosumnes Rivers.

Municipal and industrial demands come from areas above Folsom Reservoir (Auburn, Georgetown, and Placer County Water Agency), communities adjacent to Folsom Reservoir (El Dorado Hills, Citrus Heights, Orangevale, Roseville, Folsom, and Fair Oaks), and areas below Folsom Reservoir (Rancho Cordova, Carmichael, Sacramento, Elk Grove, and Galt). French Meadows Reservoir was authorized to control and conserve waters for irrigation, municipal and industrial consumption, and hydropower production. Some agricultural demands originate in areas northwest of Folsom Reservoir. However, the major irrigation demands are from southeast Sacramento County. In western Placer County, there is potential for additional irrigation demands for Folsom Reservoir water to be delivered via diversion pipelines or from the Upper American River via Auburn Ravine.

Table 2-3 summarizes the service areas by diversion points in the American River watershed. The water delivery system from Folsom Dam to the City of Roseville, San Juan Water District (SJWD), Folsom State Prison, and the City of Folsom consists primarily of an intake structure, the Natoma and North Fork Water Distribution System, and a pumping plant. The delivery system main intake subdivides into two pipelines at the inlet control center. An 84-inch pipeline (North Fork Distribution System) through the right abutment nonoverflow section provides deliveries to the City of Roseville and SJWD by a combination of gravity feed and pumping. Pumping is required when the reservoir elevation falls below 433 feet (640,000 acre-feet) during high water-demand periods (generally April–October). During periods of lower water demand, the water can be delivered via gravity flow as long as the reservoir elevation is above 426 feet (575,000 acre-feet). A 42-inch pipeline (Natoma Distribution System or Natoma Pipeline), passing through the dam to the left abutment, serves the City of Folsom and Folsom

TABLE 2-3. Existing Diversion Points and Service Areas

Diversion Point	Service Area
Folsom Reservoir	San Juan Water District (Citrus Heights Water District) (Orangevale Mutual Water District) (Fair Oaks Water District) (Placer County Water Agency)[a] City of Folsom Folsom Prison City of Roseville El Dorado Irrigation District
Folsom South Canal	Arden Cordova Water Service Omochumne Hartnell Water District Galt Irrigation District Clay Water District SMUD Sacramento County Water Agency, Portions Mather Air Force Base
American River near Landis Avenue and Ancil Hoffman Park	Carmichael Water District Arcade Water District
American River near Arden Bar	City of Sacramento
American River above H Street Bridge	Natomas Central Mutual Water District
Sacramento River near Metropolitan Airport	City of Sacramento
Sacramento River near Discovery Park	Omochumne-Hartnell Water District
Cosumnes River	Rancho Murieta CSD

[a] Placer County obtains portions of its American River water entitlements through San Juan Water District distribution system.

Source: U.S. Army Corps of Engineers 1992.

State Prison via gravity flow until the reservoir elevation falls below 414 feet (477,000 acre-feet). The 42-inch Natoma Pipeline from the inlet control center and pumping plant discharges into a concrete box, where it feeds a 48-inch line to the City of Folsom and an 18-inch line to Folsom State Prison. The water distribution system is designed to supply an ultimate demand of 65 cfs for the Natoma Pipeline and 250 cfs for the North Fork Pipeline.

2.6 Hydropower

2.6.1 Central Valley Project Hydropower System

The CVP hydropower system consists of eight powerplants and two pumping-generating plants. This system is fully integrated into the Northern California Power System and provides a significant portion of the hydropower available for use in northern and central California. The installed power capacity of the system is 2,044,350 kilowatts (kW). By comparison, the combined capacity of the 368 operational hydropower plants in California is 12,866,000 kW. Pacific Gas and Electric Company (PG&E) is the area’s major power supplier, with a generating capacity from all sources of over 20 million kW.

2.6.2 Folsom Dam and Reservoir

The Folsom powerplant has three generating units, with a total generating capacity of 196.72 MW and a release capacity of approximately 8,600 cfs. By design, the facility is operated as a peaking facility. Peaking plants schedule the daily water release volume during the peak electrical demand hours to maximize generation at the time of greatest need. At other hours during the day, there may be no release (and no generation) from the plant.

To avoid sudden water surface elevation fluctuations in the Lower American River, Nimbus Dam and Lake Natoma is operated as a regulating facility for releases from Folsom Reservoir. The Nimbus powerplant consists of two generating units, with a generating capacity of 17 MW and release capacity of approximately 5,100 cfs. Electricity is generated from this facility continuously throughout the day.

A PG&E hydroelectric facility, the Newcastle Powerhouse, is also located on the right bank of the North Fork of the American River, approximately 4 miles downstream of its entrance into Folsom Reservoir. Water passing through the Newcastle Powerhouse is primarily used for irrigation and domestic water use and for maintaining minimum flows for fish habitat within the South Canal spill channel (Aspen Environmental Group 2000).

2.7 Land Use and Socioeconomics

The California Land Conservation Act, or Williamson Act, was enacted in 1965 to counteract increasing pressures on landowners to convert agricultural and open space lands to urban uses. Under the Williamson Act, local governments and private landowners can voluntarily enter into land use contracts that restrict future development to agricultural or related open space use. In return, property tax assessments are much lower than normal because they are based on farming and open space uses and not on full market value (California Department of Conservation 2000).

The Farmland Protection Policy Act (FPPA) of 1981 was enacted to minimize the extent to which Federal programs contribute to the unnecessary conversion of farmland to nonagricultural uses. The FPPA stipulates that Federal programs must be compatible with State, local, and private efforts to protect farmland; these Federal programs include construction projects, such as levee work, that are sponsored or financed in whole or part by the Federal government.

FPPA requires Federal agencies to examine the potential impact of their programs before they approve any activity that would convert farmland. A rating form is used to measure the quality of the farmland. The rating is then used to determine the flood protection for which the farmland is eligible.

This section describes the existing and future land and socioeconomic conditions in the study area. The study area for this section includes Folsom Reservoir, the South Fork of the American River, the Lower American River, and the Sacramento and Yolo Bypasses.

2.7.1 Folsom Reservoir

The land surrounding Folsom Reservoir is mostly Federally-owned and designated for recreation and flood control use. Because the Bureau has no natural resource management or law enforcement authority, it entered into a 50-year agreement with the California Department of Parks and Recreation (DPR) in 1956 for the management of the Federal land surrounding the reservoir designated as the Folsom Lake State Recreation Area (FLSRA). The FLSRA also encompasses Lake Natoma and adjacent Federal lands.

FLSRA consists mostly of open space and extends 19 miles from the downstream side of Auburn to Nimbus Dam. It encompasses Folsom Reservoir, the lowest reaches of the North and South Forks of the American River, and Lake Natoma. Adjacent to Folsom Dam, FLSRA extends east and west along Folsom Dam Road, contiguous to Folsom State Prison property on the south of the dam and on the east side of the American River.

Several residential communities surround FLSRA, including Granite Bay, which sits on its northwestern edge. Several private residential parcels in Granite Bay are within several hundred feet of the reservoir. Portions of some of these residential parcels, including some structures, sit at elevations of less than 487 feet. Similarly, the community of Lake Hills Estates is adjacent to the eastern shore of the reservoir on the south bank of the South Fork of the American River. Residential properties in this area are within several hundred feet of the shoreline, although the steep banks of the South Fork place the majority of these homes at elevations greater than 500 feet. The City of Folsom borders the south side of Folsom Reservoir, bisected by Lake Natoma and the Lower American River. Homes within the city are generally set back from the reservoir and are well protected by the current levee system.

A PG&E hydroelectric facility, the Newcastle Powerhouse, is also located on the right bank of the North Fork of the American River, approximately 4 miles downstream of its entrance into Folsom Reservoir. The powerhouse was originally designed to withstand a maximum flood elevation of 472 feet; it is flooded at an elevation of 473 feet.

Folsom State Prison is located on a 40-acre parcel adjacent to and south of Folsom Dam. It is bounded on the west by the American River, on the south by Folsom City Park, on the east by East Natoma Road, and on the north by FLSRA near Folsom Reservoir and Folsom Dam Road. A walled perimeter encompasses five general population cell blocks, including one of the State's best-known prison factories, the license plate factory.

Socioeconomically, the City of Folsom traditionally had an economy based largely on the State prison industry. The economic/employment trends have begun to shift, however, with Folsom's efforts to plan for commercial and industrial parks. A number of large national corporations involved in the research, development, and manufacturing of electronic components have established regional offices and manufacturing facilities in Folsom. In addition, several large retail/commercial centers have been completed or are under construction. Residential development continues to increase, with single family residential zoning comprising 32 percent of Folsom's total acreage (e.g., land currently developed and/or undeveloped but designated for development) (City of Folsom 2000a).

2.7.2 South and North Forks of the American River

The segments of the South and North Forks of the American River that are within the study area are surrounded by relatively steep canyons bordered by open space lands. Land use in these areas is designated to remain generally undeveloped and "wild" (California Department of Parks and Recreation 1990). Some adjacent private lands are used for grazing (California Department of Parks and Recreation 1990).

2.7.3 Lower American River

The Lower American River extends from the confluence with the Sacramento River, through the Parkway, to Lake Natoma. The Parkway is 23 miles long and includes 14 county parks that provide user access to the river. The Jedediah Smith National Recreation Trail borders the river and provides bicycling, hiking, and horseback riding opportunities. The Parkway is flanked by homes and businesses along the levees, including the communities of Natomas, North Sacramento, South Sacramento, and Rancho Cordova.

Employment in the City of Sacramento totaled 259,000 in 1999. Most individuals were employed in the government and in services, education, medical, or retail sectors. Within the County of Sacramento, 541,000 people were employed in similar fields, with the exception of the areas outside the greater Sacramento metropolitan area, where the agricultural industry is more prevalent (Sacramento Area Council of Governments 2000a).

The American River Parkway Plan (Parkway Plan), an element of the Sacramento County General Plan, provides policy guidance for the Parkway. The Parkway Plan recognizes certain nonrecreational uses of the Parkway and acknowledges that public facilities, such as waterlines and pumping stations, already exist along the river. The plan calls for preserving the crown of the levee system along the river for recreational purposes and authorized vehicle access.

The Urban American River Parkway Preservation Act was enacted by the California State Legislature to protect the Lower American River and its riparian corridor. It states that, as practicable, flood control actions should be consistent with the Parkway Plan; however, it does not impair the authority of flood control agencies to maintain the levee system. Consistency with the Parkway Plan requires that the Sacramento County Board of Supervisors approve proposed projects within the Parkway and that effects on riparian vegetation and on the natural appearance of the Parkway be minimized.

2.7.4 Sacramento and Yolo Bypass Areas

The Sacramento Bypass is a leveed channel extending from the west bank of the Sacramento River to the east bank of the Yolo Bypass, just north of the City of West Sacramento. The Sacramento Bypass covers approximately 360 acres and conveys American River flows that exceed the channel capacity of the Sacramento River to the Yolo Bypass. The Sacramento Bypass is designated as a wildlife area and is managed by the California Department of Fish and Game (DFG). It provides recreational opportunities for fishermen and bowhunters tracking upland birds.

The Yolo Bypass provides overflow capacity for the Sacramento, Feather, and American rivers during the flood season. The predominant land use in the Yolo Bypass is seasonal agriculture, with a small amount dedicated to managed wetland (duck club) activities. Most of the agricultural fields have been laser-leveled, and crops are grown only between late spring and late fall, when the flooding risk is acceptable to landowners. Typical crops include sugar beets, corn, tomatoes, beans, sunflowers, and small grains. Fields typically consist of bare, cultivated soil in winter. Winter ground cover on duck club lands typically consists of short (6- to 12-inch) grasses and weeds (Jones & Stokes 2001a). The Yolo Bypass also encompasses the 3,700-acre Vic Fazio Wildlife Refuge near Interstate 80 (I-80), which includes restored wetlands and associated habitats.

Land use within the Yolo Bypass is restricted by easements held by the Reclamation Board. In addition to granting the State the right to inundate the land with flood waters, the easements preclude land owners from building structures or growing vegetation that would significantly obstruct floodflows (Jones & Stokes 2001a). In general, both agricultural and managed wetland activities are permitted by these easements; however, a review of the plain language of the easements indicated that the Bureau, or Bureau's representatives, are not limited to the time of year or the duration for which floodwaters can inundate lands in the Yolo Bypass (Jones & Stokes 2001a).

Most of the lands to the east and west of the leveed portion of both the Sacramento and Yolo Bypasses are in agricultural use and considered prime farmland, farmland of Statewide importance, or unique farmland by the California Department of Conservation (Jones & Stokes Associates 1994a). A former dumpsite is also located to the north of the Sacramento Bypass, within 1,000 feet of the bypass's north levee.

2.8 Recreation

This section describes the recreational facilities and their historical uses for areas that could be physically modified under any of the project alternatives, including all relevant plans, policies, and laws. The study area for this section includes Folsom Reservoir, the North and South Forks of the American River, the Lower American River, and the Sacramento and Yolo Bypasses. Unless otherwise cited, information in this section was drawn from the following documents:

- American River Watershed Investigation, California (U.S. Army Corps of Engineers et al. 1996),
- Sacramento Area Flood Control Agency Information Report (Sacramento Area Flood Control Agency 1998),
- Interim Reoperation of Folsom Dam and Reservoir (Sacramento Area Flood Control Agency and U.S. Bureau of Reclamation 1994),
- Program Environmental Impact Report on Flood Control Improvements Along the American River (Jones & Stokes 2000a), and
- Department of Parks and Recreation Use Statistics for October 1999 to September 2000.

2.8.1 Folsom Reservoir

Facilities and Activities. Folsom Reservoir is part of the FLSRA, which is managed by DPR. FLSRA is located at the base of the Sierra Nevada foothills, approximately 20 miles northeast of Sacramento. It is a popular unit of the State Park system and one of the most frequently used State recreation areas (SRA) in California. FLSRA encompasses Folsom Reservoir, the lowest reaches of both the North and South Forks of the American River, and Lake Natoma. When full, under normal operations (466 feet), the reservoir provides 11,500 acres of water surface and 75 miles of shoreline.

Folsom Reservoir supports numerous water-based activities, such as boating, water-skiing, and fishing. The lake's upper arms are designated slow zones for quiet cruising, fishing, and nature appreciation. The shoreline provides sandy swimming beaches, both formal (with lifeguard services) and informal. Summer water temperatures average 72ºF, enhancing both water-oriented and shoreline activities.

The landscape surrounding Folsom Reservoir supplies scenic, natural, and cultural values. Recreational facilities include camping and picnic areas, boat launch ramps, restrooms and dressing rooms, concession buildings, bicycle and mountain bike trails, and equestrian trails and staging areas. Approximately 180 miles of unpaved roads and trails are available for hiking and horseback riding, in addition to the 8.4-mile paved bike trail connecting the Jedediah Smith Trail with the American River Bike Trail. The reservoir has eight boat ramps at five different use areas around the lake. Major shoreline use areas are Beals Point, Granite Bay, and Rattlesnake Bar on the west shoreline; Folsom Point (formerly Dike 8), Mormon Island, and Browns Ravine Marina on the south and east shorelines; and the Peninsula campground between the North and South Forks of the American River. The locations of the major recreation areas are shown in Plate 2-3.

Granite Bay. Granite Bay is located on the west shore of Folsom Reservoir and is the most heavily used area in FLSRA. It offers five boat launch areas, including four 12-lane and one two-lane boat launch ramps, a formal beach and swim area that is lifeguard-supervised during the peak-use season, boat camping sites, day-use picnic facilities, two concessions buildings, an activity center, a play area, and a trail staging area. DPR also supports an employee house just inside and west of the south entrance to the site that sits at approximately 500 feet. The boat launch areas range in elevation from 400 feet to 470 feet, enabling their use under a wide range of lake levels. Currently, when the lake is at 466 feet, only one 12-lane ramp and the two-lane boat launch ramp are usable. Elevations of the structures (other than the boat launch ramps), parking lot, and roads at Granite Bay range from approximately 465 feet to 475 feet. The group picnic areas and beaches are partially inundated at 470 feet, and all facilities, including the concessions stands, activity center, parking areas, and significant portions of the access road, are flooded at lake levels above 475 feet.

Beals Point. Beals Point is located on the west shore of Folsom Reservoir and provides equestrian and cycling trails and camping, picnicking, and swimming facilities. There are 49 family campsites, several day-use picnic facilities, a building with restrooms and dressing rooms, a concessions building, and a swimming beach area that is supervised during the peak-use season, which is May–September. The structures, parking lot, and roads at Beals Point range in elevation from 465 feet to 475 feet. When the reservoir reaches 466 feet, water levels are just below the roads, parking lot, restroom/dressing room building, and concessions building. At 466 feet, the beach area is inundated, although turf areas for picnicking, sunbathing, and other passive uses are still usable.

A recreational vehicle (RV) campground is currently under construction on the landside of Dike 6 at Beals Point. This facility will provide the only RV hookups at the lake. Lower elevations on the east side of the campground near Folsom-Auburn Road sit at 450 feet, while peaks within the campsite range as high as 495 feet.

Folsom Point. Folsom Point (formally known as Dike 8) is located on the south shore of Folsom Reservoir adjacent to the City of Folsom. The area has four boat launch lanes and day-use picnic facilities. Elevations of the parking area and roads at Folsom Point range from approximately 470 to 540 feet. When the reservoir reaches a surface elevation of 476 feet, the boat launch facilities, parking areas, and picnic areas are inundated, as are the lower elevation roads that link the facilities.

Browns Ravine. Browns Ravine, located on the southeast shore of Folsom Reservoir, offers two boat launch facilities, including a low-water ramp, a floating concessions stand, a refueling station (the only one offered at the lake), a boat camping site, day-use picnic facilities, restrooms, and an equestrian trail staging area. It also supports Folsom Lake Marina, one of the largest inland marinas in California, and the only marina on Folsom Reservoir that is open year-round. The marina is protected by a breakwater at its west end and is equipped with 685 wet and 175 dry slips that can accommodate boats up to 26 feet long. DPR also provides one employee home near the entrance to Browns Ravine that sits at an elevation of 500 feet. At a reservoir elevation of 466 feet, the road leading to Browns Ravine off Green Valley Road is closed, making all facilities inaccessible. At an elevation of 476 feet, all facilities, including the marina, boat ramps, boat storage area, and parking areas are completely inundated.

Other Recreation Areas. Other major recreation facilities at Folsom Reservoir include the following:

- Observation Point on the west-southwest shore of Folsom Reservoir provides vista/look-out and vehicle parking facilities. Facilities at Observation Point become completely inundated at 476 feet.

- Peninsula Campground, located between the North and South Forks of the American River, provides 100 family campsites, picnic facilities, cycling and hiking trails, and two boat launching areas. The south boat ramp elevations range between 420 and 470 feet and the north ramp between 430 and 460 feet. Several of the campsites are paved. Most would be inundated at 475 feet. The peninsula is also considered a potential borrow site for construction of the dam and dikes around the reservoir.

- Salmon Falls at the north end of Folsom Reservoir provides parking and access points for cyclists, hikers, and rafters along the North Fork of the American River. The north and south parking lots, restroom facilities, and trail access points would be completely inundated at 475 feet.

- Wild Goose Flat on the northwest shore of Folsom Reservoir provides boat-in day-use sites and primitive walk-in campsites.

- Rattlesnake Bar on the northeast shore of Folsom Reservoir provides two boat launch lanes and an equestrian staging area. Portions of the road accessing the launch lanes would be inundated at 470 feet; the boat launch areas become unusable at elevations greater than 465 feet.

- Hiking and equestrian facilities include approximately 80 miles of unpaved trails and 80 miles of unpaved roads. Bicycling facilities include 8 miles of paved trail linking Beals Point with the Parkway at Folsom Dam, 8 miles of unpaved mountain bike trail between Peninsula and Sweetwater Creek, and 15 miles of unpaved trail between Salmon Falls Bridge and the Peninsula campground. In addition, DPR is currently in the process of extending the paved bike trail north from Beals Point to Granite Bay.

Recreation Use. FLSRA is one of the most heavily used units in the California park system. Proximity to a major metropolitan area, arid summer climate, high regional interest in recreation, and diminishing open space and recreation resources make the lake a significant regional and State recreation resource.

Water-dependent activities are extremely popular in the area. The boat registration of El Dorado, Nevada, and Placer Counties is above the State average; as summer temperatures reach the 90s and 100s, recreational use of the water and surrounding areas increases. Bicycling has increased dramatically in the area and there is continued demand for equestrian trails. The per capita ownership of horses in the region is among the highest in the State.

Visitors to FLSRA are predominantly local and regional. Regional users typically travel more than an hour to reach some parts of Folsom Reservoir. Because of the distance traveled, regional users typically visit the lake on weekends and may stay for extended periods in the summer. Local users, which include visitors originating from the metropolitan Sacramento area, drive less than an hour to reach the lake. They visit the lake frequently during summer and account for most of the use during nonsummer months. A subclass of the local-user group is represented by visitors that live within a 15-minute drive from Folsom Reservoir. These users are predominantly residents of Folsom, El Dorado Hills, Roseville, Granite Bay, and the other suburban/semi-rural areas in the vicinity of the lake. These users visit the lake year-round and may avoid visiting the lake during peak-use periods such as summer weekends. Visits to the lake made by this group may be shorter in length than visits by other groups.

The average annual attendance at the FLSRA for the period between 1980 and 1997 was approximately 2,076,000. Visitation during this period ranged from a high of 2,862,000 in 1986 to a low of 1,755,000 in 1997. Most visits occur between July and September when recreation is focused primarily on water-based activities. A total of 1,280,603 people visited Folsom Reservoir between July and September of 2000. Similarly, April through June recreational opportunities brought a total of 725,570 people to the lake. In contrast, visitation is substantially lower in winter, with use consisting mainly of fishing and passive recreation. October through December 1999 brought 132,860 people, and January through March of 2000 brought 207,511 visitors.

Between October 1999 and September 2000, the Granite Bay, Beals Point, Folsom Point, and Browns Ravine use areas accounted for approximately 50 percent of the use of FLSRA. The Granite Bay area accounted for 27 percent of the total use, Beals Point accounted for 11 percent, Folsom Point accounted for 7 percent, and Browns Ravine accounted for 37 percent.

FLSRA is already at capacity on some summer holiday weekends and there are no alternative recreational lakes within the immediate vicinity. The closest comparable facilities would be Sly Park Reservoir, 35 miles to the east, Camp Far West Reservoir, 27 miles to the north, Comanche Reservoir, 40 miles to the south, and Lake Berryessa, 60 miles to the west. Of these resources, Folsom Reservoir is the only one located within a major metropolitan area. As a result, the population of that metropolitan area is very dependent on FLSRA as a local recreational resource.

The increasing dependence on FLSRA for local recreational use is exemplified by the use of seasonal passes and the distribution of visitation information at the various use areas. Local passes that are valid for FLSRA, Auburn SRA, and Lake Oroville SRA are used approximately three times as often as passes that are valid at any State park, indicating the increasing popularity of these areas.

While an increased demand for motor boating and camping use is expected for both the regional and local recreationists, there are alternative resources available. It is anticipated that the highest increase in demand with respect to recreational activities will be from the local-user group for day-use activities. These activities include picnicking, swimming, trail-use, and the passive enjoyment of an outdoor setting.

Relevant Plans, Policies, and Laws. The Folsom State Recreation Area General Plan (California Department of Parks and Recreation 1978), developed by DPR, guides land use activities for the Auburn Dam area, Folsom Reservoir, and Lake Natoma. The lower reaches of the North and South Forks of the American River are also covered by the general plan. The overall goal of the general plan is to provide open space and improved recreation opportunities. More specific goals include landscape preservation, visual protection, and providing recreation uses compatible with the area's natural values.

2.8.2 South Fork of the American River

Facilities and Activities. The South Fork is one of the most popular whitewater resources in the nation because of the river's flow regime and proximity to population centers. The beginning/intermediate level of difficulty of the whitewater run is suited to the largest sector of whitewater boaters. The year-round flow regime and, in particular, reliable flows during summer are critical to supporting the use levels associated with the resource. Additionally, southern California is within a weekend's travel distance and the Central Valley, greater Sacramento region, and Bay Area are within a day's travel distance.

Facilities within the study area include access points, parking areas, and restrooms. There is an access point, parking area and restroom on the left bank (south side) of the river, immediately downstream from the Salmon Falls Bridge. There is also an access point, parking area, and restroom on the right bank (north side) of the river, upstream from the Salmon Falls bridge at Skunk Canyon. These facilities are generally used as take-out points for whitewater boaters.

Recreation Use. Whitewater use has increased since the early 1980s with most visits occurring on summer weekends. Although the river supports year-round whitewater recreation, most rafting occurs between May and September. Commercial use ranges from 40,000 to 60,000 weekend users per year, and private boater use averages 45,700 boaters per year. Peak use has exceeded 6,000 river users per weekend.

2.8.3 North Fork of the American River

Facilities and Activities. The portion of the North Fork of the American River that could be affected by the project extends upstream approximately to the location of the proposed Auburn Dam structure. This area does not have any formal recreation facilities; however, there are informal use areas and access trails in the area.

Recreational Use. Recreational use on the North Fork is concentrated upstream from the confluence of the North Fork and Middle Fork of the American River, outside of FLSRA. The North Fork supports commercial whitewater rafting upstream from Lake Clementine. On the

Middle Fork, commercial rafting occurs upstream from the confluence with the North Fork of the American River.

2.8.4 Lower American River

Facilities and Activities. The Lower American River extends 23 miles between Folsom Reservoir and the confluence with the Sacramento River. The river passes through the Parkway, a 6,000 acre open space corridor extending between Nimbus Dam and the American River's confluence with the Sacramento River, and is included in both the Federal and State wild and scenic rivers systems (U.S. Army Corps of Engineers 1991a).

The Parkway is managed by the Sacramento County Parks and Recreation Department and is recognized as one of the nation's premier urban parkways. The parkway includes 14 county parks that support a variety of activities. In addition, the nearby Jedediah Smith National Recreation Trail provides bicycling, hiking, and horseback riding opportunities that stretch from Discovery Park to the FLSRA (U.S. Army Corps of Engineers 1991a).

The Lower American River is a major site for recreational boating (rafting, kayaking, and canoeing), fishing, swimming, and wading. Both shoreline and boat fishing take place throughout the river; however, when ambient temperatures are low, rafting declines, even during the peak recreation season (May through September). Both shoreline and boat fishing for salmon, steelhead, and shad take place throughout the river. Swimming and wading are popular at Paradise Beach and Tiscornia Park.

The Guy West bridge, located between Fair Oaks Boulevard and Howe Avenue at the California State University, Sacramento campus, provides pedestrian access across the Lower American River. Equipped with walking and biking lanes, it is one of the few locations within the parkway that allows pedestrian-only access between the east and west banks of the river.

The Howe Avenue bridge, located approximately one mile upstream of the Guy West bridge, is also equipped with a bicycle lane, although it is primarily utilized by automobile traffic.

Recreational Use. The Parkway provides outstanding recreation for the 750,000 people who live within a 30-minute commute. The Lower American River accounts for about 662,000 user days annually, or 12 percent of the total recreation for the area. Seasonal temperature and riverflows affect commercial rafting. When ambient temperatures are low, rafting declines, even during the peak recreation season. About 90 percent of the annual rental business occurs between Memorial and Labor Days, although prime conditions may exist into October (Jones & Stokes 2000a). Swimming and wading are popular water-dependent activities affected by riverflows. These activities account for about 10 percent of the total recreation in the parkway, or about 523,000 annual visits. Of the 10 popular swimming areas, only Paradise Beach and Tiscornia Park have beaches with extensive sand.

Total annual use of the Parkway in 1996 was estimated at 5.5 million visitors. Water-dependent activities accounted for an estimated 32 percent of total annual use. Boating, particularly rafting, is the most popular water-dependent activity at the river, followed by fishing and swimming. (U.S. Army Corps of Engineers 1991a).

Relevant Plans, Policies, and Laws.

National Wild and Scenic Rivers Act. The National Wild and Scenic Rivers Act of 1968 was enacted to protect the water quality and free flowing condition of selected rivers or sections of selected rivers. The Lower American River was added to the system in 1981, when the Secretary of the Interior added State-designated rivers to the Federal system. The particular values for which the Lower American River was being included were not explicitly identified in the act, but the Secretary of the Interior described recreation and anadromous fishery values of the American River as "outstandingly remarkable." Although no single Federal agency was assigned land-right acquisition or management responsibilities, the act does require that agencies exercise their existing powers in a manner consistent with the policies and provisions of the act.

California Wild and Scenic Rivers Act. The California Wild and Scenic Rivers Act of 1972 was enacted to preserve certain rivers that possess extraordinary scenic, recreational, fishery, or wildlife values in their free-flowing condition, together with their immediate environment, for the benefit and enjoyment of the people of the State. The particular values for which the Lower American River was included in the State Wild and Scenic Rivers system were not stated in the legislation. However, specific sections of the Wild and Scenic Rivers Act have bearing on implementation of projects along the Lower American River.

Urban American River Parkway Preservation Act. The concept of the Parkway, developed in the early 1900s, was largely rejected because of ongoing flood damage along the American River. In the late 1950s, the idea was revived with the added flood protection of Folsom Dam. The Sacramento County Board of Supervisors established the Parks and Recreation Department in 1959 and directed it to acquire land adjacent to the river. Today, the Parkway is a 4,400-acre regional park, spanning between the mouth of the Sacramento River and Lake Natoma.

Recognizing that the Parkway contributes to the quality of life within the City and County of Sacramento, enhances the image of the city and county as desirable places to live, provides for the health and safety of the community, and contributes to the economic well-being of the community, the legislature passed the Urban American River Parkway Preservation Act in 1985. The act incorporated the Parkway Plan (described below), previously developed by the City and County of Sacramento, as the planning mechanism to provide policy guidance and coordination between agencies in protecting and managing "the diverse and valuable natural land, water, wildlife, vegetation resources" of the parkway. The act states that actions of State and local agencies with regard to land use decisions shall be consistent with the Parkway Plan.

American River Parkway Plan. The first Parkway Plan was produced in 1962. It was revised in 1968 and again in 1976 with significant public input. The plan calls for evaluation and revision, if necessary, every 5 years. The current version was published in 1985. The goals of the Parkway Plan are to:

- provide, protect, and enhance for public use a continuous open space greenbelt extending from the Sacramento River to the Sierra Nevada;

- provide appropriate access and facilities so that present and future generations can enjoy the amenities and resources of the parkway;

- preserve and improve the natural, archeological, historical, and recreational resources of the parkway, including an adequate flow of high-quality water, anadromous and resident fishes, migratory and resident wildlife, and diverse natural vegetation; and

- mitigate adverse effects of activities and facilities adjacent to the parkway.

The policies establish that the purpose and need for the project must be approved by the Sacramento County Board of Supervisors.

2.8.5 Lake Natoma

Facilities and Activities. Lake Natoma is the downstream boundary of FLSRA. Created by Nimbus Dam, it serves as a reregulating reservoir for the varying water releases from Folsom Dam. Because there are only slight variants in water fluctuation, the lake has developed an attractive, natural-appearing band of riparian vegetation around its shores.

Lake Natoma is managed by DPR as a passive recreation area; the emphasis is on nonmotorized water recreation. Developed facilities include the aquatic center for the California State University at Sacramento, a picnic area, and an 8.4-mile segment of the American River paved bicycle and pedestrian trail, which continues to Folsom Reservoir.

Bank fishing is common at Lake Natoma, and people swim and dive at the rock outcrops at the lake's upper end. Because water temperatures during the summer are lower here than at Folsom Reservoir upstream, the lake is less heavily used for swimming and wading.

Recreation Use. Annual visitation at Lake Natoma is reported as part of the total visitation to the FLSRA and discussed in "Recreation Use at Folsom Reservoir," above.

2.8.6 Sacramento and Yolo Bypasses

Facilities and Activities. Both the Sacramento and Yolo Bypasses offer recreational opportunities for birdwatchers and hunters from the surrounding area. Two wildlife areas have been established within the Yolo Bypass. Toward the northern end of the bypass, the Fremont Weir Wildlife Area provides fishing and hunting opportunities on a 210-acre parcel covered with riparian vegetation, valley oaks, and cottonwoods. Further south along the bypass, west of Sacramento off Interstate 80, the Vic Fazio Wildlife Area (VFWA) provides additional recreational opportunities for bird watchers and hunters. Centered on 3,700 acres of seasonal and year-round ponds, grasslands, and riparian forest, the VFWA provides habitat for nearly 200 species of birds, including brood and forage habitat for hawks, owls, wading birds, small mammals, and migratory bird species (Yolo Basin Foundation 2000). As the largest public/private restoration project west of the Florida Everglades, VFWA also supports the Discover the Flyway program, giving over 2,500 students each year the opportunity to interactively learn about wetland ecosystems and native grass and sedge restoration. Yolo Audubon members regularly lead weekend field trips, and a visitor center is planned for the near future. Public hunting is also allowed in some areas (Yolo Basin Foundation 2000).

In addition to the two established wildlife areas, there are approximately 17 established duck clubs in the Yolo Bypass that provide informal hunting opportunities. All are private clubs ranging in size from 30 acres to 3,244 acres (Delta Protection Commission 1997). Informally, occasional sustenance fishermen utilize the Tule Canal/Toe Drain that runs along the east levee of the Yolo Bypass, although the amount and quality of fish located within these canals is limited. In addition, during high flows, when the agricultural lands in the bypass are inundated, fishing opportunities are potentially expanded and enhanced.

The 360-acre Sacramento Bypass Wildlife Area also provides informal recreational opportunities for fishermen and bow hunters (California Department of Fish and Game 2000a).

Recreation Use. Approximately 2,500 to 3,000 students and teachers visited the VFWA in 1999 as participants in the wildlife area education or discover the Flyway programs. Guided field trips host approximately 500 people each year while visitors outside the education programs average about 150 per week. In addition, DFG allows hunters to enter the park between mid-October and mid-January, accounting for an additional use of approximately 1,500 people (Kulakow pers. comm. 2000).

Both the Sacramento Bypass and the Fremont Weir Wildlife Areas are DFG Type C wildlife areas, meaning that they are not staffed or monitored by DFG personnel. As a result, use statistics must be estimated by DFG personnel. In 1998, the Sacramento Bypass Wildlife Area was closed by the Bureau to facilitate necessary levee repair. Although the wildlife area has not officially been open since then, it is estimated that 200 people per year utilized the wildlife area for pheasant hunting and bird watching prior to its closure. Similarly, approximately 500 people per year participate in hunting and fishing activities at the Fremont Weir Wildlife Area (Stowers pers. comm. 2000).

Since the hunting and duck clubs in the Yolo Bypass are open to members and their guests only, use statistics and records are limited.

2.9 Fisheries

Current fishery conditions in the study area (Folsom Reservoir, Lake Natoma, Lower American River, Sacramento and Yolo Bypasses, and Sacramento River) and in areas potentially affected by the project (San Francisco Bay, Delta) are described below. Much of the information was summarized from several recent environmental documents, including the Draft Environmental Impact Statement (EIS) for the Sacramento River Service Area Water Contracting Program (U.S. Bureau of Reclamation 1988), the American River Watershed Investigation (U.S. Fish and Wildlife Service 1990), the Draft Operation Plan and EIS for Folsom Dam and Reservoir Reoperation (U.S. Army Corps of Engineers 1992), the Preliminary Administrative Draft Fisheries Technical Appendix for the Central Valley Project Improvement

Act (Jones & Stokes Associates 1994b), the final Environmental Impact Report (EIR) and SEIS V for the Sacramento River Bank Protection Project (Jones & Stokes Associates 1998), and the final Biological Data Report for the Sacramento River Bank Projection Project site river mile 149.0L (Jones & Stokes 2000b). These documents contain additional information on historical population trends, existing conditions, and the life history traits and habitat requirements of the principal management species. Fish species known to occur in Folsom Reservoir, Lake Natoma, the Lower American River, Sacramento River, and the Sacramento and Yolo Bypasses are listed in Table 2-4.

2.9.1 L. L. Anderson Dam

Resident fish species found in the Middle Fork of the American River and the French Meadow Reservoir include rainbow trout (*Oncorhynchus mykiss*), brown trout (*Salmo trutta*), brook trout (*Salvelinus fontinalis*), Sacramento sucker (*Catostomus occidentalis*), speckled dace (*Rhinichthys osculus*), and other coldwater fish species. No Federal or State special status fish species are found within the study area.

2.9.2 Folsom Reservoir

Folsom Reservoir supports both coldwater and warmwater game and forage fish. Important warmwater game species include black bass, sunfish, and catfish. Coldwater species include rainbow trout and landlocked sockeye salmon (*kokanee*). Annual hatchery plants of subcatchable and catchable rainbow trout sustain a seasonal (primarily winter and spring) trout fishery. Natural fish production in Folsom Reservoir is limited by low nutrient levels and annual reservoir level fluctuations of 60 feet or more.

2.9.3 Lower American River

Over 40 game and nongame fish species occur in the Lower American River and adjacent backwaters and ponds. Anadromous species include chinook salmon, steelhead trout, American shad, striped bass, and Pacific lamprey. Resident game fish include rainbow trout, largemouth bass, smallmouth bass, sunfish, and catfish. Common nongame species include Sacramento sucker, Sacramento squawfish, and tule perch. Hardhead, a California species of special concern, (Moyle et al. 1989) is known to occur in the Lower American River or adjacent waters. In addition, Sacramento splittail has been Federally listed as threatened (64 FR 5963-5981).

Adult fall-run chinook salmon may enter the Lower American River from August to January, with peak abundance from October through December. Most spawning occurs from late October through January, with peak spawning activity in November and early December. Juvenile chinook utilize the Lower American River for rearing and migrate downstream during April and June. On September 16, 1999, the NMFS determined that the proposed listing of fall-run chinook salmon as threatened was not warranted. Fall/late-fall-run chinook salmon remain a candidate species for listing under the Federal Endangered Species Act (ESA) (64 FR 50394-50415).

The Lower American River is included in the area defined as Essential Fish Habitat for chinook salmon by the Pacific Fishery Management Council in Amendment 14 to the Pacific

TABLE 2-4. Fish Species Occurring in the Lower American River

Common Name	Scientific Name
Steelhead/rainbow trout	*Oncorhynchus mykiss*
Chinook salmon	*Oncorhynchus tshawytscha*
American shad	*Alosa sapidissima*
Striped bass	*Morone saxatilis*
Pacific lamprey	*Lampetra tridentata*
Sacramento pike minnow	*Ptychocheilus grandis*
Sacramento sucker	*Catostomus occidentalis*
White catfish	*Ictalurus catus*
Green sunfish	*Lepomis cyanellus*
Bluegill	*Lepomis macrochirus*
Tule perch	*Hysterocarpus traski*
Mosquitofish	*Gambusia affinis*
Largemouth bass	*Micropterus salmoides*
Smallmouth bass	*Micropterus dolomieui*
Riffle sculpin	*Cottus gulosus*
Prickly sculpin	*Cottus asper*
Brown trout	*Salmon trutta*
Threadfin shad	*Dorosoma petenense*
Goldfish	*Carassius auratus*
Carp	*Cyprinus carpio*
California roach	*Hesperoleucus symmetricus*
Hitch	*Lavinia exilicauda*
Hardhead	*Mylopharadon conocephalus*
Golden shiner	*Notmigonus crysoleucas*
Sacramento blackfish	*Orthodon microlepidotus*
Sacramento splittail	*Pogonichthys macrolepidotus*
Speckled dace	*Rhynichthys osculus*
Black bullhead	*Ictalurus melas*
Brown bullhead	*Ictalurus nebulosus*
Channel catfish	*Ictalurus punctatus*
White crappie	*Pomoxis annularis*
Inland silverside	*Menidia beryllina*
Threespine stickleback	*Gasterosteus aculeatus*
Bigscale logperch	*Percina macrolepida*
Wakasagi (pond smelt)	*Hypomesus nipponensis*
White sturgeon	*Acipenser transmontanus*
Redear sunfish	*Lepomis microlophus*
Sacramento perch	*Archoplites interruptus*

Coast Salmon Plan. Chinook salmon Essential Fish Habitat includes all streams, lakes, ponds, wetlands, tributaries, and other water bodies currently viable and most of the habitat historically accessible to chinook salmon. The Magnuson-Stevens Act requires consultation for all Federal agency actions that may adversely affect Essential Fish Habitat.

Juvenile chinook salmon in the winter-run chinook size range have been caught in the Lower American River above the confluence of the Sacramento River, suggesting that juveniles actively swim from the Sacramento River upstream into the Lower American River (Jones & Stokes Associates 1999a). Juvenile winter-run salmon occur in the Lower Sacramento River and potentially in the Lower American River as early as September and may continue to rear through May. Winter-run chinook salmon is currently designated an endangered species under the Federal and State ESAs.

There is no evidence that Central Valley spring-run chinook salmon use the Lower American River for spawning, but juveniles may temporarily use the Lower American River during outmigration, similarly as winter-run chinook salmon. Spring-run adults occur in the Lower Sacramento River during migration to upstream spawning areas. Juvenile spring-run chinook salmon also use the Sacramento and Yolo Bypasses for rearing and migration during winter flood and spring flood periods (California Department of Water Resources 1999).

Adult and juvenile steelhead use the Sacramento River as a migration path primarily during winter and spring. The majority of steelhead in the American River are hatchery produced, and many of the steelhead produced at Coleman National and Feather River Fish Hatcheries stray and return to the American River. Steelhead may also occur in the Sutter, Yolo, and Sacramento Bypasses as migrating adults or juveniles during winter flood and spring flood periods. The Central Valley spring-run steelhead is Federally-listed as threatened (65 FR 42422-42481) and the Lower American River has been designated as part of their critical habitat (65 FR 7764-7787).

The aquatic environment and fish fauna in the Lower American River have been substantially altered from historic conditions. Folsom and Nimbus Dams blocked access and inundated much of the historic salmon and steelhead trout spawning and rearing habitat above the dam sites. Anadromous species are now limited to the lower 23 miles from Nimbus Dam to the Sacramento River confluence. Reservoir operation largely eliminated the seasonal flow extremes that occurred in the Lower American River before dam construction, resulting in higher discharges during summer and fall, and lower discharges during winter and spring. Fishery resources are also subjected to relatively rapid flow fluctuations resulting from the operation of Folsom Reservoir to meet Delta water quality standards and CVP water contract obligations.

Seasonal water temperatures in the Lower American River have been substantially altered by reservoir operations. Water temperatures can reach unsuitable levels for juvenile salmon and steelhead trout during spring and summer, especially in dry and critically dry water years. High summer water temperatures severely limit natural steelhead production in the Lower American River because juvenile steelhead reside in fresh water for a full year or more before migrating to sea. Significant reductions in Folsom Reservoir storage in dry and critically dry water years can cause water temperatures to exceed suitable levels for chinook salmon egg survival in October and November, adversely affecting both natural and hatchery production.

Nimbus Salmon and Steelhead Hatchery was completed in 1955 to compensate for salmon and steelhead trout losses caused by construction of Folsom and Nimbus Dams. The hatchery currently produces smolt-size fall-run chinook salmon and yearling steelhead trout, which are transported and released directly into the Sacramento-San Joaquin River estuary.

Shaded Riverine Aquatic Cover. SRA cover is defined as the nearshore aquatic area at the interface between a river and adjacent woody riparian habitat (U.S. Fish and Wildlife Service 1993). The principal attributes of SRA cover include the following:

- riparian vegetation that overhangs and/or protrudes into the water
- submerged woody debris such as leaves, logs, branches, and roots
- an adjacent bank composed of natural substrates; and
- variable water depths, velocities and currents.

These attributes provide high value feeding areas, escape cover, and reproductive cover for regionally important fish and wildlife species. Because of its unique biological attributes and its increasing scarcity throughout the Sacramento River system, SRA cover has been designated as Resource Category 1 by the Service (U.S. Fish and Wildlife Service 1992). A Category 1 habitat classification is defined by the Service as "unique and irreplaceable on a national basis or in the ecoregion." Accordingly, the Service recommends that the Corps actively seek impact avoidance and mitigation measures that result in no loss of existing SRA habitat value for bank protection projects in the Sacramento River system. For projects that may affect Federally listed or State-listed threatened or endangered anadromous fish in the system National Marine Fisheries Service (NMFS) and DFG require mitigation plans that adequately compensate for impacts on the SRA cover (U.S. Fish and Wildlife Service 1992).

Anadromous salmonids have been identified as key evaluation species for SRA cover because most of the attributes of SRA cover important to salmonids also benefit other terrestrial and aquatic species (U.S. Fish and Wildlife Service 1989). Adult chinook salmon and steelhead trout may use SRA cover during their upstream migration, but SRA cover is most important to juveniles because it moderates stream temperatures during the growing season and provides high-value resting and feeding areas, protection from predators, and shelter from high flows.

Shaded Riverine Habitat cover is also important because it provides habitat for other species as well. Native (i.e., splittail, tule perch) and nonnative species (i.e., smallmouth bass, largemouth bass) use shallow stream margins and backwaters for feeding, spawning, and protection of young. Shaded Riverine Habitat cover also provides a significant source of organic material and energy to the aquatic ecosystem that directly or indirectly benefits many aquatic species.

2.9.4 Lake Natoma

Lake Natoma supports many of the same species that are found in Folsom Reservoir. However, these fish populations are much smaller than those in Folsom Reservoir. Rapid turnover rates, low water temperatures, limited cover habitat, and frequent water level fluctuations contribute to poor fish production.

2.9.5 Sacramento River

The Sacramento River between Keswick Dam and the Delta supports a diverse assemblage of anadromous and resident fishes. Anadromous species include four races of chinook salmon (fall-, late fall-, winter-, and spring-run), steelhead trout, striped bass, American shad, white and green sturgeon, and Pacific lamprey. Chinook salmon and steelhead trout runs in the Upper Sacramento River have declined substantially during the last 30 years. Winter-run chinook salmon, which experienced record low run sizes in recent years, is currently designated an endangered species under the Federal and State ESAs. Central Valley spring-run chinook salmon has been Federally and State classified as a threatened species. Sacramento splittail has also been Federally listed as a threatened species. Species of special concern include hardhead, and Sacramento perch (Moyle et al. 1989). Delta smelt, a State-listed and Federally-listed endangered species, occurs in the Delta and Lower Sacramento River. Resident game and nongame species in the Sacramento River include most of the species common to the Lower American River.

Factors affecting fish populations in the Sacramento River include fish passage problems at Red Bluff Diversion Dam; unfavorable water temperatures during incubation, rearing, and emigration phases; altered river hydrology; entrainment losses at water diversions; habitat loss associated with levee and bank stabilization projects; predation; toxic discharges; and sport harvest. In general, existing fisheries conditions described for Folsom Reservoir apply to conditions in Shasta Reservoir, Lake Oroville, and other major low-elevation Sacramento Basin reservoirs.

2.9.6 Sacramento and Yolo Bypasses

The Sacramento and Yolo Bypasses are leveed floodways that transport floodflows from the Sacramento River to reenter the Sacramento River near Rio Vista. Flooding of the Sacramento and Yolo Bypasses creates an area of up to 59,000 acres of shallow water habitat. The bypasses' period of inundation ranges from early November to late June, peaking from January to March (California Department of Water Resources 1999). The primary input to the Yolo Bypass is the Fremont Weir, which conveys floodwaters from the Sutter Bypass, and the Sacramento and Feather Rivers. The Sacramento Weir (or Sacramento Bypass) allows water from the American and Sacramento Rivers to enter into the Yolo Bypass during major storm events. Water also enters the Yolo Bypass through Knight's Landing Ridge Cut, Cache Creek, Willow Slough Bypass, and Putah Creek. The Yolo Bypass provides important seasonal and permanent habitat to at least 40 fish species (California Department of Water Resources 1999). The bypass provides valuable spawning habitat for Sacramento splittail as well as rearing habitat for juvenile chinook salmon. Higher growth rates for juvenile chinook salmon have been observed on the Yolo Bypass as well as in the Sacramento Bypass (California Department of Water Resources 1999).

2.9.7 San Francisco Bay and Sacramento-San Joaquin Delta

The San Francisco Bay and the Delta provide important migration, spawning, and nursery habitats for numerous anadromous and resident fish species. Anadromous species use or are dependent on the San Francisco Bay and the Delta for some portion of their life cycle. The Sacramento-San Joaquin estuary is the primary habitat for several euryhaline (i.e., adapted to a wide salinity range) species, including Delta smelt and longfin smelt. The Sacramento-San Joaquin estuary and the San Francisco Bay also support numerous estuarine and marine species. Special-status species include winter- and spring-run chinook salmon, Delta smelt, longfin smelt, and Sacramento splittail. Dominant resident fish include sunfish, black bass, catfish, and minnows.

San Francisco Bay and Delta environmental conditions depend primarily on the physical structure of Delta channels, volume of freshwater inflow, Delta cross channel operations, within-Delta diversions (including Delta export pumping, small agricultural diversions, and others), and tidal fluctuations. The previous conditions determine Delta flow patterns, total Delta outflow to San Francisco Bay, and the location of the entrapment zone. Furthermore, fish distribution and survival is influenced through a variety of mechanisms related to water temperature, predation, food production and availability, physical habitat conditions, entrainment in Delta exports and diversions, competition with introduced fish and invertebrates, and pollutant levels.

2.10 Vegetation

This section describes existing vegetation resources in the study area. Information on vegetation was derived from the following sources:

- SAFCA Draft Preliminary Environmental Impact Statement (DPEIR), (April 2000) (Jones & Stokes 2000a),
- Folsom Dam and Reservoir Permanent Reoperation Study (Jones & Stokes 1994c),
- Suitability Analysis for Enhancing Wildlife Habitat in the Yolo Basin (Jones & Stokes 1994a),
- Supplemental Information Report on the American River Watershed Investigation. (U.S. Army Corps of Engineers et al. 1996),
- Dry Creek Flood Control Plan (Jones & Stokes 1993),
- California Department of Fish and Game's California Natural Diversity Database (CNDDB) 2000, and
- California Native Plant Society's (CNPS's) Electronic Inventory of Rare and Endangered Plants of California 2000 Update.

For this document, no field studies to develop descriptions of the existing vegetation in the study area or vicinity were conducted.

For the purposes of this document, vegetation resources are classified as common plant communities, sensitive plant communities, and special-status plant species. Natural plant communities in the study area (both sensitive and common) were classified using a system modified from Holland (1986). The common and scientific names of all species discussed in the following text are provided in Table 1A-1 in Attachment 1 of Appendix A.

2.10.1 Vegetation Resources in the Study Area

Common Plant Communities

Common plant communities refer to communities whose dominant species are abundant in the project vicinity and throughout California. Common plant communities that occur in the study area include chaparral, nonnative annual grassland and ruderal.

Chaparral. Chaparral consists of a dense cover of perennial, mostly evergreen shrubs, generally 1 to 3 meters in height. Chaparral is common around Folsom Reservoir, especially on steep, west or south facing slopes. The predominant species include chamise (*Adenostoma fasciculatum*) and whiteleaf manzanita (*Arctostaphylos viscida*); other common species present include toyon (*Heteromeles arbutifolia*), California coffeeberry (*Rhamnus californica*), buck brush (*Ceanothus cuneatus* var. *cuneatus*), poison oak (*Toxicodendron diversilobum*), and redbud (*Cercis occidentalis*).

Gabbroic northern mixed chaparral occurs on gabbro- and diorite-derived soils along the South Fork American River arm of Folsom Reservoir. This community is considered a sensitive plant community, supports several special-status plants, and is described below under "Sensitive Communities."

Nonnative Annual Grassland. Nonnative annual grasslands are communities dominated by nonnative annual grasses and low growing forbs. This community occurs in upland environments and forms the understory within oak woodlands throughout the study area. Typical species in nonnative annual grasslands in the study area include ripgut grass (*Bromus diandrus*), soft chess (*Bromus hordeaceus*), hare barley (*Hordeum murinum* ssp. *leporinum*), storkbill (*Erodium* spp.), and annual cranesbill (*Geranium molle*).

Ruderal. Ruderal areas include weedy fields, pastures, road margins, and other frequently disturbed habitats. In the study area, they are typically located along the edges of human disturbance and developed areas. Plants typically found in ruderal habitats in the study area and vicinity include yellow star-thistle (*Centaurea solstitialis*), medusahead grass (*Taeniatherum caput-medusae*), and many of the same species found in nonnative annual grasslands.

Sierran Mixed Conifer Forest. This plant community is only present at the French Meadows Reservoir site and consists of trees like ponderosa pine (*Pinus ponderosa*), incense cedar (*Calocedrus decurrens*), and white fir (*Abies concolor*). Common shrubs include greenleaf manzanita (*Arctostaphylos patula*), mountain whitethorn (*Ceanothus cordulatus*), deerbrush (*Ceanothus integerrimus*), keckiella (*Keckiella lemmonii*), huckleberry oak (*Quercus vaccinifolia*), and willows (*Salix* sp.). Some of the forbs and graminoids present include Indian paintbrush (*Castilleja pruinosa*), fireweed (*Epilobium* sp.), rush (*Juncus* sp.), monkeyflower (*Mimulus* sp.), mint (*Monardella* sp.), beardtongue (*Penstemon* sp.), and skullcap (*Scuttellaria californica*).

Sensitive Communities

Sensitive plant communities have special protection or consideration under Federal, State, and local laws because they carry out important ecological functions, including water quality maintenance, slope stabilization and the provision of essential wildlife habitat. Sensitive communities for this project are considered those that meet any of the following criteria:

- Communities that are described as Significant Natural Areas (SNAs) by DFG (California Department of Fish and Game 1999) (Fish and Game Code Sections 1930-1933)

- Communities that are either known or believed to be of high priority for inventory in the CNDDB due to their rarity or level of threat (California Natural Diversity Database 2000)

- Wetland and riparian communities subject to Corps jurisdiction under Section 404 of the Federal Clean Water Act (CWA) and DFG jurisdiction under Section 1601-1603 of the State Fish and Game Code

- Communities that are protected or recognized as a community of special concern by the State or local ordinances

Sensitive plant communities in the study area and vicinity include valley oak and blue oak savanna and woodland, gabbroic northern mixed chaparral, riparian forest, riparian scrub, freshwater marsh, and seasonal wetland (including vernal pools). Project-related effects on streams, wetlands, and some associated vegetation communities, are regulated by the Corps under Section 404 of the Federal CWA and DFG under Section 1601–1603 of the State Fish and Game Code. Specifically, the Corps regulates the discharge of dredged or fill material into waters of the United States under Section 404 of the CWA. DFG has adopted a "no net loss" policy for riparian habitat value. The Service mitigation policy for California's riparian habitats states that there should be no net loss of existing habitat value (46 FR 15:7644, January 23, 1981). Freshwater marsh and seasonal wetlands generally have wetland hydrology and hydric soils and can, in most cases, be considered wetlands subject to Corps jurisdiction. Riparian scrub and forest communities may occur adjacent to jurisdictional wetlands or streams, and may meet the criteria for Corps jurisdiction depending on local hydrology and soil conditions.

California State Senate Concurrent Resolution 17 and several city and county ordinances regulate effects on native oak and riparian trees and woodlands, as well as designated *landmark* or *heritage* trees. These local ordinances generally require permits for any activities that directly remove covered trees of specific size and species, or indirectly affect them by work under or adjacent to their canopy driplines. The ordinances typically have specific quantitative mitigation ratios for replacement of trees affected by projects.

Oak Woodland and Savanna. Oak woodlands have a discontinuous overstory dominated by oaks and an understory dominated by chaparral shrubs or nonnative annual grassland species. Oak savannas are transitional between oak woodlands and nonnative annual grasslands; they have an average oak canopy cover of less than 30 percent with an understory made up primarily of grassland species. Oak woodlands and savannas provide some of the highest quality habitat for both common and special-status wildlife species in California. These trees serve as an indicator of historical conditions and are an important part of California's natural heritage.

Woodlands dominated by blue oak (*Quercus douglasii*) are common around Folsom Reservoir. Other common woodland species include interior live oak (*Quercus wislizenii*), gray pine (*Pinus sabiniana*), ponderosa pine (*P. ponderosa*), buck brush, coyote brush (*Baccharis pilularis*), California buckeye (*Aesculus californica*), and poison oak (*Toxicodendron diversilobum*). Where more soil moisture is available, woodlands also contain common riparian species such as blackberry (*Rubus* sp.), elderberry (*Sambucus mexicana*), California bay (*Umbellularia californica*), and Fremont cottonwood (*Populus fremontii*).

The higher elevations of the Lower American River flood plain support woodlands dominated by a combination of interior live oak, valley oak (*Quercus lobata*), and blue oak. A 17-acre live oak woodland occurs in Goethe Park. At lower elevations, valley oak becomes more prevalent and is a common component in riparian forests. At all elevations, nonnative annual grassland commonly forms the understory beneath the oak woodland canopy.

Riparian Forest. Riparian forest consists of vegetation along stream channels, lake margins, or wetlands dominated by dense stands of riparian-associated tree and shrub species. Many riparian tree and shrub species are deciduous. Common tree species in riparian forests in the study area include valley oak, Goodding's black willow (*Salix gooddingii*), Fremont cottonwood, Oregon ash (*Fraxinus latifolia*), box elder (*Acer negundo* ssp. *negundo*), California buckeye, California bay, black oak (*Quercus kelloggii*), big-leaf maple (*Acer macrophyllum*), white alder (*Alnus rhombifolia*), California black walnut (*Juglans californica*) and western sycamore (*Platanus racemosa*). Common shrub and vine species include button willow (*Cephalanthus occidentalis*), red willow (*Salix laevigata*), toyon, California coffeeberry, poison oak, elderberry, blackberry, California grape (*Vitis californica*), and California pipevine (*Aristolochia californica*). Understory species include sedges (*Carex* sp.), rushes (*Juncus* sp.), deer grass (*Muhlenbergia rigens*) or other wetland or grassland species. Riparian forest occurs along tributary streams to Folsom Reservoir, such as Sweetwater Creek and the North and South Forks of the American River, the Lower American River, the Sacramento River, and portions of the Sacramento and Yolo Bypasses.

Riparian Scrub. Riparian scrub consists of shrubs and low trees, and is commonly dominated by willow species (*Salix* spp.), especially Goodding's black willow. This community is often found in more recently or more frequently disturbed environments than riparian forest, and often contains a similar overstory and understory species composition, but lacks the height, structural diversity, or cover of a riparian forest. The North and South Forks of the American

River, other tributaries to Folsom Reservoir, the Lower American River, Sacramento River, and Sacramento and Yolo Bypasses support small patches of riparian scrub. Other plant species include button willow, red willow, elderberry, poison oak, box elder, blackberry, mulefat (*Baccharis salicifolia*), mugwort (*Artemisia douglasiana*), smartweed (*Polygonum* spp.), and other shrubs and trees commonly found in riparian forests. Goodding's black willow is generally the only species that occupies regularly inundated habitats because it is more tolerant to inundation than other riparian species. Understory species may include rushes, sedges, and other wetland or grassland species. Patches of the invasive nonnative giant reed (*Arundo donax*) occur in disturbed areas near streams.

Gabbroic Northern Mixed Chaparral. Gabbroic northern mixed chaparral occurs north and south of the South Fork arm of Folsom Reservoir between Sweetwater and Weber Creeks. Specific soil types define this community. The soil types at this location (the Rescue Series) are rich in iron and magnesium and other heavy metals that many common plants species do not tolerate. Gabbroic northern mixed chaparral in the study area is typically dominated by chamise and locally supports several special-status plants, many of them local endemics, including four species that are Federally-listed as endangered and one species that is Federally-listed as threatened (Table 2-5). Federally-listed plants include Stebbinss morning glory (*Calystegia stebbinsii*), Pine Hill ceanothus (*Ceanothus roderickii*), Pine Hill flannelbush (*Fremontodendron decumbens*), El Dorado bedstraw (*Galium californicum* ssp. *sierrae*), and Layne's ragwort (*Senecio layneae*).

These special-status plants occur in a fire-adapted plant community, either entirely within chaparral or on the ecotone between chaparral and woodland. Fire is important for seed germination and seedling reestablishment; it reduces or eliminates competition and shading, and replenishes nutrients in the soil. Fire is essential to the survival of the special-status plant of the northern mixed chaparral community and chaparral-woodland ecotone; without periodic fires, they may not reproduce by seed or may be shaded by other plants (50 FR Part 17, October 18, 1996).

Freshwater Marsh. Freshwater marsh habitat occurs in backwaters, side channels, off-channel ponds, borrow pits, and small ponds and ditches along Lake Natoma, the Lower American River, and the Sacramento and Yolo Bypasses. Cattails (*Typha* sp.) and common tule (*Scirpus acutus*) along with other wetland plants such as three-square (*Scirpus americanus*), rushes and sedges typically dominate freshwater marsh. Riparian forest and scrub species typically occur along the margins of freshwater marshes. Sanford's arrowhead (*Sagittaria sanfordii*), a special-status plant species, occurs in freshwater marsh habitats along the Lower American River.

Seasonal Wetlands. Seasonal wetlands occur in drainage ditches in the study area, and consist of mostly low-growing herbaceous species. Seasonal wetlands are typically dominated by smartweed, annual hairgrass (*Deschampsia danthoniodes*), barnyard grass (*Echinochloa crus-galli*), purslane speedwell (*Veronica peregrina* ssp. *xalapensis*), rabbitsfoot grass (*Polypogon monspeliensis*), curly dock (*Rumex crispus*), stipitate popcornflower (*Plagiobothrys stipitatus* var. *micranthus*), sedges (*Carex* spp.), nutsedge (*Cyperus eragrostis*), coyote thistle (*Eryngium vaseyi*), fireweed (*Boisduvalia densiflora*), and rushes (*Juncus* spp.). Some riparian or upland plants that tolerate inundation may also occur in seasonal wetlands.

TABLE 2-5. Special-Status Plants that Occur or Have the Potential to Occur in the Project Area

Common and Scientific Name	Legal Status[a] Federal/ State/ CNPS	Geographic Distribution	Habitat Requirements	Identification Period	Area Where Species May Occur: Folsom Reservoir and Dam	Lake Natoma and Lower American River	Yolo Bypass Area and North Delta	Potential that Species Could Be Affected by the Program
Suisun Marsh aster *Aster lentus*	SC/--/1B	Sacramento/San Joaquin Delta, San Francisco Bay Region. Contra Costa, Napa, Sacramento, San Joaquin, and Solano Counties	Suisun Marsh, brackish and freshwater marsh	Aug-Nov			X	Low: habitat outside levees not likely to be affected
Alkali milk-vetch *Astragalus tener* var. *tener*	--/--/1B	Merced, Solano, and Yolo Counties; historically more widespread	Grassy flats and vernal pool margins, on alkali soils, below 200'	Mar-Jun			X	Low: vernal pool habitat not likely to be affected
Heartscale *Atriplex cordulata*	SC/--/1B	Western Central Valley and valleys of adjacent foothills	Saline or alkaline soils in chenopod scrub, or sandy soils in valley and foothill grasslands below 200 meters elevation	May-Oct			X	Low: vernal pool habitat not likely to be affected
Brittlescale *Atriplex depressa*	--/--/1B	Western Central Valley and valleys of adjacent foothills on west side of Central Valley	Alkali or clay soils of chenopod scrub, playas, valley and foothill grasslands, below 660'	May-Oct			X	Low: vernal pool habitat not likely to be affected
San Joaquin saltbush *Atriplex joaquiniana*	SC/--/1B	West edge of Central Valley from Glenn County to Tulare County	Alkali grassland, alkali scrub, alkali meadows, saltbush scrub, below 1,000'	Apr-Sep			X	Low: vernal pool habitat not likely to be affected
Big-scale balsamroot *Balsamorhiza macrolepis* var. *macrolepis*	--/--/1B	San Francisco Bay region, Sierra Nevada foothills, Coast Ranges, eastern Cascade Ranges, Sacramento Valley	Woodlands, open foothill grasslands, sometimes in serpentine soils generally below 4,600'	Mar-Jun	X			Low: no known occurrences within affected area
Stebbins's morning-glory *Calystegia stebbinsii*	E/E/1B	Northern Sierra Nevada foothills, Nevada and El Dorado Counties	Serpentine or gabbro chaparral opening, woodland generally 1,000'	May-Jun	X			Low: no known occurrences within affected area
Bristly sedge *Carex comosa*	--/--/2	Scattered occurrences throughout California, Oregon and Washington	Wet places and lake margins	May-Sep			X	Low: habitat not likely to be affected
Pine Hill ceanothus *Ceanothus roderickii*	E/R/1B	Northern Sierra Nevada foothills, Pine Hill, western El Dorado County	Often on serpentine or gabbro soils in northern mixed chaparral, cismontane woodland between 1,000-2,000'	May-Jun	X			Low: no known occurrences within affected area
Red Hills soaproot *Chlorogalum grandiflorum*	SC/--/1B	North and central Sierra Nevada foothills, Placer, El Dorado, and Tuolumne Counties	Chaparral, foothill pine-blue oak woodland; on serpentine or gabbro soils, between 1,000-1,650'	May-Jun	X			Low: no known occurrences within affected area
Palmate-bracted bird's-beak *Cordylanthus palmatus*	E/E/1B	Central Valley: Alameda, Colusa, Fresno, Madera*, San Joaquin*, and Yolo Counties	Alkaline flats and valley foothill grassland, chenopod scrub.	May-Oct			X	Low: habitat not likely to be affected
Dwarf downingia *Downingia pusilla*	--/--/2	California's central valley and inner north Coast Ranges, Merced Mariposa, Napa, Placer, Sacramento, Sonoma, Stanislaus and Tehama Counties and South America	Vernal pools, roadside ditches and mesic valley and foothill grasslands below 1,500 feet	Mar-May				Low: habitat not likely to be affected

TABLE 2-5. Continued

Common and Scientific Name	Legal Status[a] Federal/ State/ CNPS	Geographic Distribution	Habitat Requirements	Identification Period	Area Where Species May Occur: Folsom Reservoir and Dam	Lake Natoma and Lower American River	Yolo Bypass Area and North Delta	Potential that Species Could Be Affected by the Program
Pine Hill flannelbush *Fremontodendron decumbens*	E/R/1B	Northern high Sierra Nevada, Pine Hill (El Dorado County) near Grass Valley (Nevada County)	Gabbro or serpentine chaparral, woodland	Apr-Jun	X			Low: no known occurrences in or near affected area
Adobe-lily *Fritillaria pluriflora*	SC/--/1B	Inner North Coast Range, Northern Sierra Nevada foothills, edges of Sacramento Valley; Butte, Colusa, Glenn, Lake, Napa, Plumas, Solano, Tehama, Yolo	Adobe soil, chaparral, woodland, valley and foothill grassland	Feb-Apr			X	Low: no known occurrences within affected area
El Dorado bedstraw *Galium californicum* ssp. *sierrae*	E/R/1B	Northern Sierra Nevada foothills, El Dorado County	Open Pine-oak forests, chaparral, cismontane woodland, lower montane coniferous forest, on gabbroic soils between 330-1,650'	May-Jun	X			Low: no known occurrences within affected area
Bogg's Lake hedge-hyssop *Gratiola heterosepala*	--/E/1B	Inner north Coast Ranges, Central Sierra Nevada foothills, Sacramento Valley and Modoc Plateau; Fresno, Lake, Lassen, Madera, Modoc, Placer, Sacramento, Shasta, San Joaquin, Solano, and Tehama Counties	Clay soils in areas of shallow water, lake margins and vernal pool margins	Apr-Jun				Low: habitat not likely to be affected
Bisbee Peak rush-rose *Helianthemum suffrutescens*	--/--/3	Northern outer Coast Range, northern and central Sierra Nevada foothills, northern High Sierra Nevada, San Joaquin Valley, Central western California, south coast, Channel Islands, San Bernardino mountains, and the peninsular ranges. Amador, Calaveras, El Dorado, Sacramento and Tuolumne Counties	Chaparral, often on serpentine, gabbro, or Ione substrate, below 5,000'	Apr-May	X			Low: no known occurrences within affected area
Rose-mallow *Hibiscus lasiocarpus*	--/--/2	Central and southern Sacramento Valley, Delta. Butte, Contra Costa, Colusa, Glenn, Sacramento, San Joaquin, Solano, Sutter, and Yolo Counties	Wet banks, freshwater marshes, below 135'	Aug-Sep			X	Low: habitat outside levees not likely to be affected
Northern California black walnut *Juglans californica* var. *hindsii*	SC/--/1B	Last two native stands in Napa and Contra Costa Counties. Historically widespread through southern north inner Coast Range, southern Sacramento Valley, northern San Joaquin Valley, San Francisco Bay region	Canyons, valleys, riparian forest, riparian woodland, between 160-660'	Apr-May		X	X	Moderate: non-native stands of black walnut may be affected
Ahart's dwarf rush *Juncus leiospermus* var. *ahartii*	SC/--/1B	Eastern Sacramento Valley, northeastern San Joaquin Valley, Butte, Calaveras, Placer, Sacramento	Vernal pool margins generally between 160-330'	Mar-May			X	Low: habitat not likely to be affected

TABLE 2-5. Continued

Common and Scientific Name	Legal Status[a] Federal/ State/ CNPS	Geographic Distribution	Habitat Requirements	Identification Period	Area Where Species May Occur: Folsom Reservoir and Dam	Lake Natoma and Lower American River	Yolo Bypass Area and North Delta	Potential that Species Could Be Affected by the Program
Delta tule pea *Lathyrus jepsonii* var. *jepsonii*	SC/--/1B	Central valley, especially the San Francisco Bay region. Alameda, Contra Costa, Fresno, Marin, Napa, Sacramento, San Benito, Santa Clara, San Joaquin, and Solano Counties	Coastal and estuarine marshes generally below 1,000'	May-June			X	Low: habitat outside levees not likely to be affected
Legenere *Legenere limosa*	SC/--/1B	Primarily located in the lower Sacramento Valley, also from north Coast Ranges, northern San Joaquin Valley and the Santa Cruz mountains	Deep, seasonally wet habitats such as vernal pools, ditches, marsh edges, and river banks, below 500'	May-Jun			X	Low: habitat not likely to be affected
Heckard's pepper-grass *Lepidium latipes* var. *heckardii*	--/--/1B	Southern Sacramento Valley, Glenn, Solano, and Yolo Counties	Annual grassland on margins of alkali scalds, below 660'	Apr-May			X	Low: habitat not likely to be affected
Mason's lilaeopsis *Lilaeopsis masonii*	SC/R/1B	Southern Sacramento Valley, northeast San Francisco Bay region, Alameda, Contra Costa, Marin, Napa, Sacramento, San Joaquin, and Solano Counties	Freshwater and intertidal marshes, streambanks in riparian scrub generally at sea level	Apr-Oct			X	Low: habitat outside levees not likely to be affected
Delta mudwort *Limosella subulata*	--/--/2	Deltaic central valley, Contra Costa, Marin, Sacramento, San Joaquin, and Solano Counties; Oregon	Muddy or sandy intertidal flats and marshes generally at sea level	May-Aug			X	Low: habitat outside levees not likely to be affected
Little mousetail *Myosurus minimus* ssp. *apus*	SC/--/3	Central valley, San Francisco Bay region, southern outer Coast Range, couth coast. Alameda, Butte, Contra Costa, Colusa, Kern, Riverside, San Bernardino, San Diego*, Solano, and Stanislaus Counties	Alkaline vernal pools and marshes below 5,000'	Mar-Jun			X	Low: habitat not likely to be affected
Baker's navarretia *Navarretia leucocephala* ssp. *bakeri*	--/--/1B	Inner north Coast Range, western Sacramento Valley, Colusa, Lake, Mendocino, Marin, Napa, Solano, Sonoma, and Tehama Counties	Vernal pools and swales in woodland, lower montane coniferous forest, mesic meadows, and grassland, generally below 5,600'	May-Jul				Low: habitat not likely to be affected
Pincushion navarretia *Navarretia myersii* ssp. *myersii*	--/--/1B	Central valley, Amador, Lake, Merced and Sacramento Counties	Edges of vernal pools, between 60-300'	May				Low: habitat not likely to be affected
Colusa grass *Neostapfia colusana*	T/E/1B	Central valley, Colusa*, Merced, Solano, Stanislaus, and Yolo Counties	Adobe soils of vernal pools, generally below 650'	May-Jul				Low: habitat not likely to be affected
Slender Orcutt grass *Orcuttia tenuis*	T/E/1B	Sierra Nevada and Cascade Range foothills; Lake, Plumas, Sacramento, Shasta, Siskiyou, and Tehama Counties	Vernal pools, generally between 650-3,600'	May-Jul				Low: habitat not likely to be affected
Sacramento Orcutt grass *Orcuttia viscida*	E/E/1B	Endemic to Sacramento County	Vernal pools below 330'	May-Jun				Low: habitat not likely to be affected

TABLE 2-5. Continued

Common and Scientific Name	Legal Status[a] Federal/ State/ CNPS	Geographic Distribution	Habitat Requirements	Identification Period	Area Where Species May Occur: Folsom Reservoir and Dam	Lake Natoma and Lower American River	Yolo Bypass Area and North Delta	Potential that Species Could Be Affected by the Program
Sanford's arrowhead *Sagittaria sanfordii*	SC/--/1B	Scattered locations in Central Valley and Coast Ranges	Freshwater marshes, sloughs, canals, and other slough moving water habitats generally below 1,000'	May-Aug		X	X	Moderate: effects of operations may be positive or negative
Layne's butterweed *Senecio layneae*	T/R/1B	Northern Sierra Nevada foothills, El Dorado and Tuolumne Counties	Rocky serpentine or gabbro soils, chaparral and foothill woodland, between 660-3,300'	Apr-Jul	X			Low: no known occurrences within affected area
Crampton's tuctoria *Tuctoria mucronata*	E/E/1B	Southwestern Sacramento Valley, Solano and Yolo Counties	Mesic valley and foothill grassland, vernal pools, below 500'	Apr-Jul			X	Low: no known occurrences in affected area
El Dorado County mule ears *Wyethia reticulata*	SC/--/1B	Endemic to El Dorado County	Chaparral, woodland, lower coniferous forest on clay or gabbro soils, between 1,000-1,640'	May-Jul	X			Low: no known occurrences within affected area

[a] Status explanations:

Federal
E = listed as endangered under the federal Endangered Species Act.
T = listed as threatened under the federal Endangered Species Act.
PE = proposed for federal listing as endangered under the federal Endangered Species Act.
PT = proposed for federal listing as threatened under the federal Endangered Species Act.
C = species for which USFWS has on file sufficient information on biological vulnerability and threat(s) to support issuance of a proposed rule to list.
SC = species of concern; species for which existing information indicates it may warrant listing but for which substantial biological information to support a proposed rule is lacking.
-- = no listing.

State
E = listed as endangered under the California Endangered Species Act.
T = listed as threatened under the California Endangered Species Act.
R = listed as rare under the California Native Plant Protection Act. This category is no longer used for newly listed plants, but some plants previously listed as rare retain this designation.
SSC = species of special concern in California.
-- = no listing.

California Native Plant Society
1A = List 1A species: presumed extinct in California.
1B = List 1B species: rare, threatened, or endangered in California and elsewhere.
2 = List 2 species: rare, threatened, or endangered in California but more common elsewhere.
3 = List 3 species: plants about which more information is needed to determine their status.
4 = List 4 species: plants of limited distribution.
-- = no listing.

* in distribution - species presumed extirpated from County. CNPS Inventory of Rare and Endangered Vascular Plants of California.

Vernal pools are a specialized type of seasonal wetlands. They are typically low swales or bowl-shaped depressions underlain by an impermeable substrate. Rainwater collects in vernal pools during the fall, winter, and spring, and then evaporates during the spring and summer. Species common to vernal pools may include those listed above under seasonal wetlands. Many special-status plant species have adapted to the unique soils and hydrology of vernal pools in the project vicinity, including alkali milk-vetch (*Astragalus tener* var. *tener*), palmate-bracted bird's beak (*Cordylanthus palmatus*), dwarf downingia (*Downingia pusilla*), Tuolumne button-celery (*Erynigium pinnatisectum*), Bogg's Lake hedge-hyssop (*Gratiola heterosepala*), Ahart's dwarf rush (*Juncus leiospermus* var. *ahartii*), legenere (*Legenere limosa*), Colusa grass (*Neostapfia colusana*), slender Orcutt grass (*Orcuttia tenuis*), and Sacramento Orcutt grass (*O. viscida*).

Special-Status Plant Species

Special-status plant species are legally protected under State and Federal ESAs or other regulations, and species that the scientific community considers to be sufficiently rare to qualify for such listing. Special-status plants are species in any of the following categories:

- Plants listed, proposed for listing, or candidates for possible future for listing as threatened or endangered under Federal ESA (50 Code of Federal Regulations (CFR) 17.12 [listed plants] and various notices in the Federal Register [proposed species]; 61 FR 40:7596-7613, February 28, 1996 [candidates])

- Plants listed or proposed for listing by the State of California as threatened or endangered under the California ESA (14 CCR 670.5)

- Plants listed as rare or endangered under the California Native Plant Protection Act (CNPPA) (California Fish and Game Code, Section 1900 et seq.)

- Plants that meet the definitions of rare or endangered under the State CEQA Guidelines Sec. 15380

- Plants considered by the CNPS to be "rare, threatened, or endangered in California" (Lists 1B and 2 in Skinner and Pavlik 1994 and California Native Plant Society 2000)

- Plants listed by CNPS as plants about which more information is needed to determine their status, and plants of limited distribution (Lists 3 and 4 in Skinner and Pavlik 1994 and California Native Plant Society 2000), which may be included as special-status species on the basis of local significance or recent biological information

- Plants listed as sensitive by the local U.S. Forest Service region (Forest Service Manual 2670) or U.S. Bureau of Land Management resource area

A list of special-status plants that are reported to occur or have potential to occur in the study area or vicinity was compiled for this report based on consultation with the Service, and searches of the latest versions of the CNDDB (California Natural Diversity Database 2000) and

CNPS's Electronic Inventory (California Native Plant Society 2000) (Table 2-5). The following U.S. Geological Survey (USGS) 7.5 topographic quadrangles were searched in the CNDDB and CNPS databases to develop a list of special-status plants that may occur in the study area: Auburn, Coloma, Pilot Hill, Rocklin, Clarksville, Folsom, Citrus Heights, Rio Linda, Taylor Monument, Gray's Bend, Woodland, Knights Landing, Davis, Sacramento West, Sacramento East, Carmichael, Buffalo Creek, Folsom SE, Sloughhouse, Clarksburg, Saxon, Liberty Island, Rio Vista, Courtland, Isleton, and Jersey Island.

Table 2-5 provides information on the special-status plants with potential to occur in the study area or be affected by the project, including listing status, geographic range, general ecological information, habitat associations, blooming period, known occurrences in the study area, and potential project-related impacts.

2.10.2 L. L. Anderson Dam

Special-Status Plant Species

Two rare plants occurred in the DFG's CNDDB for the area around the project site: saw-toothed lewisia (*Lewisia serrata*) and Stebbins's phacelia (*Phacelia stebbinsii*). These two species tend to occur on metamorphic rock outcrops near waterfall areas and have a low potential to occur on the project site. Neither species was observed during the reconnaissance and no further rare-plant surveys need to be conducted for them. Other plant species were collected during the survey and identified to the level necessary to determine if they were sensitive or watchlist plants listed for the Tahoe National Forest. No rare plants were present and no further rare-plant surveys need to be conducted at the project site. Table 2-5 provides more information on these plants.

2.10.3 Folsom Dam and Reservoir

Sensitive Plant Communities

Oak Woodland and Savanna. Woodlands dominated by blue oak (*Quercus douglasii*) surround Folsom Reservoir. Other common woodland species include grey pine (*Pinus sabiana*), interior live oak (*Q. wislizenii*), buck brush, coyote brush (*Baccharis pilularis*), tree tobacco (*Nicotiana glauca*), and poison oak (*Toxicodendron diversilobum*). Woodlands also contain patches of herbaceous riparian vegetation where blackberry (*Rubus* sp.) and elderberry shrub (*Sambucus mexicana*) occur and Fremont cottonwood (*Populus fremontii*) may be more prevalent. Annual grassland occurs beneath the woodland canopy. Where the tree canopy cover is less than 30 percent, the community is considered a savanna rather than a woodland.

Riparian Forest. Narrow stringers of riparian forest occur along the creeks that feed Folsom Reservoir (e.g., Sweetwater Creek) and along the North and South Forks of the American River. Dominant tree species in riparian forests may include Goodding's black willow (*Salix gooddingii*), Fremont cottonwood, Oregon ash (*Fraxinus latifolia*), box elder (*Acer negundo*), blackberry, and other species. A sparse understory of sedges (*Carex* sp.), rushes (*Juncus* sp.) and other wetland species may be present.

Willow Scrub. The North and South Forks of the American River and some tributary creeks to Folsom Reservoir locally support small patches of willow scrub. Sparse willow scrub also occurs in the higher elevations around Folsom Reservoir. This riparian vegetation is dominated by Goodding's black willow. Other plant species may include button willow (*Cephalanthus occidentalis*), red willow (*Salix laevigata*), and box elder. However Goodding's black willow is the only species that occupies the inundation zone, because it is more tolerant to inundation than other riparian species. Understory species may include rushes and sedges.

Gabbroic Northern Mixed Chaparral. Gabbroic northern mixed chaparral occurs north and south of the South Fork arm of Folsom Reservoir, between Sweetwater Creek and Weber Creek. This area is probably underlain at least in part by the gabbro-diorite intrusion centered to the south at Pine Hill; soils here (the Rescue Series) are rich in iron and magnesium and commonly contain other heavy metals as well. Gabbroic northern mixed chaparral in the study area is typically dominated by chamise and locally supports several special-status plants, including four species that are Federally listed as endangered and one species that is Federally listed as threatened (Table 2-5). These special-status plants occur in a fire-adapted plant community, either entirely within chaparral or on the ecotone between chaparral and woodland. Fire is important for seed germination and seedling reestablishment; it reduces or eliminates competition and shading and replenishes nutrients in the soil. Fire is essential to the survival of the special-status plants of the northern mixed chaparral community and chaparral-woodland ecotone; without periodic fires, they may not reproduce by seed or may be shaded by other plants (50 FR Part 17, October 18, 1996).

Special-Status Plant Species

The habitats surrounding Folsom Reservoir support or have the potential to support several special-status plant species. Gabbroic northern mixed chaparral supports five Federally listed plant species. Four species are listed as endangered: Stebbins's morning glory (*Calystegia stebbinsii*), Pine Hill ceanothus (*Ceanothus roderickii*), Pine Hill flannelbush (*Fremontodendron decumbens*) and El Dorado bedstraw (*Galium californicum* ssp. *sierrae*). Layne's butterweed (*Senecio layneae*) is listed as threatened. All except Pine Hill flannelbush occur within 0.5 mile of the banks of the South Fork of the American River arm of Folsom Reservoir (California Natural Diversity Database 1999). Pine Hill flannelbush is not known from the area near Folsom Reservoir; the closest occurrence of this species is more than 2.5 miles from the reservoir banks (California Natural Diversity Database 1999). Three other special-status plants occur within the gabbroic northern mixed chaparral and adjacent oak woodland habitats: El Dorado County mule ears (*Wyethia reticulata*), Red Hills soaproot (*Chlorogalum grandiflorum*), and Bisbee Peak rush-rose (*Helianthemum suffrutescens*). These species have no status under the Federal ESA, but El Dorado County mule ears and Red Hills soaproot are considered "rare, threatened or endangered" by CNPS (List 1B) and Bisbee Peak rush-rose is on a CNPS watch list for plants "about which more information is needed to determine their status" (List 3).

In addition, annual grassland and oak woodland in the Folsom Reservoir region support big-scale balsamroot (*Balsamorhiza macrolepis* var. *macrolepis*). This species is listed by CNPS as "rare, threatened or endangered" (List 1B). Big-scale balsamroot has been historically reported as occurring in the vicinity of the North Fork of the American River arm of the reservoir, but the status of this occurrence is currently unknown (California Natural Diversity Database 2000).

2.10.4 Lake Natoma

Sensitive Plant Communities

Oak Woodland. Woodlands dominated by blue oak and interior live oak surround Lake Natoma. Other species include grey pine, cottonwood, buck brush, coyote brush and wild grape (*Vitus californica*).

Riparian Forest. Patches of forest dominated by riparian trees occur along the riverbanks near Lake Natoma. Dominant species typically include some combination of the following: willows (*Salix* spp.), cottonwoods (*Populus* spp.) and valley oak. Other common species include white alder (*Alnus rhombifolia*), walnut (*Juglans* sp.) and western sycamore (*Platanus racemosa*). Riparian forest communities may also support such shrubs as elderberry, button bush (*Cephalanthus occidentalis*), or blackberry. Patches of the invasive nonnative species giant reed (*Arundo donax*) occur in disturbed areas near water courses.

Permanent Freshwater Marsh. Marsh habitat occurs in narrow patches along the bank of Lake Natoma. Permanent freshwater marsh is typically dominated by cattails (*Typha* sp.) and common tule (*Scirpus acutus*) along with other wetland plants such as threesquare *(Scirpus americanus*). These are all obligate wetland plants (Reed 1988 and U.S. Fish and Wildlife Service 1996). Permanent marsh is locally interspersed with willow, blackberry scrub, and riparian forest to form a vegetation mosaic.

Special-Status Plant Species

Potential habitat for several special-status plant species occurs in the vicinity of Lake Natoma. Nonnative annual grassland and oak woodland communities provide potential habitat for big-scale balsamroot. Riparian forest plant communities provide potential habitat for Northern California black walnut (*Juglans californica* var. *hindsii*); native stands of this species are listed as “rare, threatened or endangered” (List 1B) by CNPS. Permanent freshwater marsh plant communities provide potential habitat for Sanford’s arrowhead (*Sagittaria sanfordii*), which is listed by CNPS as “rare, threatened or endangered” in California (List 1B). Table 2-5 provides more information on these plants.

2.10.5 Lower American River

Sensitive Plant Communities

Oak Woodland. The higher elevations of the Lower American River flood plain support woodlands dominated by a combination of interior live oak, valley oak and blue oak. A 17-acre live oak woodland occurs in Goethe Park. At lower elevations, valley oak becomes more prevalent and the oak woodland gives way to riparian forest. At all elevations, annual grassland forms the understory beneath the oak woodland canopy.

Permanent Freshwater Marsh. Permanent freshwater marsh is found in backwaters, side channels, off-channel ponds, borrow pits, and small ponds and ditches. It is typically dominated by cattails and common tule and contains other wetland plants such as sedges and rushes. Permanent freshwater marsh is locally interspersed with willow, blackberry scrub, and riparian forest to form a vegetation mosaic.

Riparian Forest. Riparian forest dominated by Fremont cottonwood and Goodding's black willow occurs along the riverbanks. Other dominant species locally include red willow and valley oak. Common species include alder, walnut, and sycamore. Riparian forest communities may also support such shrubs as elderberry, button bush, and blackberry.

Riparian Scrub. Riparian scrub occurs along the riverbanks, commonly adjacent to permanent marsh, and is typically dominated by willows. Other common shrubs include button bush, elderberry, and blackberry. The understory may consist of facultative wetland plants (those able to live in both wetland and upland conditions) or of upland grassland species. This plant community is described as Great Valley willow scrub in Holland (1986). Willow scrub transitions gradually into riparian forest, which contains a greater diversity of tree species and larger trees.

Special-Status Plant Species

Potential habitat for several special-status plant species occurs in the vicinity of the study area. These species include Northern California black walnut and Sanford's arrowhead. See Table 2-5 for more information on these plants.

2.10.6 Sacramento Bypass, Yolo Bypass, and Northern Delta

Sensitive Plant Communities

Permanent Freshwater Marsh. Marsh habitat occurs in a number of ditches in the Sacramento Bypass, Yolo Bypass, and Northern Delta areas. Permanent freshwater marsh is typically dominated by cattails and common tule and contains other wetland plants such as rushes and sedges. These species are generally obligate wetland plants (Reed 1988 and U.S. Fish and Wildlife Service 1996). Permanent marsh may be interspersed with willow, blackberry scrub, and riparian forest in a vegetation mosaic.

Seasonal Wetland. Seasonal wetland in this area occurs in drainage ditches. Seasonal wetlands are typically dominated by species including smartweed (*Polygonum* spp.), annual hairgrass (*Deschampsia danthoniodes*), barnyard grass (*Echinochloa crus-galli*), purslane speedwell (*Veronica peregrina* ssp. *xalapensis*), rabbitsfoot grass (*Polypogon monspeliensis*), curly dock (*Rumex crispus*), stipitate popcornflower (*Plagiobothrys stipitatus* var. *micranthus*), sedges, nutsedge (*Cyperus eragrostis*), coyote thistle (*Eryngium vaseyi*), fireweed (*Boisduvalia densiflora*), and rushes. Some riparian or upland plants that tolerate inundation may also occur in seasonal wetlands.

Riparian Scrub. Riparian scrub occurs in and along drainage ditches, commonly adjacent to permanent marsh, and is typically dominated by willows with an understory of facultative wetland plants or upland grassland species. Other common species include button bush and blackberry. Areas of riparian scrub may be dominated by nonwoody riparian vegetation such as mulefat (*Baccharis salicifolia*), mugwort (*Artemisia douglasiana*) or smartweed. This plant community is described as Great Valley willow scrub in Holland (1986). Riparian scrub transitions gradually into riparian forest, which contains a greater diversity of tree species and larger trees.

Riparian Forest. Riparian forest patches are dominated by riparian trees, and occur scattered along levees, ditches, and sloughs. These communities typically include Fremont cottonwood, Goodding's black willow, red willow, box elder, and valley oak. This plant community may also support such shrubs as blackberry, elderberry or button bush. Generally, these communities conform to Holland's (1986) Great Valley Riparian Forest.

Special-Status Plant Species

The Sacramento Bypass, Yolo Bypass, and Northern Delta areas provide potential habitat for several special-status plant species. Nonnative annual grassland communities provide potential habitat for Heckard's peppergrass (*Lepidium latipes* var. *heckardii*), a species listed as "rare, threatened or endangered" by CNPS (List 1B). Permanent freshwater marsh communities provide potential habitat for Mason's lilaeopsis (*Lilaeopsis masonii*), which is State-listed as rare, and for three species listed as "rare, threatened or endangered" in California by CNPS (List 1B): Suisun Marsh aster (*Aster lentus*), Sanford's arrowhead and Delta tule pea (*Lathyrus jepsonii* var. *jepsonii*). Permanent freshwater marsh provides habitat for three species that are listed as "rare, threatened or endangered" in California by CNPS, but are more common outside the State: rose-mallow (*Hibiscus lasiocarpus*), bristly sedge (*Carex comosa*) and Delta mudwort (*Limosella subulata*). Seasonal wetlands in the area provide potential habitat for two plants that are both State and Federally listed as endangered: palmate-bracted bird's-beak (*Cordylanthus palmatus*) and Crampton's tuctoria *(Tuctoria mucronata*). They also provide potential habitat for Bogg's Lake hedge-hyssop *(Gratiola heterosepala*), which is State-listed as endangered, and for Colusa grass (*Neostapfia colusana*), which is Federally listed as threatened and State-listed as endangered. In addition, seasonal wetlands offer potential habitat for five species on CNPS List 1B: alkali milkvetch (*Astragalus tener* var. *tener*), heartscale (*Atriplex cordulata*), brittlescale (*Atriplex depressa*), legenere (*Legenere limosa*) and San Joaquin spearscale (*Atriplex joaquiniana*). Seasonal wetlands may provide habitat for dwarf downingia (*Downingia pusilla*), which is included on CNPS List 2, and for little mousetail (*Myosurus minimus* ssp. *apus*), which is on CNPS List 3, but regarding which more information is needed to determine its status. Finally, riparian forest and riparian scrub communities provide potential habitat for Northern California black walnut.

Table 2-5 provides additional information on special-status plant species in the Sacramento Bypass, Yolo Bypass and Northern Delta areas.

2.11 Wildlife

This section presents information on wildlife resources in the study area. Descriptions of biological resources were derived from the following sources:

- Folsom Dam and Reservoir Permanent Reoperation Study (Jones & Stokes 1994c)
- Feasibility Report: American River Watershed Investigation (U.S. Army Corps of Engineers 1991b)
- Suitability Analysis for Enhancing Wildlife Habitat in the Yolo Basin (Jones & Stokes 1994a)
- Interim Reoperation of Folsom Dam and Reservoir (Sacramento Area Flood Control Agency and U.S. Bureau of Reclamation 1994)
- Supplemental Information Report on the American River Watershed Investigation (U.S. Army Corps of Engineers et al. 1996)

This environmental document recognizes three categories of wildlife resources: common wildlife habitats, sensitive wildlife habitats, and special-status wildlife species. Like plant communities, wildlife habitats in the study area (both sensitive and common) were classified using a system modified from Holland (1986) (Section 2.10, "Vegetation). Special-status wildlife species include those species that fulfill one or more of the following criteria:

- Protected under the State or Federal ESA
- Proposed for Federal listing or candidates for Federal listing
- Federal species of concern
- State species of special concern

The common and scientific names of all species discussed in the following text are provided in Table 1A-2 in Attachment 1 of Appendix A.

Sensitive Wildlife Habitats

For purposes of this document, the term sensitive habitat is defined as plant communities and wildlife habitats composed of native species that are especially diverse, regionally uncommon, or of specific concern to State or Federal agencies. Sensitive habitats in the study area include seasonal wetland, freshwater marsh, oak woodland and savanna, blue oak savanna, willow scrub, and riparian forest.

A substantial Statewide decline of riparian communities in recent years has increased concerns about riparian-dependent plant and wildlife species, leading State and Federal agencies to adopt policies to arrest further loss. DFG has adopted a "no-net-loss" policy for riparian habitat value. The Service's mitigation policy identifies California's riparian habitats in Resource Category 2, for which they recommend "no net loss" of existing habitat value (46 FR 15:7644, January 23, 1981).

Common Wildlife Habitats

Common habitats are distinguished from sensitive habitats on the basis of their local, regional, or Statewide abundance. In the study area, common wildlife habitats include chaparral, annual grassland, ruderal field, and agricultural land.

Special-Status Wildlife

Preparation of this environmental document included compilation of a list of special-status wildlife species that are known to occur or that have the potential to occur in the study area (Table 2-6). The list was based on search conducted at the CNDDB (2000), on local environmental documents, and on other biological studies as needed. Potential occurrences of special-status wildlife species in the study area are discussed below.

2.11.1 L. L. Anderson Dam

Common Wildlife Habitats

The project site provides limited habitat for wildlife due to its disturbed characteristics and lack of vegetative cover. The surrounding area is dominated by sierran mixed conifer forest. Common mammals in this forest habitat include western gray squirrel, deer mice, and several other small mammal species. Bird species using the pines for nesting and foraging include yellow-rumped warbler, dark-eyed junco, and hairy woodpecker.

Sensitive Wildlife Habitats

A reconnaissance level survey for rare plants was performed on June 23, 2001. The resource survey included walking portions of the spillway channel and river below the spillway escape channel and identifying potential special-status amphibian habitat and suitable nesting habitat for nesting raptors in the vicinity of the project site. The U.S. Forest Service representative, Harlen Hamburger, was contacted by telephone on June 27, 2001 to discuss biological resource issues. In addition, a review of the CNDDB search for the Bunker Hill quadrangle was conducted and previous surveys conducted at the project site in 1997 were reviewed.

Special-status wildlife that have potential to occur in the study area include foothill yellow-legged frog (*Rana boylii*), northwestern pond turtle (*Clemmys marmorata marmorata*), northern goshawk (*Accipiter gentilis*), Cooper’s hawk (*Accipiter cooperii*), sharp-shinned hawk (*Accipiter stiatus*), osprey (*Pandion haliaetus*) and marten (*Martes americana*). Based on the reconnaissance visit it is unlikely that foothill yellow-legged frogs occur in the study area; however, this species may occur downstream of the project site. The project site is located at an elevation of approximately 5,200 feet. The California red-legged frog (*Rana aurora draytonii*) is not likely to be affected by the project because this species is not known to occur at elevations above 4,500 feet. Pond turtles are not known to occur above 5,000 feet in elevation; however, the project is located just above the upper elevation for this species and pond turtles may occur downstream of the project site. No evidence of nesting activity by raptors was observed during the 1-day survey of June 23, 2001. Suitable nesting habitat for all of the raptors listed above was

TABLE 2-6. Special-Status Wildlife that are Known to Occur or Could Occur in the Project Area

Common Name and Scientific Name	Status [a] Federal/ State	California Distribution	Habitats	Reason for Decline or Concern	Occurrence in Study Area
Vernal pool fairy shrimp *Branchinecta lynchi*	T/--	Central Valley, central and south Coast Ranges from Tehama County to Santa Barbara County; isolated populations also in Riverside County	Common in vernal pools; also found in sandstone rock outcrop pools	Habitat loss to agricultural and urban development	No known occurrences in program area; no suitable habitat
Vernal pool tadpole shrimp *Lepidurus packardi*	E/--	Shasta County south to Merced County	Vernal pools and ephemeral stock ponds	Habitat loss to agricultural and urban development	No known occurrences in program area; no suitable habitat
Shirttail Creek stonefly *Megaleuctra sierra*	SC/--	Shirttail Creek, a tributary of the North Fork American River	Shallow, fast flowing, Mossy rifles	Not known	Shirttail Creek, upstream of Folsom Reservoir
Gold rush hanging scorpionfly *Orbittacus obscurus*	SC/--	American River	Dense riparian forests	Loss of riparian forest	Lower American River and along the North and Middle Forks of the American River
Spiny rhycophilan caddisfly *Rhyacophila spinata*	SC/--	Upper American River	Well-aerated riffles in clear, cold, swift streams	Unknown	Known only from small tributaries of the upper American River, just below Forest Hill
Valley elderberry longhorn beetle *Desmocerus californicus dimorphus*	T/--	Streamside habitats below 3,000 feet through the Central Valley of California	Riparian and oak savanna habitats with elderberry shrubs; elderberries are host plant	Loss and fragmentation of riparian habitats	Occurs in upper and lower American River, Sacramento River, and Yolo Bypass
Sacramento Valley tiger beetle *Cicindela hirticollis abrupta*	SC/--	Lower Sacramento Valley (i.e., Sacramento River, lower American River, and Cache Creek)	Found in sandy areas among willows in riverine and riparian habitats		Recorded from the Sacramento River downstream from American River and from the lower American River
Sacramento anthicid (beetle) *Anthicus sacramento*	SC/--	Restricted to a dune area at mouth of Sacramento River; western tip of Grand Island, Sacramento County; dunes near Rio Vista, Solano County; Ord Ferry Bridge, Butte County; upper Putah Creek	Found in sand slip-faces among willows	Alteration of Delta dunes, limited range	Potential for occurrence along the Sacramento River downstream from the American
Delta green ground beetle *Elaphrus viridus*	T/--	Restricted to Olcott Lake and other vernal pools at Jepson Prairie Preserve, Solano County	Sparsely vegetated edges of vernal lakes and pools	Limited range	No known occurrences

TABLE 2-6. Continued

Common Name and Scientific Name	Status [a] Federal/ State	California Distribution	Habitats	Reason for Decline or Concern	Occurrence in Study Area
California red-legged frog *Rana aurora draytoni*	T/SSC	Found along the coast and coastal mountain ranges of California from Humboldt County to San Diego County; Sierra Nevada (mid-elevations [above 1,000 feet] from Butte County to Fresno County)	Permanent and semi-permanent aquatic habitats, such as creeks and coldwater ponds, with emergent and submergent vegetation and riparian species along the edges; may estivate in rodent burrows or cracks during dry periods	Alteration of stream and wetland habitats, overharvesting (historically), habitat destruction, competition and predation by fish and bullfrogs	Nearest known occurrences are on Webber Creek, near Placerville; Tributaries (small streams) of Folsom Reservoir are potential habitat, excluding the North, Middle, and South Forks of the American River; no suitable habitat downstream of Folsom Dam
Foothill yellow-legged frog *Rana boylii*	SC/SSC	Occurs in the Klamath, Cascade, north Coast, south Coast, and Transverse Ranges; through the Sierra Nevada foothills up to approximately 6,000 feet (1,800 meters) south to Kern County	Creeks or rivers in woodlands or forests with rock and gravel substrate and low overhanging vegetation along the edge; usually found near riffles with rocks and sunny banks nearby	Reduced habitat quality from alteration of stream hydrology, predation by non-native aquatic fauna, loss of habitat from urban development	No known occurrences in the program area; potential habitat occurs along tributary steams of upper American River
Northwestern pond turtle *Clemmys marmorata marmorata*	SC/SSC	In California, range extends from Oregon border of Del Norte and Siskiyou Counties south along coast to San Francisco Bay, inland through Sacramento Valley, and on the western slope of Sierra Nevada; range overlaps with that of southwestern pond turtle through the Delta and Central Valley to Tulare County	Woodlands, grasslands, and open forests; occupies ponds, marshes, rivers, streams, and irrigation canals with muddy or rocky bottoms and with watercress, cattails, water lilies, or other aquatic vegetation	Loss and alteration of aquatic and wetland habitats, habitat fragmentation	Occurs in the upper and lower American River, Sacramento River, Sacramento and Yolo Bypass Sloughs, and Putah Creek
Giant garter snake *Thamnophis gigas*	T/T	Central Valley from Fresno north to the Gridley/Sutter Buttes area; has been extirpated from areas south of Fresno	Sloughs, canals, and other small water-ways where there is a prey base of small fish and amphibians; requires grassy banks and emergent vegetation for basking and areas of high ground protected from flooding during winter	Loss of habitat from agriculture and urban development, habitat fragmentation	Occurrences in Natomas Basin and Yolo Bypass

TABLE 2-6. Continued

Common Name and Scientific Name	Status [a] Federal/ State	California Distribution	Habitats	Reason for Decline or Concern	Occurrence in Study Area
White-faced ibis *Plegadis chihi*	SC/SSC	Both resident and winter populations on the Salton Sea and in isolated areas in Imperial, San Diego, Ventura, and Fresno Counties; breeds at Honey Lake, Lassen County, at Mendota Wildlife Management Area, Fresno County, and near Woodland, Yolo County; winters in Merced County and along the Sacramento River in Colusa, Glenn, Butte, Sutter, and Yolo Counties	Prefers freshwater marshes with tules, cattails, and rushes, but may nest in trees and forage in flooded agricultural fields, especially flooded rice fields	Loss of wetlands to agriculture and urban development	Occasionally occurs in the Yolo Bypass; becoming more common in the lower Sacramento Valley, especially in rice fields and seasonal wetlands
Aleutian Canada goose *Branta canadensis leucopareia*	T/--	The entire population winters in Butte Sink, then moves to Los Banos, Modesto, the Delta, and East Bay reservoirs; stages near Crescent City during spring before migrating to breeding grounds	Roosts in large marshes, flooded fields, stock ponds, and reservoirs; forages in pastures, meadows, and harvested grainfields; corn is especially preferred	Introduction of predators on breeding grounds, loss of traditional wintering habitat	Rare occurrences in the Yolo Bypass
Bald eagle *Haliaeetus leucocephalus*	T/E	Nests in Siskiyou, Modoc, Trinity, Shasta, Lassen, Plumas, Butte, Tehama, Lake, and Mendocino Counties and in the Lake Tahoe Basin; reintroduced into central coast; winter range includes the rest of California, except the southeastern deserts, very high altitudes in the Sierras, and east of the Sierra Nevada south of Mono County; range expanding	In western North America, nests and roosts in coniferous forests within 1 mile of a lake, a reservoir, a stream, or the ocean	Nest sites vulnerable to human disturbance, pesticide contamination	Winters at Folsom Reservoir; occasionally observed along the American River
Cooper's hawk *Accipiter cooperii*	--/SSC	Throughout California except high altitudes in the Sierra Nevada; winters in the Central Valley, southeastern desert regions, and plains east of the Cascade Range; permanent residents occupy the rest of the state	Nests primarily in riparian forests dominated by deciduous species; also nests in densely canopied forests from digger pine-oak woodland up to ponderosa pine; forages in open woodlands	Human disturbance at nest sites, loss of riparian habitats, especially in the Central Valley; pesticide contamination	Potential nester along the lower American River
Swainson's hawk *Buteo swainsoni*	--/T	Lower Sacramento and San Joaquin Valleys, the Klamath Basin, and Butte Valley; the state's highest nesting densities occur near Davis and Woodland, Yolo County	Nests in oaks or cottonwoods in or near riparian habitats; forages in grasslands, irrigated pastures, and grain fields	Loss of riparian, agriculture, and grassland habitats; vulnerable to human disturbance at nest sites	Nests along the Sacramento River, Natomas Basin, and Yolo Bypass

TABLE 2-6. Continued

Common Name and Scientific Name	Status [a] Federal/ State	California Distribution	Habitats	Reason for Decline or Concern	Occurrence in Study Area
American peregrine falcon *Falco peregrinus anatum*	--/E	Permanent resident on the north and south Coast Ranges; may summer on the Cascade and Klamath Ranges south through the Sierra Nevada to Madera County; winters in the Central Valley south through the Transverse and Peninsular Ranges and the plains east of the Cascade Range		Pesticide contamination; population recovering	Occasional winter visitor in the Yolo Bypass and along the lower American River and Sacramento River
Mountain plover *Charadrius montanus*	C/SSC	Does not breed in California; in winter, found in the Central Valley south of Yuba County, along the coast in parts of San Luis Obispo, Santa Barbara, Ventura, and San Diego Counties; parts of Imperial, Riverside, Kern, and Los Angeles Counties	Occupies open plains or rolling hills with short grasses or very sparse vegetation; nearby bodies of water are not needed; may use newly plowed or sprouting grainfields	Loss of habitat to agriculture and urban development; decline of California's wintering population may be attributable to disturbance of breeding population	Occasional winter visitor in the Yolo Bypass
Western yellow-billed cuckoo *Coccyzus americanus occidentalis*	--/E	Nests along the upper Sacramento, lower Feather, south fork of the Kern, Amargosa, Santa Ana, and Colorado Rivers	Wide, dense riparian forests with a thick understory of willows for nesting; sites with a dominant cottonwood overstory are preferred for foraging; may avoid valley-oak riparian habitats where scrub jays are abundant	Loss of riparian habitat to agriculture and water control development, possibly pesticide contamination	No known occurrences; no suitable nesting habitat present
Western burrowing owl *Athene cunicularia hypugea*	SC/SSC	Lowlands throughout California, including the Central Valley, northeastern plateau, southeastern deserts, and coastal areas; rare along south coast	Rodent burrows in sparse grassland, desert, and agricultural habitats	Loss of habitat, human disturbance at nesting burrows	Occurs along the western edge of the Yolo Bypass, south of Putah Creek
Bank swallow *Riparia riparia*		The state's largest remaining breeding populations are along the Sacramento River from Tehama County to Sacramento County and along the Feather and lower American Rivers, in the Owens Valley; nesting areas also include the plains east of the Cascade Range south through Lassen County, northern Siskiyou County, and small populations near the coast from San Francisco County to Monterey County	Nests in bluffs or banks, usually adjacent to water, where the soil consists of sand or sandy loam to allow digging	Loss of natural earthen banks to bank protection and flood control, erosion control related to stream regulation by dams	Four recently active colonies along the lower American River

TABLE 2-6. Continued

Common Name and Scientific Name	Status [a] Federal/ State	California Distribution	Habitats	Reason for Decline or Concern	Occurrence in Study Area
Tricolored blackbird *Agelaius tricolor*	SC/SSC	Largely endemic to California; permanent residents in the Central Valley from Butte County to Kern County; at scattered coastal locations from Marin County south to San Diego County; breeds at scattered locations in Lake, Sonoma, and Solano Counties; rare nester in Siskiyou, Modoc, and Lassen Counties	Nests in dense colonies in emergent marsh vegetation, such as tules and cattails, or upland sites with blackberries, nettles, thistles, and grainfields; nesting habitat must be large enough to support 50 pairs; probably requires water at or near the nesting colony; requires large foraging areas, including marshes, pastures, agricultural wetlands, dairies, and feedlots, where insect prey is abundant	Loss of wetland and upland breeding habitats from conversion to agriculture and urban development and to water development projects, pesticides contamination, human disturbance of nesting colonies	Occasional occurrences in the Yolo Bypass; no known nesting sites in the Yolo Bypass

[a] Status definitions:

Federal

E = listed as endangered under the Federal Endangered Species Act.
T = listed as threatened under the Federal Endangered Species Act.
C = species for which USFWS has on file sufficient information on biological vulnerability and threat(s) to support issuance of a proposed rule to list, but issuance of the proposed rule is precluded.
SC = species of concern; species for which existing information indicates it may warrant listing but for which substantial biological information to support a proposed rule is lacking.
-- = no listing.

State

E = listed as endangered under the California Endangered Species Act.
T = listed as threatened under the California Endangered Species Act.
SSC = species of special concern in California.
-- = no listing.

located within 0.25 mile of the project site. Suitable habitat for martin was also located within 0.25 mile of the project site.

Cliff and barn swallows are two swallow species that frequently build mud nests on the underside of artificial structures, such as bridges. Swallow activity was observed on the underside of the bridge crossing the French Meadow spillway. Cliff swallows and barn swallows are not considered special-status wildlife species; however, their occupied nests and eggs are protected by both Federal and State laws, including the Federal Migratory Bird Treaty Act (50 CFR 10 and 21) and California Fish and Game Code, Sections 3503, 3513, and 3800. The Service is responsible for overseeing compliance with the Migratory Bird Treaty Act, and the U.S. Department of Agriculture animal damage control officer makes recommendations on animal protection issues. DFG is responsible for overseeing compliance with the California Fish and Game Code.

2.11.2 Folsom Dam and Reservoir

Common Wildlife Habitats

Chaparral. Chaparral provides important cover and foraging habitat for brush-dependent wildlife and a range of other wildlife species. Wrentits and California thrashers are primarily chaparral-dependent wildlife species; other species that use the chaparral habitat include spotted towhees, California towhees, golden-crowned sparrows, orange-crowned warblers, gray foxes, coyotes, and mule deer. Many species of reptiles occur in chaparral, including western rattlesnakes, gopher snakes, western fence lizards, and western whiptails.

Annual Grassland. Annual grasslands in the study area have moderate value as wildlife habitat. Grasslands provide foraging habitat for wide-ranging species such as red-tailed hawks, coyotes, gray foxes, and bobcats. These species depend on grassland prey species that include California voles, California ground squirrels, gopher snakes, and western fence lizards. In addition, many species that nest or roost in adjacent woodlands, including western bluebirds, western kingbirds, and some species of bats, may forage in grasslands.

Ruderal Grassland. Ruderal grasslands have similar wildlife values to those of annual grasslands, except that they commonly support fewer wildlife species because they are dominated by nonnative plants and therefore may offer sparse cover. In addition, ruderal fields are typically disturbed on a more or less ongoing basis by human activity, which further reduces their value for wildlife.

Sensitive Wildlife Habitats

Oak Woodland and Savanna. Oak woodlands and savannas offer diverse, abundant, and valuable wildlife habitat. Oak trees provide nesting sites for cavity-nesting birds and small mammals, including acorn woodpeckers, Nuttall's woodpeckers, northern flickers, white-breasted nuthatches, oak titmice, western bluebirds, western gray squirrels, and raccoons. Oak trees also provide roosting sites for some species of bats including the hoary bat and pallid bat. Acorns are used by a variety of wildlife species, including California quail, wild turkeys, northern flickers, western scrub jays, western gray squirrels, and mule deer. Oak foliage provides a foraging substrate for insectivorous birds such as ruby-crowned kinglets, bushtits, warbling vireos, Hutton's vireos, and Wilson's warblers. Blackberries and elderberries are eaten by many species of birds and mammals, including American robins, Bullock's orioles, house finches, spotted towhees, California towhees, and gray foxes. Finally, the shrub understory of these habitats provide cover for many species of songbirds as well as for California quail, gopher snakes, common kingsnakes, bobcats, gray foxes, and a variety of rodents.

Blue Oak Savanna. Blue oak savanna has particularly high value for wildlife because blue oak trees provide excellent substrates for cavity-nesting wildlife. Wildlife use of blue oaks in the savanna setting is similar to the use of oak woodlands described above, except that the higher density of blue oaks provides a greater number of nesting sites for cavity-nesting birds and small mammals.

Willow Scrub. Willow scrub along the North and South Forks of the American River has high value for wildlife. Willow scrub provides cover, nesting habitat, and foraging habitat for many wildlife species, including habitat particularly suitable for migratory songbirds. Belted kingfishers, Anna's hummingbirds, bushtits, ruby-crowned kinglets, Wilson's warblers, yellow warblers, and lesser goldfinches also use the willow scrub environment, as do Pacific treefrogs, raccoons, striped skunks, and mule deer.

Special-Status Wildlife Species

Several special-status wildlife species occur in the Folsom Reservoir pool area, in adjacent uplands, and in tributary streams and rivers. These species include vernal pool fairy shrimp, vernal pool tadpole shrimp, valley elderberry longhorn beetles (VELBs), California red-legged frogs, foothill yellow-legged frogs, western spadefoot toads, northwestern pond turtles, great blue herons, great egrets, Aleutian Canada geese (winter only), Cooper's hawks, sharp-shinned hawks, white-tailed kites, mountain plovers, and tricolored blackbirds. Ospreys, bald eagles, and American peregrine falcons do not nest in the study area, but regularly visitors it. Table 2-6 provides additional information on these special-status wildlife species.

2.11.3 Lower American River

Common Wildlife Habitats

The wildlife values of oak woodland and annual grassland along the Lower American River are similar to those described above for similar habitats around Folsom Reservoir.

Permanent Freshwater Marsh. Permanent freshwater marsh along the Lower American River has substantial value for river and marsh wildlife. The marsh vegetation downstream from Lake Natoma is more extensive, so habitat value increases in this area. Water birds and other wildlife depend on freshwater marshes for food, water, and cover. Pacific treefrogs, western toads, common garter snakes, beavers, raccoons, and muskrats use the marsh environment for foraging and/or rearing habitat. Mallards, wood ducks, and song sparrows also feed in these areas.

Riparian Forest. Riparian forest along the Lower American River is wider and more substantial than in upstream areas. The multi-layered vegetation of the forest environment provides nesting habitat, foraging habitat, and cover for many resident and migratory wildlife species, and riparian forest has the highest wildlife species diversity in the region. Mature oaks, cottonwoods, and sycamores provide nesting or roosting sites for cavity-nesting birds and mammals, including wood ducks, acorn woodpeckers, western screech owls, barn owls, titmice, nuthatches, western gray squirrels, and certain species of bats. Overstory and understory vegetation provides foraging habitat for a variety of resident and migratory birds, including vireos, warblers, flycatchers, tanagers, and orioles. Wild turkeys, California quail, and mule deer are also common in riparian forest areas. Reptiles and amphibians that can be found in riparian forest habitat include Pacific treefrogs, western toads, western fence lizards, and gopher and garter snakes.

Willow Scrub. Like the riparian forest found along the Lower American River, willow scrub in this area has high habitat value and supports a diversity of wildlife. Because this habitat commonly occurs adjacent to permanent marsh or riparian forest, it supports many wildlife species that occur in those habitats, including small mammals, reptiles, amphibians, and many species of birds. Willow scrub habitat is also important for breeding and migratory birds.

Sensitive Wildlife Habitats

Shaded Riverine Aquatic Cover. SRA cover vegetation is the unique, near-shore aquatic cover that grows at the interface between a waterbody and adjacent riparian habitat. A discussion of SRA cover is provided in Section 2.9.4

Special-Status Wildlife Species

Potential habitat for seven special-status wildlife species occurs along and in the Lower American River. These include VELBs, Sacramento River tiger beetles, northwestern pond turtles, great blue herons, great egrets, Cooper’s hawks, sharp-shinned hawks, white-tailed kites, and bank swallows. In particular, the Service has designated two areas of critical habitat and two areas of essential habitat for VELBs along the Lower American River.

2.11.4 Lake Natoma

Common Wildlife Habitats

The values offered by common wildlife habitats such as oak woodland and annual grassland in the Lake Natoma area are similar to those described for the Folsom Reservoir area.

Sensitive Wildlife Communities

Riparian Forest. Narrow bands of riparian forest are present around the edges of Lake Natoma. This forest provides valuable wildlife habitat and supports many of the same species described below for riparian habitats of the Lower American River.

Permanent Freshwater Marsh. Although patchy and narrow, strips of permanent freshwater marsh along the lake's edge have substantial value for river and marsh wildlife. Water birds and other wildlife depend on the freshwater marshes in these areas for foraging and/or rearing habitat. These species include Pacific treefrogs, western toads, common garter snakes, beavers, raccoons, and muskrats.

Special-Status Wildlife Species

Special-status wildlife that occurs in the Lake Natoma pool area, in adjacent uplands, and in tributary streams and rivers are the same as those described above for Folsom Dam and Reservoir (Table 2-6).

2.11.5 Sacramento and Yolo Bypasses

Common Wildlife Habitats

Annual grassland. Annual grassland is the most abundant common wildlife habitat in the Sacramento and Yolo Bypass areas. Annual grassland has a limited distribution, but provides important foraging habitat for a wide variety of wildlife species. Seed-eating birds, including ring-necked pheasants, savanna sparrows, white-crowned sparrows and house finches feed in the grassland, especially along levee slopes and in fields south of Putah Creek. Rodents such as California voles and western harvest mice also depend on grassland resources. A number of raptor species hunt for rodents and birds in grassland environments; these include red-tailed hawks, rough-legged hawks, American kestrels, white-tailed kites, northern harriers, barn owls, and great horned owls. Snakes also depend on grassland prey species for food. In addition, waterfowl, herons, and egrets forage in flooded grasslands.

Agricultural Land. A variety of crops are grown in the vicinity of the bypasses, including rice, corn, milo, tomatoes, and safflower (Jones & Stokes Associates 1990). Flooded croplands (in particular, rice paddies, wheatfields, and cornfields) have substantial value for waterfowl, especially for mallards, northern pintails, and geese. Herons, egrets, gulls, and raptors also feed in dry and flooded agricultural lands in the bypass areas.

Sensitive Wildlife Habitats

Permanent Freshwater Marsh. Freshwater marsh in the bypass areas provides important wintering habitat for ducks, geese, swans, and many other species of migratory waterbirds. During the spring and early summer, these wetlands provide critical duck brooding habitat, which is generally lacking throughout most of the study area. Marshes are also used by many other wildlife species, including pied-billed grebes, herons, egrets, bitterns, coots, shorebirds, rails, and raptors, as well as muskrats, otters, and beavers. Upland wildlife, including ring-necked pheasants, black-tailed hares, and desert cottontails, forage and take cover at the margins of wetlands. Garter snakes, treefrogs, and bullfrogs also rely on freshwater marsh for cover and forage.

Seasonal Wetland. Managed seasonal wetland, alkali sink seasonal wetland, and other seasonal wetland habitats in the Sacramento and Yolo Bypass areas have high value for wildlife.

Managed seasonal wetland is widespread in the area and typically consists of moist, fallow farmland or land managed by duck clubs or the Vic Fazio Wildlife Area. This land provides foraging and roosting habitat for waterfowl and other waterbirds during the fall, winter, and spring (Jones & Stokes Associates 1990, 1994a). The wetland is also used by pelicans, coots, rails, herons, egrets, and raptors for foraging and roosting. An alkali sink seasonal wetland is located west of the Yolo Bypass in the vicinity of the Woodland and Davis wastewater facilities. It supports nesting raptors (harriers and short-eared owls), mallards, pheasants, and meadowlarks. Alkali wetland in the bypass areas also serves as foraging habitat for raptors, herons, egrets, songbirds, and rodents.

Willow Scrub. Willow scrub environments associated with sloughs and canals in the bypass areas have high wildlife value. Willows typically grow in dense clumps and provide cover for many species of wildlife species. Many small mammals and birds feed on willow seeds, and young willow shoots are the favored food of beavers. The large number of insects that feed and breed in willows and other riparian shrubs provide food for a diversity of resident and migratory birds, including warblers, vireos, kinglets, and flycatchers. In addition, Nuttall's and downy woodpeckers commonly nest in willow scrub habitats and black-crowned night-herons are known to roost there. Pacific treefrogs and garter snakes can also be found in willow scrub habitat.

Riparian Forest. Riparian forest habitat in the bypass supports many species of wildlife. Specifically, the large cottonwoods oaks, and sycamores found here provide nesting opportunities for large birds such as hawks, owls, American crows, egrets, herons, and wood ducks and small birds such as tree swallows. The open forest canopy of this habitat provides hunting perches for aerial foragers, including ash-throated flycatchers and western kingbirds. Acorns produced by the oaks provide an important food source for many species, including California quail, acorn woodpeckers, northern flickers, western scrub jays, and white-breasted nuthatches. Other species that can be found in riparian forest habitat include Pacific treefrogs, western toads, fence lizards, and gopher and garter snakes.

Special-Status Wildlife Species

The following special-status wildlife species are known to occur in the vicinity of the Sacramento and Yolo Bypasses: vernal pool fairy shrimp, midvalley fairy shrimp, California linderiella fairy shrimp, vernal pool tadpole shrimp, Sacramento anthicid beetles, VELB, western pond turtles, giant garter snakes, American white pelicans, double-crested cormorants, white-faced ibises, white-tailed kites, bald eagles (wintering only), northern harriers, Swainson's hawks, American peregrine falcons, greater sandhill cranes (uncommon visitors), western snowy plovers, mountain plovers, short-eared owls, long-eared owls (rare visitors), western burrowing owls (do not nest in flooded areas), bank swallows, and tricolored blackbirds.

2.11.6 Sacramento-San Joaquin Delta

Common Wildlife Habitats

The most widespread common wildlife habitat in the Delta is agricultural land. The agricultural fields in the Delta area offer wildlife values similar to those of agricultural lands in the Sacramento and Yolo Bypass areas. However, some of the Delta islands escape winter flooding and remain emergent throughout the year. In addition, Delta agricultural lands outside the flooded areas include orchards that provide fruit for crows, jays, magpies, orioles, and finches.

Sensitive Wildlife Habitats

The value of riparian scrub and perennial freshwater marsh in the Delta is similar to the value of these habitats in the Sacramento and Yolo Bypass areas.

Special-Status Wildlife Species

The following special-status wildlife species are known to occur in the Delta: vernal pool fairy shrimp, midvalley fairy shrimp, California linderiella fairy shrimp, vernal pool tadpole shrimp, Sacramento anthicid beetles, delta green ground beetles, VELBs, giant garter snakes, western pond turtles, Aleutian Canada geese (south Delta), Swainson's hawks, American peregrine falcons (migrant and winter visitors), greater sandhill cranes, long-billed curlews, western burrowing owls, loggerhead shrikes, and tricolored blackbirds (Table 2-6).

2.12 Water Quality

State and Federal law mandates a series of programs for the management of surface water quality. In the State of California, water resources are protected under the Federal CWA and the State Porter-Cologne Water Quality Control Act, which created the SWRCB and nine Regional Water Quality Control Boards (RWQCBs). Each RWQCB is responsible for preparing and updating a water-quality control plan (basin plan) every three years; the basin plan for a specific region identifies water quality protection policies and procedures for that region (California Regional Water Quality Control Board 1998).

In the study area, the Central Valley RWQCB is responsible for designating beneficial uses for waters of the American and Sacramento River basins and the Delta. Beneficial uses include such uses as agricultural, municipal, and industrial supply; fisheries and wildlife habitat; recreation; navigation; and power generation. These uses are protected by a range of Central Valley RWQCB programs that:

- specify waste discharge requirements for discharges of wastes to land or water; and
- authorize discharges under the National Pollutant Discharge Elimination System (NPDES) permitting process, pursuant to the Federal CWA with oversight by the U.S. Environmental Protection Agency (EPA).

The Central Valley RWQCB also establishes water quality objectives for the American and Sacramento River basins and the Sacramento-San Joaquin Delta. Water quality objectives are intended to support the protection of beneficial uses. The Central Valley RWQCB has established both numerical and narrative objectives for physical and chemical water-quality parameters in a number of water bodies, and has extended both numerical and narrative objectives to water bodies not directly named in the basin plan by implementing the "tributary rule." Specific numerical objectives are set for total dissolved solids (TDS), acidic value (pH), electrical conductivity (EC), dissolved oxygen content, bacterial content, temperature, turbidity, and concentrations of chloride, boron, iron, and trace metals. General narrative objectives are set for color, taste and odor, and aquatic toxicity and for concentrations of suspended and settleable solids, biostimulatory substances, oils and grease, and pesticides. In addition, water quality objectives for metals and organic compounds in fresh and salt water are regulated under the California Toxics Rule (CTR) for the protection of human health and aquatic life. The Federal and State drinking water quality standards regulate the quality of municipal drinking water supplies after a raw water source has been treated to remove pollutants.

Section 303(d) of CWA requires each state to maintain a list of streams in which physical and/or chemical aspects of water quality are limited or impaired by the presence of pollutants. Section 303(d) requires preparation of a total maximum daily load (TMDL) program for waters identified by the State as impaired. The TMDL process consists of quantitatively assessing pollutant loading of the water body and establishing the allowable load of pollutants from individual sources to ensure compliance with water quality standards.

Several types of NPDES permits apply to stormwater discharges in the study area and are administered by the Central Valley RWQCB. Municipal NPDES permits apply on an areawide basis to the management and treatment of stormwater discharges from municipal drainage infrastructure. Sacramento County and the Cities of Sacramento, Folsom, and Galt cooperate in the management of an areawide municipal NPDES stormwater permit and a related monitoring program for evaluating regional stormwater quality. Stormwater discharges from general industrial activities and construction activities that disturb more than 5 acres of land are also permitted by the Central Valley RWQCB. The Central Valley RWQCB also administers general NPDES stormwater permits for "low threat" discharges including construction dewatering (removal of accumulated water in an excavation). The NPDES permitting process for general construction activity and construction dewatering requires the applicant to:

- File a Notice of Intent (NOI) to discharge stormwater with the Central Valley RWQCB

- Prepare a Storm Water Pollution Prevention Plan (SWPPP) that identifies best management practices (BMPs) that would be employed to prevent or minimize the discharge of sediments and other contaminants with the potential to affect beneficial uses or lead to violation of water-quality objectives

- Complete a self-implemented annual monitoring program and prepare a report on BMP performance

At least three other types of permitting relevant to water-quality control may apply to activities in the study area. Activities covered by the Corps' jurisdiction over wetlands (CWA Section 404 Department of Army permits) require Section 401 water quality certifications or waivers from the Central Valley RWQCB. The California Department of Fish and Game typically specifies water quality protection measures when they issue streambed alteration agreements pursuant to Section 1601/1603 of the Fish and Game Code. Local city and county grading and erosion-control ordinances may also apply to components of the proposed project as they relate to soil disturbance in the area.

This section provides background information on water quality issues relevant to the Project Alternatives. It specifically addresses issues related to the following areas:

- The American River Basin, focusing on Folsom Reservoir and the Lower American River
- The Sacramento River Basin, focusing on the Sacramento River downstream of the confluence of the American and the Sacramento Rivers
- The Sacramento – San Joaquin Delta

Information in this discussion is drawn from American River Watershed Investigation, California (U.S. Army Corps of Engineers et al. 1996), East Bay Municipal Utility District Supplemental Water Supply Project (Jones & Stokes Associates 1997a), and Sacramento Area Flood Control Agency Information Report (1998).

2.12.1 Lower American River

The American River system supports a number of beneficial uses along its three main forks and many tributaries and is generally considered an excellent source of high-quality water. Water from the American River watershed is suitable for all existing beneficial uses, including municipal supply, contact and noncontact recreation, agricultural and industrial supply, warmwater and coldwater fish habitat (including anadromous fish migration and spawning habitat), and wildlife habitat. Waters from the upper watershed generally have excellent quality with regard to mineral and nutrient content and low concentrations of TDS.

In the Lower American River, water quality is strongly influenced by releases from Folsom Dam and Reservoir, Nimbus Dam, and by urban runoff and local stormwater discharges. Because Folsom Reservoir, as a component of CVP, is used to control salinity and to manage the use of water to support a range of environmental purposes in the Sacramento-San Joaquin Delta. Therefore the storage and flow of its water in the American River is a key component of Delta water quality management. The Lower American River does not receive municipally treated wastewater, but does intermittently receive surface discharges of treated groundwater from Aerojet GenCorp's groundwater cleanup efforts.

Water temperature increases in the Lower American River are primarily controlled by water detention and release from Folsom and Lake Natoma. During periods of detention and resulting low flow, the Lower American River experiences elevated water temperatures. These elevated temperatures may be a concern for various aquatic species, particularly for coldwater fish such as salmon and steelhead. Periodic blooms of algae and microorganisms may also be related to elevated water temperatures in Folsom Reservoir and the Lower American River which can affect water color and taste (U.S. Army Corps of Engineers et al. 1996). During these blooms, municipal drinking water treatment facilities may be required to increase water treatment.

The Sacramento Coordinated Monitoring Program (CMP) has routinely monitored the Lower American River for heavy metals content and for compliance with conventional water-quality parameters. Monitoring has shown that water quality generally meets the CTR ambient water-quality criteria for aquatic life protection. Specifically, CMP data for the 1992/1995 monitoring period indicate a mean total suspended solids content of <1 mg/L (milligrams per liter), mean EC of 52 microSiemens per centimeter (µS/cm), and a hardness of CaCO3 of 25 mg/L (Sacramento County Water Agency 1995). Nevertheless, through its Resolution No. 98-055 (1998) and its CWA Section 303(d) efforts, SWRCB named the Lower American River as impaired because of group “A” pesticides, mercury, and unknown toxicity and assigned low, medium, and low priority rankings, respectively, for the development of corresponding TMDL programs. In addition, Chicken Ranch Slough and Strong Ranch Slough, both of which are tributaries of the Lower American River, were listed as impaired by the pesticide chlorpyrifos and assigned a medium-priority ranking for the development of a TMDL program.

2.12.2 Sacramento River Basin

The Sacramento River receives water from an area of approximately 23,500 square miles that includes numerous tributary streams and rivers and provides almost 80 percent of the freshwater inflow to the Delta and San Francisco Bay. Flow in the Sacramento River is largely regulated by Shasta Reservoir, a key element in CVP; through operation of CVP, the Sacramento River also receives water from the Trinity River watershed via the Clear Creek Tunnel. Approximately two-thirds of the California population obtains at least a portion of its drinking water from the Sacramento River Basin.

The upper regions of the Sacramento River Basin typically exhibit excellent water quality. Water quality below Red Bluff is of similarly high quality and generally supports all designated beneficial uses. However, the potential for decreased water quality exists; possible sources of contamination include mine drainage, urban runoff, NPDES discharges, and agricultural drainage (California Regional Water Quality Control Board 1998) as well as periodic late-summer agricultural return flows, which can contribute a diversity of contaminants including suspended solids, nutrients, and pesticides. Historically, rice field management and pesticide use were responsible for a large part of the pesticide load in the Sacramento River. Current practices have been modified to coordinate pesticide application with return flow discharge in order to minimize the transport of pesticides into the river.

The Sacramento River Watershed Program, initiated in 1996 to investigate sources of toxicity affecting aquatic organisms within the watershed, has indicated that test organisms are particularly exposed to toxic substances during winter runoff conditions (Larry Walker Associates 2001). Nevertheless, through Resolution No. 98-055 (1998) and its CWA Section 303(d) efforts, SWRCB named the Lower Sacramento River (between Red Bluff and the Delta) as impaired for diazinon, mercury, and unknown toxicity; and assigned high, high, and medium priority rankings, respectively, for the development of corresponding TMDL programs. The Feather River, which is the principal tributary to the Sacramento River below Red Bluff, was listed as impaired for diazinon, group A pesticides, mercury, and unknown toxicity, and assigned high, low, medium, and medium rankings, respectively, for the development of corresponding TMDL programs.

2.12.3 Sacramento-San Joaquin River Delta

The Sacramento-San Joaquin Delta is a triangular network of interconnected waterways covering approximately 1,150 square miles. Water quality in the Delta is heavily influenced by a combination of environmental and institutional variables, including upstream pollutant loading, water diversions within and upstream from the Delta, and agricultural and other land use activities throughout the watershed. Critical water-quality parameters in the Delta such as salinity, TDS, dissolved organic carbon (DOC), bromide, pathogens, temperature, dissolved oxygen, nutrients, and priority pollutants can show considerable geographic and seasonal variation. Salinity, bromide, and temperature in particular are closely related to changes in Delta inflows and outflows (California State Water Resources Control Board 1995).

As an estuary system, the Delta is a zone where fresh (riverine) and saline (oceanic) waters converge. Tidal currents drive saltwater up the estuary in an inland direction; the intruding saltwater wedge is met and balanced by freshwater input to the Delta system. Thus, the extent of the saltwater plume that intrudes into the Delta from the San Francisco Bay and the Pacific Ocean is largely controlled by the strength of freshwater inflow from the Sacramento, San Joaquin, Mokelumne, Calaveras, and Cosumnes Rivers. If water development facilities upstream and within the Delta reduce freshwater Delta inflow, more salt water is permitted to enter the Delta, and salinity levels within the Delta may be at least locally raised. Conversely, if water development facilities increase freshwater Delta inflow, salinity levels may be lowered. By augmenting natural or historic flows via releases from upstream reservoirs, existing water development facilities have eliminated the severe saline intrusions that once occurred every summer, and that in dry years extended as far upstream as the City of Sacramento on the Sacramento River and the City of Stockton on the San Joaquin River.

Upstream agricultural discharges into the Sacramento and San Joaquin Rivers and agricultural drainage represent additional sources of salt and TDS to the Delta. To a limited degree, runoff and treated wastewater also influence Delta TDS levels. TDS concentrations measured at the Banks Pumping Plant for the most recent 15-year period from 1984 to 1994 ranged from 85 to 525 mg/L with an annual average of approximately 265 mg/L (California Department of Water Resources 2001).

Delta waters receive DOC from a variety of sources, including agricultural drainage, surface runoff, algal productivity, channel bed and bank sediments, levee materials, riparian vegetation, and treated wastewater discharges. However, the principal sources of Delta DOC loading are natural runoff from soils and agricultural return flows within the Delta. DOC concentrations measured at the Banks Pumping Plant during 1990/1993 ranged from 2.6 to 10.5 mg/L, approximately twice as high as those at Greene's Landing on the Sacramento River.

Nutrients in Delta waters (nitrogen, phosphorus, and silicon) are derived from several sources, including riverine inflow, oceanic water intrusion, overland runoff, decay of wetland vegetation, atmospheric fallout (rain and dust), and upstream sewage treatment plant input. Nutrient concentrations vary seasonally; in the Delta, where riverflow provides most of the nutrient load, nutrient concentrations are highest in winter and lowest in summer (California State Water Resources Control Board 1995). Nutrient peaks produce algal blooms that can deplete oxygen in the water when algae die and decompose. Waterways of the Delta have been listed under Section 303(d) of the CWA as impaired for organic enrichment resulting in low dissolved oxygen content.

Metals, pesticides, and petroleum hydrocarbons enter the Delta from several sources, including agricultural runoff, municipal and industrial wastewater discharge, urban runoff, recreational uses, river inflow, and atmospheric deposition (California State Water Resources Control Board 1995). The concentrations of these pollutants in the Delta vary both geographically and seasonally. Pesticides from agricultural runoff are of particular concern, because biologically significant pesticide concentrations have been recorded in portions of the Delta (California State Water Resources Control Board 1995). Waterways of the Delta have been listed under Section 303(d) of the CWA as impaired for copper, mercury, nickel, diazinon, chlorpyrifos, DDT, Group A pesticides, and polychlorinated biphenyls (PCBs).

Finally, levels of Cryptosporidium, Giardia, and other pathogens in Delta waters have been of increasing concern to municipal water suppliers in recent years. Samples collected for the most recent Sanitary Survey of the SWP system did not detect Giardia at Banks Pumping Plant, California Aqueduct, or Delta-Mendota Canal in 1995, but Giardia cysts were detected in samples from selected locations in the Delta (California Department of Water Resources 1996). Cryptosporidium was detected at Banks Pumping Plant, the Delta Mendota Canal, and Checkpoint 29 at respective mean concentrations of 54, 40, and 17 oocysts per 100 liters (Metropolitan Water District of Southern California 1993), however, Department of Water Resources (DWR) samples collected in 1995 showed lower values near the detection limit for the test methods (California Department of Water Resources 1996).

2.13 Cultural Resources

2.13.1 Introduction

"Cultural resources" is the term used to describe several different types of properties: prehistoric and historic archeological sites; architectural properties, such as buildings, bridges, and infrastructure; and resources of importance to Native Americans (traditional cultural properties). Artifacts include any objects manufactured or altered by humans.

Prehistoric archeological sites date to the time before recorded history and in this area of the United States are primarily sites associated with Native American use before the arrival of European explorers and settlers. Archeological sites dating to the time when these initial Native American-European contacts were occurring are referred to as protohistoric. Historic archeological sites can be associated with Native Americans, Europeans, or any other ethnic group. In the study area, these sites include a wide range of site types, including early settlement sites, mines, logging camps, refuse deposits, and the remains of historic structures.

Architectural properties are considered historic when they are more than 45 years old or when they are exceptionally significant. Exceptional significance can be gained through exceptional design or association with an exceptionally significant historic event, or person

(Criterion Consideration G). Such a property may have played an important role in the Cold War, for instance.

A traditional cultural property is defined generally as "one that is eligible for inclusion in the National Register because of its association with cultural practices or beliefs of a living community that (a) are rooted in that community's history, and (b) are important in maintaining the continuing cultural identity of the community" (Parker and King, n.d.). Traditional cultural properties can include landscapes, mountains, lakes, streams, rivers, towns, neighborhoods, or groves of trees. These locations can have importance for their religious associations, or their historical uses.

2.13.2 Regulatory Setting

Federal Regulations. This project has been conducted in compliance with Section 106 of the National Historic Preservation Act and its implementing regulations. Section 106 requires Federal agencies, or those they fund or permit, to consider the effects of their actions on the properties that may be eligible for listing or are listed in the National Register of Historic Places (NRHP). To determine whether an undertaking could affect NRHP-eligible properties, cultural resources (including archeological, historical, and architectural properties) must be inventoried and evaluated for listing in the NRHP. Although compliance with Section 106 is the responsibility of the lead Federal agency, the work necessary to comply can be undertaken by others.

The Section 106 review process involves a four-step procedure:

- Initiate Section 106 process – establish undertaking, and identify appropriate State Historic Preservation Office (SHPO)/THPO and other parties to consult,
- Identify historic properties,
- Assess adverse effects, and
- Resolve adverse effects – may result in development of an agreement document. Council may or may not agree to participate in consultation.

State Regulations. CEQA requires that for public or private projects financed or approved by public agencies, the effects of the projects on historical resources and unique archeological resources must be assessed. Historical resources are defined as buildings, sites, structures, objects, or districts, each of which may have historical, architectural, archeological, cultural, or scientific significance, that have been determined to be eligible for listing in the California Register of Historical Resources (CRHR). Properties listed in the NRHP are automatically eligible for listing in the CRHR.

CEQA also requires that if a project would result in an effect that may cause a substantial adverse change in the significance of a historical resource or a unique archeological resource, alternative plans or mitigation measures must be considered; however, only significant resources need to be addressed. Therefore, the significance of resources must first be determined before project effects are assessed or mitigation measures are developed.

The following are the steps that are taken in a cultural resources investigation for CEQA compliance:

- Identify cultural resources.
- Evaluate the significance of the resources.
- Evaluate the effects of a project on all cultural resources.
- Develop and implement measures to mitigate the effects of the project on significant resources.

2.13.3 Historical Background

Additional discussion of cultural resources is provided in Appendix A, Attachment 1, Appendix 1E.

2.14 Traffic and Circulation

This section describes the existing local and regional transportation facilities and roadways that would provide access to construction sites in the study area, including those that provide access to the construction sites that would support the implementation of each Project Alternative. Also described are roads that could temporarily be closed during the construction of some of the flood control elements.

2.14.1 Regulatory Setting

LOS is a term that describes the operating performance of roadways and intersections. LOS is reported on a qualitative scale ranging from LOS A (best/free-flowing) to LOS F (worst/congested) (see also Table 2-7).

Cities and counties use various criteria to determine acceptable LOS on their roadway systems. The City of Sacramento has established LOS C as its standard acceptable LOS for roadways, while the County of Sacramento uses LOS E for its urban areas and LOS D for rural areas. The City of Folsom considers LOS C the minimum acceptable level of service for intersections and roadways.

TABLE 2-7. Level of Service Criteria for Freeways [a]

Level of Service	Description	Volume/Capacity Ratio and Speed
A	Free-flow conditions exist with a high level of maneuverability.	0.00–0.30 65 mph
B	Free-flow conditions exist but presence of other vehicles is noticeable. Minor disruptions are easily absorbed.	0.30–0.47 65 mph
C	Minor disruptions cause significant local deterioration.	0.47–0.70 64 mph
D	Conditions border on unstable flow with ability to maneuver severely restricted due to congestion.	0.70–0.89 61 mph
E	Conditions are at or near capacity. Disruptions cannot be dissipated and cause queues to form.	0.89–1.00 53 mph
F	Forced or breakdown flow with queues form at locations where demand exceeds capacity.	Greater than 1.00 Variable

[a] Based on design speed of 65 miles per hour.

Source: Transportation Research Board 1994

2.14.2 Regional Roadway Network

Metropolitan Sacramento has an extensive roadway system consisting of four major freeways (Interstate-5 (I-5), I-80, U.S. Highway 50 (U.S. 50), and State Route (SR) 99, five major expressway segments (SR 160 between Sutterville Road and Meadowview Road, 65th Street Expressway, Alta-Arden Expressway, Sunrise Boulevard between Folsom Boulevard and Fair Oaks Boulevard, Watt Avenue between Folsom Boulevard and Fair Oaks Boulevard), and numerous primary and secondary arterials and collector streets. I-80 traverses the study area in an east-west direction, and links the San Francisco Bay region with Reno and points to the east; Both I-80 and its business loop, Business 80, pass through the central urban area of Sacramento. U.S. 50 is an important commuter and recreation route between Sacramento and South Lake Tahoe and other destinations to the east. I-5 and SR 99 are the primary inland transportation routes connecting northern and southern California.

Generally, this transportation network affords a high level of mobility for private and commercial vehicle traffic and operates at acceptable levels of service during much of the day. Growing congestion is evident, however, and has resulted in deteriorating peak hour conditions at certain roadway locations.

All of these regional roadways connect suburban residential areas with regional centers of employment, commerce, and recreation. Primary employment centers are located in urban Sacramento and along the U.S. 50 and I-80 roadway corridors. Workers commute to these areas from points throughout the region, including El Dorado, Placer, Yolo, and San Joaquin Counties. Travel to and from employment centers typically occurs during the peak morning (6:00 a.m.–10:00 a.m.) and afternoon (3:00 p.m.–6:00 p.m.) commute periods.

Table 2-8 displays 1995 peak period traffic conditions estimated by the Sacramento Area Council of Governments (SACOG), with 374,000 person-miles of travel (PMT) on Sacramento area roadways operating at LOS F. LOS F is characterized by stop-and-go conditions and frequent queuing. In 1995, the U.S. 50 corridor was estimated to support 165,000 PMT, or 44 percent of the regional LOS F PMT. The I-80 eastbound corridor had the second worst congestion, with 25 percent of the region's LOS F PMT. By 2015, the congestion on U.S. 50 is projected to grow 272 percent to 449,000 LOS F PMT. LOS levels in other areas are expected to increase as well; southbound SR 99, southeastbound SR 16, southbound I-5, and westbound I-80 are expected to become congestion problem corridors.

TABLE 2-8. Peak Period Person-Miles of Travel on LOS F Roadways [a]

	Person Miles of Travel (LOS F)		
Travel Corridor	**1995**	**2015**	**Percent Change**
Downtown Sacramento	23,469	85,942	366
Del Paso/Rio Linda	3,734	14,789	396
I-80 East	94,798	217,834	230
Arden/Citrus Heights	22,401	42,546	190
U.S. 50	165,306	449,337	272
SR 16 Southeast	24,913	159,735	641
SR 99 South	28,730	271,188	944
I-5 South	1,901	123,839	6,514
I-80 West	7,074	191,877	2,712
I-5 North	1,967	66,748	3,393

[a] Based on travel conditions under the current regional transportation plan.

Source: Sacramento Area Council of Governments 1996 Metropolitan Transportation Plan, Working Paper #3, Analysis.

Daily traffic on Sacramento-Folsom roadways varies considerably by the type of facility. U.S. 50 carries current volumes of over 190,000 vehicles daily in both directions at the western end of the corridor. At the eastern end of the corridor in the vicinity of the City of Folsom, the average daily traffic (ADT) is 55,000 vehicles per day. I-80 carries volumes nearing 100,000 ADT, with volumes expected to more than double by 2015 (Table 2-8).

As part of its congestion management program, Sacramento County has established evaluation criteria for LOS based upon facility type, daily traffic volumes, number of travel lanes, and the time distribution of traffic. The criteria for freeways that provide full access control set the maximum daily traffic volume per lane at 20,000 for LOS E. Above this threshold, LOS F, or failure conditions, typically result. Based on this standard and average traffic conditions, U.S. 50 between SR 99 and Howe Avenue experiences persistently severe congestion with LOS F and I-80 between SR 99 and West Sacramento experiences increasingly severe congestion with LOS F.

2.14.3 Local Roadway Network–Folsom Dam Area

The major streets providing access to the Folsom Dam area include Folsom Dam Road, Rainbow Bridge Road, and Lake Natoma crossing bridge. Both Folsom Dam Road and Rainbow Bridge Road are two-lane roadways with posted speed limits of 30–35 miles per hour (mph). The Lake Natoma crossing bridge is a recently completed four-lane roadway with a posted speed limit of 50 mph. All of these roadways are important commute routes.

Traffic counts were collected in October 1999 for Folsom Dam Road, Rainbow Bridge, and the Lake Natoma crossing bridge. The average daily volumes during the 3-day count period were as follows: Folsom Dam Road–16,000, Rainbow Bridge–27,600, and Lake Natoma crossing–20,700. During an average weekday, operations on Folsom Dam Road exceeded LOS C for 6 hours and equaled LOS F for three hours. Similarly, for Rainbow Bridge, average daily volumes exceeded LOS D for 9 hours per day and equaled LOS F for 1 hour per day. For the Lake Natoma crossing, average weekday volumes did not exceed LOS C. Although Folsom Dam Road operates at unacceptable levels for fewer hours each weekday than Rainbow Bridge, operations are at LOS F for more hours. The influence of commute traffic on Folsom Dam Road is the main factor that leads to the greater peaks in traffic on this roadway (Fehr and Peers 1999).

The opening of the Lake Natoma crossing bridge in mid-1999 resulted in a substantial shift in traffic from Rainbow bridge. A slight shift in traffic (about 3,000 vehicles per day according to before-after traffic counts) from Folsom Dam Road also occurred. However, most motorists crossing the American River or Lake Natoma still use the Rainbow bridge as opposed to the Lake Natoma crossing bridge because of the improved traffic conditions on Rainbow bridge. These improved conditions resulted from the shift in traffic to the Lake Natoma crossing bridge and from a favorable traffic signal progression for motorists on Riley Street south of Rainbow Bridge.

During construction, the proposed project could affect traffic flow on the roads in and around Folsom Dam. The volume of traffic is expected to increase as a result of construction activities and construction worker commute trips. In addition, the increased traffic volume and presence of construction activities and construction equipment is anticipated to reduce the overall flow of traffic. However, it is anticipated that traffic volume and flow would return to normal once construction is complete. Roadways on which effects from construction activities are anticipated are Folsom-Auburn, Green Valley, and Salmon Falls Roads, Natoma Street, Francisco Drive, and Lakehills Drive. Once complete, the proposed project would not affect any roads in the Folsom area.

2.14.4 Local Road Network–Lower American River Area

Arterial daily traffic volumes (outside of downtown Sacramento) are on the order of 20 percent of those on U.S. 50, but the range of traffic volumes is much greater on the arterials than on U.S. 50. Highest volumes are on the north-south arterials crossing the corridor, reaching a peak of over 100,000 vehicles per day on Watt Avenue north of U.S. 50 (Table 2-9). Howe Avenue carries slightly more than half the volume carried by Watt Avenue. The average north-south volume (Table 2-9) is about 45,000 vehicles per day, more than twice the average traffic volume of the east-west arterials. The reason for this difference is that U.S. 50 carries the

TABLE 2-9. Average Daily Traffic Volumes on Selected Roadways

Roadway	Segment	1997 Conditions	New Conditions	New Date	Difference	2015 Conditions
U.S. 50	15th/16th Streets to Route 99	193,000	225,000	1999 [a]	32,000	245,730
	Route 99 to 59th St.	188,000	198,000	1999 [a]	10,000	226,150
	59th St to Howe Ave	182,000	188,000	1999 [a]	6,000	213,750
	Howe Ave to Watt Ave	165,000	173,000	1999 [a]	8,000	192,540
	Watt Ave to Bradshaw Rd	153,000	161,000	1999 [a]	8,000	187,770
	Bradshaw Rd to Mather Field Rd	157,000	163,000	1999 [a]	6,000	195,140
	Mather Field Rd to Zinfandel Dr	143,000	149,000	1999 [a]	6,000	197,590
	Zinfandel Dr to Sunrise Blvd	125,000	131,000	1999 [a]	6,000	165,390
	Sunrise Blvd to Hazel Ave	97,000	103,000	1999 [a]	6,000	135,920
	Hazel Ave to Folsom Blvd	70,000	72,000	1999 [a]	2,000	118,680
	Folsom Blvd to Prairie City Rd	62,000	64,000	1999 [a]	2,000	110,170
	Prairie City to Scott Rd	55,000	61,000	1999 [a]	6,000	99,670
Power Inn Rd	South of Folsom Blvd	37,800	39,843	Calculated [b]	2,043	56,590
Howe Ave	Folsom Blvd to U.S. 50	54,000	56,918	Calculated [b]	2,918	73,640
	North of U.S. 50	54,600	57,551	Calculated [b]	2,951	53,960
Watt Ave	South of Folsom Blvd	42,470	44,765	Calculated [b]	2,295	63,140
	Folsom Blvd to U.S. 50	72,190	73,723	09/10/1998 [c]	1,533	89,220
	North of U.S. 50	101,570	95,738	05/26/2000 [c]	-5,832	125,390
Bradshaw Rd	South of U.S. 50	36,790	54,055	01/10/2000 [c]	17,265	62,840
	U.S. 50 to Folsom Blvd	20,820	21,930	01/10/2000 [c]	1,110	30,090
Mather Field Rd	South of U.S. 50	30,250	32,217	03/16/1999 [c]	1,967	54,170
	U.S. 50 to Folsom Blvd	22,690	27,699	09/20/2000 [c]	5,009	23,180
Zinfandel Dr	South of U.S. 50	39,530	40,511	03/06/2000 [c]	981	43,850
	U.S. 50 to Folsom Blvd	23,400	20,069	02/24/1999 [c]	-3,331	30,650
	North of U.S. 50	14,110	10,038	02/24/2000 [c]	-4,072	15,390
Sunrise Blvd	South of Folsom Blvd	52,370	55,149	03/07/2000 [c]	2,779	76,290

TABLE 2-9. Continued

Roadway	Segment	1997 Conditions	New Conditions	New Date	Difference	2015 Conditions
	Folsom Blvd to U.S. 50	60,700	69,675	08/13/1998 [c]	8,975	86,550
	North of U.S. 50	79,020	87,546	07/19/2000 [c]	8,526	99,660
Hazel Ave	Folsom Blvd to U.S. 50	14,660	27,268	09/10/1997 [c]	12,608	26,240
	North of U.S. 50	43,220	52,299	09/17/1998 [c]	9,079	69,470
Folsom Blvd	65th St to Power Inn Rd	20,320	21,418	Calculated [b]	1,098	25,690
	Power Inn Rd to SR 16	39,000	41,108	Calculated [b]	2,108	52,560
	SR 16 to Watt Ave	22,340	23,547	Calculated [b]	1,207	27,800
	Watt Ave to Bradshaw Rd	24,240	33,231	02/02/1999 [c]	8,991	30,480
	Bradshaw Rd to Mather Field Rd	22,480	22,859	11/16/1999 [c]	379	35,030
	Mather Field Rd to Zinfandel Dr	33,540	34,032	03/29/2000 [c]	492	38,330
	Zinfandel Dr to Sunrise Blvd	21,040	17,718	01/05/2000 [c]	-3,322	26,330
	Sunrise Blvd to Hazel Ave	17,040	17,731	03/29/2000 [c]	691	27,260
	Hazel Ave to Aerojet Rd	13,840	13,572	09/07/1999 [c]	-268	24,900
	Aerojet Rd to U.S. 50	11,450	12,069	Calculated [b]	619	24,810
	U.S. 50 to Iron Point Rd	31,840	33,561	Calculated [b]	1,721	40,260
Folsom Blvd	Iron Point Rd to Blue Ravine Rd	28,140	29,661	Calculated [b]	1,521	34,400
	Blue Ravine Rd to Natoma St	14,770	15,568	Calculated [b]	798	22,110
	Natoma St to Sutter St	9,500	10,013	Calculated [b]	513	21,540
Iron Point Rd	Folsom Blvd to Prairie City Rd	6,840	7,210	Calculated [b]	370	17,820
Blue Ravine	Folsom Blvd to Prairie City Rd	16,140	17,012	Calculated [b]	872	22,870

Notes:

[a] Source: California Department of Transportation. Traffic and Vehicle Data Systems Unit. Information obtained from Caltrans website (http://www.dot.ca.gov/hq/traffops/saferesr/trafdata/1999all.htm)

[b] Source: Calculated from average growth. (1+average growth)*1997 conditions

[c] Source: Sacramento County Public Works Agency Department of Transportation, Stanley Uyeda

majority of the east-west traffic in the corridor, while there are no north-south freeways that cross the corridor east of Business 80 (U.S. Department of Transportation, Federal Transit Administration, and Sacramento Regional Transit 1999).

During construction, the proposed project could affect traffic flow on the roads directly accessing the construction sites and on detour routes resulting from construction. The volume of traffic is expected to increase as a result of construction activities and construction worker commute trips. In addition, the increased traffic volume and presence of construction activities and construction equipment is anticipated to reduce the overall flow of traffic. However, it is anticipated that traffic volume and flow would return to normal once construction is complete.

Construction would occur along the American River from the California Exposition and State Fairgrounds to the region of the river between Sunrise Boulevard and Hazel Avenue. In addition, construction activities are expected to affect those roads along the length of this construction zone that lead to and are directly around the construction sites by increasing traffic volume and decreasing traffic flow. However, once construction is completed, traffic volume and flows are expected to return to normal.

2.15 Air Quality

The study area is located in the Sacramento Valley air basin, which is topographically bordered by the California Coast Ranges to the west and the foothills of the Sierra Nevada and the Cascade Range to the east and north. For the purposes of air quality assessment, the area addressed in this report is generally defined by the geographic boundaries of Sacramento and Yolo Counties. This section provides background information on air quality within Sacramento and Yolo Counties and the applicable air quality management plans.

2.15.1 Surface Wind Climatology

Sacramento and Yolo Counties are located at the southern end of Sacramento Valley, which is bounded by the California Coast Ranges on the west and by the Sierra Nevada on the east. The counties are located about 50 miles northeast of the Carquinez Strait, which is a sea-level gap in the Coast Ranges. Plate 2-4 shows annual average wind speed and directional frequency at Mather Air Force Base in the study area. The prevailing winds in the study area are from the south, primarily because of marine breezes through the Carquinez Strait, although during winter the sea breezes diminish and winds from the north occur more frequently.

The study area experiences episodes of poor atmospheric mixing caused by inversion layers. Normally, air temperature decreases with increasing altitude. Inversion layers are formed when a mass of warm, dry air settles over a mass of cooler air near the ground. Inversion layers limit vertical mixing in the atmosphere, trapping pollutants near the surface. Surface inversions (those at altitudes of 0–500 feet) are most frequent during winter, and subsidence inversions (those at 1,000–2,000 feet) are most common in the summer.

2.15.2 Regulatory Setting

Both State and local levels of government are responsible for air quality management. During the past decade, air quality management planning programs have generally been developed in response to requirements established by the Federal Clean Air Act. However, the enactment of the California Clean Air Act (CCAA) of 1988 has produced additional changes in the structure and administration of air quality management programs in California.

Air Quality Management at the State Level. Passage of CCAA added substantially to the authority and responsibilities of the State's air pollution control districts. CCAA established a State air-quality management process that generally parallels the Federal process. CCAA, however, focuses on attainment of the State ambient air quality standards, which are more stringent for certain pollutants and averaging periods than the comparable Federal standards.

CCAA requires air pollution control districts to prepare an air quality attainment plan if the district violates State air quality standards for CO, sulfur dioxide (SO_2), NO_X, or ozone. At present, no locally prepared attainment plans are required for areas that violate State PM10 standards. CCAA requires that State air quality standards be met as expeditiously as practicable, but it does not specify precise attainment deadlines. Instead, the act establishes a framework of increasingly stringent requirements for areas that are expected to require additional time to achieve the standards. The least stringent requirements apply to areas that were expected to achieve air quality standards by the end of 1994. The most stringent requirements apply to areas that did not achieve the standards by 1997. Since Sacramento did not attain the State ozone standard by 1997, the Sacramento Metropolitan Air Quality Management District has enacted and continues to develop additional rules and incentives to limit emissions of ozone precursors. These include measures designed to reduce emissions of ROG and NO_X from both stationary and mobile sources.

The air quality attainment plan requirements established by CCAA are based on the severity of air pollution problems caused by locally generated emissions; upwind air pollution control districts are required to establish and implement emission control programs commensurate with the extent of pollutant transport to downwind districts. Air pollution problems in Sacramento County are primarily the result of locally generated emissions. However, Sacramento County has been identified as a source of ozone precursor emissions that occasionally contribute to air quality problems in the San Joaquin Valley air basin and the northern Sacramento Valley air basin. Consequently, air quality planning for Sacramento County must not only correct local air pollution problems but must also reduce the area's impact on downwind air basins (California Health and Safety Code, Section 40912).

Sacramento County Air Quality Management. The Sacramento County Air Quality Management District, in conjunction with several air pollution control districts and air quality management districts that together make up the Lower Sacramento air basin, developed the 1994 Sacramento Area Regional Ozone Attainment Plan (El Dorado County Air Pollution Control District et. al. 1994). The 1994 plan addresses attainment of California air quality standards for ozone. The plan increased the Lower Sacramento air basin's designation for nonattainment of Federal ozone standards from *serious* to *severe*. The designation *severe* gives the Sacramento area until 2005 to attain Federal ozone standards but in the meantime requires the implementation of much more stringent measures for the control of stationary, area, and mobile emissions. In addition, progress to meet the objectives of the 1994 plan are determined every three years and disclosed in a rate of progress report.

Yolo-Solano Air Quality Management District. The Yolo-Solano Air Quality Management District (YSAQMD) is the primary local agency responsible for protecting human health and property from the harmful effects of air pollution for all of Yolo County and northeastern Solano County. YSAQMD was established in 1971 by a joint powers agreement between the Yolo and Solano County Boards of Supervisors. YSAQMD is governed by a board of directors composed of representatives from both the county boards of supervisors and the city councils from the two counties and seven cities within the district. The district includes roughly 1,500 square miles and a population of approximately 270,000. YSAQMD participated in the development of the 1994 Sacramento Area Regional Ozone Attainment Plan (El Dorado County Air Pollution Control District et al. 1994) designed to improve ozone air quality in the lower Sacramento air basin.

2.15.3 Air Pollutants and Ambient Air Quality Standards

Both the State of California and the Federal government have established ambient air quality standards for a number of different pollutants. For some pollutants, separate standards have been set for different monitoring periods. Most air quality standards were set to protect public health; however, for some pollutants, standards were based on other values, such as protection of crops, protection of materials, or avoidance of nuisance conditions. The pollutants of greatest concern in Sacramento County are carbon monoxide (CO), ozone, and inhalable particulate matter less than 10 microns in diameter (PM10). Table 2-10 presents a summary of State and Federal ambient air quality standards. The EPA has recently enacted additional ozone and PM10 Federal standards; however, these new standards have not been implemented pending the result of a lawsuit between the American Trucking Association and EPA. Portions of the lower Sacramento Valley air basin are classified as areas of nonattainment for State and Federal ozone standards and areas of nonattainment for State PM10 standards.

Carbon Monoxide. State and Federal CO standards have been set for both 1-hour and 8-hour averaging times. The State 1-hour standard is 20 parts per million (ppm) by volume, and the Federal 1-hour standard is 35 ppm. Both State and Federal standards are 9 ppm for the 8-hour averaging period. CO is a public health concern because it combines readily with hemoglobin and thus reduces the amount of oxygen transported in the bloodstream.

Motor vehicles are the dominant source of CO emissions in most areas. High CO levels develop primarily during winter when periods of light wind combine with the formation of ground-level temperature inversions, typically from the evening through early morning. These conditions result in reduced dispersion of vehicle emissions. Motor vehicles also exhibit increased CO emission rates at low air temperatures.

Ozone. Ozone is an oxidant. It is of concern because it is a respiratory irritant and increases susceptibility to respiratory infections; in addition, it can cause substantial damage to vegetation and other materials.

Ozone is not emitted directly into the air, but is formed by a photochemical reaction in the atmosphere. Ozone precursors, which include reactive organic gases (ROG) and oxides of nitrogen (NO_X), react in the atmosphere in the presence of sunlight to form ozone. Because photochemical reaction rates depend on the intensity of ultraviolet light and air temperature, ozone is primarily a summer air pollution problem.

State and Federal standards for ozone have been set for a 1-hour averaging period. The State 1-hour ozone standard, not to be exceeded, is 0.09 ppm. The Federal 1-hour ozone standard, not to be exceeded more than three times in any 3-year period, is 0.12 ppm.

Particulate Matter 10 Microns or Less in Diameter. Health concerns associated with suspended particulate matter focus on those particles small enough to reach the lungs when inhaled. Because few particles larger than 10 microns in diameter reach the lungs, both Federal and State air quality standards for particulate matter apply only to PM10. The State PM10 standards are 50 micrograms per cubic meter as a 24-hour average and 30 micrograms per cubic meter as an annual geometric mean. The Federal PM10 standards are 150 micrograms per cubic meter as a 24-hour average and 50 micrograms per cubic meter as an annual arithmetic mean.

PM10 emissions in Sacramento and Yolo Counties reflect a mix of rural and urban sources, including agricultural activities, industrial emissions, dust suspended by vehicle traffic, and secondary aerosols formed by reactions in the atmosphere.

2.15.4 Existing Air Quality Conditions

Emission Sources. There are two main categories of emission sources in any area: stationary and mobile. Within Sacramento County, mobile sources are the dominant contributor to NO_X and CO emissions. Mobile sources constitute approximately 45 percent of the region's ROG emissions, 90 percent of the region's NO_X emissions, and 89 percent of Sacramento County's CO emissions. (El Dorado Air Pollution Control District et al. 2000).

Air quality in any local area must be studied in context. Mobile sources (primarily vehicles) may contribute air emissions to the study area even though the mobile sources do not originate in the study area. Furthermore, mass transport of air pollutants between basins occurs. For example, air emissions originating in the San Francisco Bay Area may contribute to air pollution in the Sacramento Valley and air emissions originating in Sacramento may contribute to air pollution in the San Joaquin Valley, dependent upon prevailing atmospheric conditions. Therefore, air pollution control requires a coordinated effort throughout the State.

Monitoring Data. Table 2-11 summarizes 1995-1999 air quality data from monitoring stations near the study area. Monitoring stations included in Table 2-11 were selected based on their relative proximity to the Project Site. Not all monitoring stations monitor the same pollutants, nor does a single monitoring station represent the study area as a whole; however, integrating the data from a number of monitoring stations makes it possible to present a synthesis of trends. In general, monitored CO levels have decreased over the last few years, primarily because of the use of oxygenated gasoline during the winter CO season. The State ozone standard was exceeded several times each year at each monitoring station. The State 24-hour

TABLE 2-10. Federal and State Ambient Air Quality Standards

	State	Federal	
Air Pollutant	**Concentration**	**Primary (>)**	**Secondary (>)**
Ozone (O_3)	0.09 ppm, 1-hr. avg. >	0.08 ppm, 8-hr. avg. 0.12 ppm, 1-hr. avg.	0.12 ppm, 1-hr. avg.
Carbon Monoxide (CO)	9 ppm, 8-hr. avg. > 20 ppm, 1-hr. avg. >	9 ppm, 8-hr. avg. 35 ppm, 1-hr. avg. >	9 ppm, 8-hr. avg. 35 ppm, 1-hr. avg. >
Nitrogen Dioxide (NO_2)	0.25 ppm, 1-hr. avg. >	0.053 ppm, annual avg.	0.053 ppm, annual avg.
Sulfur Dioxide (SO_2)	0.04 ppm, 24-hr. avg. ≥ with ozone ≥ 0.10 ppm, 1-hr. avg. or TSP ≥ 100 $\mu g/m^3$, 24-hr. avg. 0.25 ppm, 1-hr. avg. >	0.03 ppm, annual avg. 0.14 ppm, 24-hr. avg.	0.50 ppm, 3-hr. avg.
Particulate Matter < 2.5 microns (PM2.5)	NA	15 $\mu g/m^3$, annual arithmetic mean 65 $\mu g/m^3$, 24-hr. avg.	NA
Particulate Matter < 10 microns (PM10)	30 $\mu g/m^3$, annual geometric mean > 50 $\mu g/m^3$, 24-hr. avg. >	50 $\mu g/m^3$, annual arithmetic mean 150 $\mu g/m^3$, 24-hr. avg.	50 $\mu g/m^3$, annual arithmetic mean 150$\mu g/m^3$, 24-hr. avg.
Sulfates	25 $\mu g/m^3$, 24-hr. avg. ≥	NA	NA
Lead (Pb)	1.5 $\mu g/m^3$, 30-day avg. ≥	1.5 $\mu g/m^3$, calendar quarter	1.5 $\mu g/m^3$, calendar quarter
Hydrogen Sulfide	0.03 ppm, 1-hr. avg. ≥	NA	NA
Vinyl Chloride	0.010 ppm, 24-hr. avg. ≥	NA	NA
Visibility Reducing Particles	In sufficient amount to reduce the visual range to less than 10 miles at relative humidity less than 70%, 8-hr. avg. (9 a.m.–5 p.m.)	NA	NA

Notes:

ppm = parts per million

$\mu g/m^3$ = micrograms per cubic meter

NA = not applicable

TABLE 2-11. Summary of Carbon Monoxide, Ozone, and PM10 Monitoring Data

Station Location	1995	1996	1997	1998	1999
Carbon Monoxide					
El Camino and Watt					
Highest 8-hour concentration (ppm)	7.40	7.20	7.20	6.10	6.20
Days above standard [a]	0.00	0.00	0.00	0.00	0.00
T Street					
Highest 8-hour concentration (ppm)	6.60	6.80	6.00	7.10	3.60
Days above standard [a]	0.00	0.00	0.00	0.00	0.00
Ozone					
T- Street					
1st High - 1-hour (ppm)	0.13	0.12	0.09	0.14	0.12
2nd High - 1-hour (ppm)	0.11	0.11	0.09	0.12	0.11
Days above standard [b]	7.00	5.00	0.00	8.00	6.00
Del Paso Manor					
1st High - 8-hour (ppm)	0.15	0.15	0.11	0.16	0.13
2nd High - 8-hour (ppm)	0.15	0.13	0.10	0.15	0.12
Days above standard [b]	29.00	26.00	26.00	19.00	12.00
Folsom					
1st High - 1-hour (ppm)	0.16	0.16	0.13	0.15	0.15
2nd High - 1-hour (ppm)	0.15	0.14	0.12	0.15	0.14
Days above standard [b]	33.00	35.00	19.00	31.00	22.00
PM10					
T Street					
Highest 24-hour concentration (ug/m3)	85.00	75.00	108.00	75.00	57.00
Geomentric mean (ug/m3)	26.00	22.00	21.00	20.00	16.00
Calculated days above standard [c]	50.00	17.00	9.00	18.00	6.00
North Highlands					
Highest 24-hour concentration (ug/m3)	81.00	68.00	85.00	81.00	63.00
Geomentric mean (ug/m3)	20.00	21.00	17.00	22.00	26.00
Calculated days above standard [c]	24.00	12.00	18.00	48.00	24.00
West Sacramento					
Highest 24-hour concentration (ug/m3)	83.00	76.00	109.00	63.00	126.00
Geomentric mean (ug/m3)	25.50	21.60	21.70	19.10	25.60
Calculated days above standard [c]	42.00	12.00	12.00	12.00	48.00

[a] Days above standard = days above state 8-hour standard of 9 ppm.

[b] Days above standard = days with hourly concentration above state 1-hour standard of 0.09 ppm.

[c] Estimated days above standard based on sampling once every six days.

Source: California Air Resources Board 2000.

PM10 standard was exceeded between 1 percent and 10 percent of the time. The State annual PM10 standard was not exceeded during this period.

2.16 Noise

Noise is defined as unwanted sound that evokes a subjective reaction to the characteristics of a physical phenomenon. The unit of sound-level measurement is the decibel (dB). A-weighted sound levels (dBAs) are measurements of sound that approximate the way the human ear responds to sound levels. The dBA correlates well with community reactions to noise and is used throughout this analysis unless otherwise indicated. The equivalent sound level (L_{eq}) is the energy average sound level over a specific period of time. The day-night shift (L_{dn}) is a 24-hour weighted average with penalties for noise that occur in nighttime hours (10:00 p.m. to 7:00 a.m.).

2.16.1 Applicable Laws, Regulations, and Codes

Federal Guidelines. The Federal Noise Control Act of 1972 (PL 92-574) established a requirement that all Federal agencies administer their programs in a manner that promotes an environment free from noises that may jeopardize public health or welfare. EPA was given the responsibility for:

- Providing information to the public regarding identifiable effects of noise on public health or welfare
- Publishing information on levels of environmental noise that will protect the public health and welfare with an adequate margin of safety
- Coordinating Federal research and activities related to noise control
- Establishing Federal noise emission standards for selected products distributed in interstate commerce

The Federal Noise Control Act also requires that all Federal agencies comply with applicable Federal, State, interstate and local noise-control regulations.

Although EPA was given a major role in public information and Federal agency coordination and may require other Federal agencies to justify their noise regulations in terms of Federal noise control act policy requirements, each Federal agency retains the authority to adopt noise regulations pertaining to agency programs. For example, the Occupational Safety and Health Administration retains primary authority for setting workplace noise exposure standards. Similarly, in the interest of aviation safety, the U.S. Federal Aviation Administration retains primary jurisdiction over aircraft noise standards.

In response to the requirements of the Federal Noise Control Act, EPA (1974) has identified indoor and outdoor noise limits to protect public health and welfare by preventing hearing damage, sleep disturbance, and communication disruption. Outdoor L_{dn} values of 55 dB and indoor L_{dn} values of 45 dB are considered desirable to protect against speech interference and sleep disturbance for residential, educational, and healthcare areas. Noise-level criteria to protect against hearing damage in commercial and industrial areas are identified as 24-hour L_{eq} values of 70 dB (both outdoors and indoors).

The Federal Highway Administration (FHWA) has adopted criteria for evaluating noise impacts associated with Federally funded highway projects and for determining whether these impacts are sufficient to justify funding noise mitigation actions (47 FR 131:29653-29656). The FHWA noise abatement criteria are based on peak-hour L_{eq} noise levels, not L_{dn} or 24-hour L_{eq} values. The peak 1-hour L_{eq} criteria for residential, educational, and healthcare facilities are 67 dB outdoors and 52 dB indoors. The peak 1-hour L_{eq} criteria for commercial and industrial areas is 72 dB (outdoors).

The U.S. Department of Housing and Urban Development has established guidelines for evaluating noise impacts on residential projects seeking financial support under various grant programs (44 FR 135:40860-40866). Sites are generally considered acceptable for residential use if they are exposed to outdoor L_{dn} values of 65 dB or less. Sites are considered normally unacceptable if they are exposed to outdoor L_{dn} values of 65-75 dB. Sites are considered clearly unacceptable if they are exposed to outdoor L_{dn} values above 75 dB.

State Agency Guidelines. The California Governor's Office of Planning and Research has published guidelines for the noise element of local general plans (Office of Planning and Research 1998). These guidelines include a noise level/land use compatibility chart that categorizes various outdoor L_{dn} ranges as:

- Normally acceptable
- Conditionally acceptable
- Normally unacceptable
- Clearly unacceptable

for a range of land uses. For many land uses, the chart shows overlapping L_{dn} ranges for two or more compatibility categories.

The noise element guidelines identify the normally acceptable range for low-density residential uses as an L_{dn} of less than 60 dB, while the conditionally acceptable range is an L_{dn} of 55–70 dB. The normally acceptable range for high-density residential uses is identified as L_{dn} values below 65 dB, while the conditionally acceptable range is identified as 60–70 dB L_{dn}. For educational and medical facilities, L_{dn} values below 70 dB are considered normally acceptable, while L_{dn} values of 60–70 dB are considered conditionally acceptable. For office and commercial land uses, L_{dn} values below 70 dB are considered normally acceptable, while L_{dn} values of 67.5–77.5 are categorized as conditionally acceptable.

These overlapping L_{dn} ranges are intended to indicate that local conditions (existing noise levels and community attitudes toward dominant noise sources) should be considered in evaluating land use compatibility at specific locations. In actual practice, however, the overlapping L_{dn} ranges result mostly in confusion rather than in facilitation of the evaluation of local conditions.

The California Department of Housing and Community Development has adopted standards of performance for noise insulation in new hotels, motels, and dwellings other than detached single-family structures (24 Cal. Adm. Code 25-28). These standards require that "interior community noise equivalent levels (CNEL) with windows closed, attributable to exterior sources, shall not exceed an annual CNEL of 45 dB in any habitable room."

Local Agency Guidelines. The City and County of Sacramento, Placer County, Yolo County, El Dorado County and the City of Folsom have all adopted noise ordinances, which serve as enforcement mechanisms for controlling noise and as guidelines to ensure that noise generated by a source is compatible with adjacent land uses.

County and City of Sacramento. The County and City of Sacramento's General Plan and Noise Ordinance establish noise standards for the County and City of Sacramento. The general plan and noise ordinance for the County of Sacramento is the same as for the City of Sacramento. The general plan states that the maximum acceptable noise exposure level for residential, motels, hotels, schools, libraries, churches, and hospital areas is 60 dBA L_{dn}, while the maximum acceptable noise exposure level for agricultural and open space areas is 65 dBA L_{dn}. (Plate 2-5). Additionally, the General Plan further states that noise insulation features for new construction should be such that an interior L_{dn} of 45 dBA will be achieved in areas where people sleep.

The noise ordinance states that exterior noise limits shall not exceed 50 dBA between 10 p.m. and 7 a.m. and 55 dBA between 7 a.m. and 10 p.m. for residential and agricultural areas. However, construction activities between the hours of 7 a.m. and 6 p.m., Monday through Saturday, and 9 a.m. and 6 p.m. on Sunday are exempt from this ordinance. However, internal combustion engines in use on construction sites must be equipped with "suitable exhaust and intake silencers which are in good working order."

Placer County. The County of Placer's General Plan establishes noise standards for the County of Placer. The general plan states that new projects may not produce noise levels in excess of 60 db L_{dn} at the property line of a residentially zoned area or 45 L_{dn} for an indoor area. The general plan further states that new projects may not produce noise levels in excess of 70 db L_{dn} at the property line of an area zoned for recreation or forestry use.

Yolo County. The Yolo County noise element provides basic compatibility guidelines and states that the county will review all new developments, public and private, for noise compatibility with surrounding use to protect the occupants of nearby lands from undesirable noise levels and shall discourage new residential development in areas subject to legal, long-term, excessive noise.

El Dorado County. The County of El Dorado's General Plan establishes noise standards for the County of El Dorado. The general plan states that the maximum allowable hourly noise level for residential communities is 55 dB L_{eq} during daytime hours (7 a.m. to 7 p.m.), 50 dB L_{eq} during evening hours (7 p.m. to 10 p.m.), and 45 dB L_{eq} during nighttime hours (10 p.m. to 7 a.m.). The general plan further states that the maximum peak noise level is 70 dB L_{eq} during daytime hours (7 a.m. to 7 p.m.), 60 dB L_{eq} during evening hours (7 p.m. to 10 p.m.), and 55 dB L_{eq} during nighttime hours (10 p.m. to 7 a.m.). For rural areas, the general plan establishes a maximum allowable hourly noise level of 50 dB L_{eq} during daytime hours (7 a.m. to 7 p.m.), 45 dB L_{eq} during evening hours (7 p.m. to 10 p.m.), and 40 dB L_{eq} during nighttime hours (10 p.m. to 7 a.m.). The general plan further states that the maximum peak noise level for rural areas is 60 dB L_{eq} during daytime hours (7 a.m. to 7 p.m.), 55 dB L_{eq} during evening hours (7 p.m. to 10 p.m.), and 50 dB L_{eq} during nighttime hours (10 p.m. to 7 a.m.).

City of Folsom. The City of Folsom's General Plan and Noise Ordinance establish noise standards for the City of Folsom. The city's general plan and noise ordinance state that the maximum acceptable noise exposure level for an outdoor area is 60 dBA L_{dn} /CNEL for nontransportation related noise sources. For noise due to traffic on public roadways, the maximum acceptable noise exposure level is 60 dBA L_{dn}/CNEL for an outdoor area and 45 dBA v/CNEL for an indoor area. However, if it is not possible to reduce exterior noise due to these sources to 60 dBA $L_{dn/}$CNEL or less by incorporating a practical application of the best available noise-reduction technology, an exterior noise level of up to 65 dBA L_{dn}/CNEL will be allowed. Under no circumstances will interior noise levels be permitted to exceed 45 $L_{dn/}$CNEL with windows and doors closed.

In addition, the noise ordinance states that exterior noise limits shall not exceed an average of 50 dBA between 7:00 a.m. and 10:00 p.m. and 45 dBA between 10:00 p.m. and 7:00 a.m. for a 30 minute noise measurement; 55 dBA between 7:00 a.m. and 10:00 p.m. and 50 dBA between 10:00 p.m. and 7:00 a.m. for a 15 minute noise measurement; 60 dBA between 7:00 a.m. and 10:00 p.m. and 55 dBA between 10:00 p.m. and 7:00 a.m. for a 5-minute noise measurement; 65 dBA between 7:00 a.m. and 10:00 p.m. and 60 dBA between 10:00 p.m. and 7:00 a.m. for a 1-minute noise measurement; and 70 dBA between 7:00 a.m. and 10:00 p.m. and 65 dBA between 10:00 p.m. and 7:00 a.m. for a an instantaneous noise measurement. However, construction activities between the hours of 7:00 a.m. and 6:00 p.m., Monday through Saturday, and 9:00 a.m. and 6:00 p.m. on Sunday are exempt from this ordinance. However, internal combustion engines in use on construction sites must be equipped with "suitable exhaust and intake silencers which are in good working order." Table 2-12 indicates acceptable exposure levels for new projects and developments in the City of Folsom.

TABLE 2-12. Noise Level Performance Standards for New Projects and Development

Exceedance of Exterior Noise Level Standard (dB-A)(minutes)		
Average During Any 1-Hour Period	**Daytime (7 a.m. to 10 p.m.)**	**Nighttime (10 p.m. to 7 a.m.)**
30	50	45
15	55	50
5	60	55
1	65	60
0	70	65

Source: City of Folsom 1993.

2.16.2 Existing Noise Conditions and Noise-Sensitive Land Uses

Folsom Reservoir Area. Existing sources of noise near Folsom Dam include operations at the Folsom Dam powerhouse, traffic on Folsom Dam Road and Auburn-Folsom Road, and boat and jet-ski noise at the lake. Noise created by motor boats and other recreational activities at the lake is seasonal, with peak noise levels occurring in the summer. Noise generated at the powerhouse located in the American River canyon is generally not audible from Folsom Dam Road, from Folsom-Auburn Road, or from the American River bike trail because noise is attenuated by the canyon.

Lower American River. Existing sources of noise along the Lower American River include previously authorized levee improvements and maintenance activities. The closest sensitive receptors to the sites of the proposed levee improvements are residences located on the landside of the levees. The levee improvements would occur on the river side of the levees; the levees would thus help to buffer the residences from noise effects. Additional sources of noise along the Lower American River include freeway traffic from U.S. Highway 50 and local surface streets, as well as site-specific industrial and commercial operations.

Downstream from the American River. Existing sources of noise downstream of the American River include previously-authorized levee improvements and maintenance activities. The closest sensitive receptors to the sites of the proposed levee improvements are residences located on the landside of the levees. The levee improvements would occur on the river side of the levees; the levees would thus help to buffer the residences from noise effects.

2.17 Visual Resources

This section provides an overview of the visual resources present within the study area, including the Folsom Reservoir area, the Lower American River, and specific portions of the area downstream from the American River, including the Sacramento and Yolo Bypasses. The Upper Sacramento River and the Delta areas are not discussed in this section because the alternatives do not have the potential to affect visual resources in those areas. Unless otherwise cited, the information in this section was obtained from the Draft Program EIR on Flood Control Improvements Along the Mainstem of the American River prepared for the SAFCA (Jones & Stokes 2000a).

Visual images dominate the impression that an observer forms of a region. Both natural and created features that compose a landscape contribute to its perceived image and visual quality. Identifying the scenic resources in a landscape requires a process that can objectively distinguish visual features in the landscape. This process is used to appraise the character and quality of those features in the landscape and establish a rating of sensitivity. The visual assessment process has been derived from established Federal procedures and is commonly used for a broad spectrum of proposed projects.

The visual quality of an area is influenced by a wide range of landscape characteristics, including geology, hydrology, plants, wildlife, and recreational and urban features. Visual resource sensitivity is largely determined by the extent of the public's concern for a particular view, by the number of people who see that view, and by viewing frequency and duration. Areas of elevated visual sensitivity are those that are highly visible to the general public. Views from scenic highways, tourist routes, and recreation areas are considered to be highly sensitive.

Several sets of criteria have been developed for defining and evaluating visual quality. A commonly used set of criteria includes vividness, intactness, and unity. These terms are defined as follows (Federal Highway Administration 1983, Dunne and Leopold 1978, Jones et al. 1975).

Vividness is the visual power or memorability of landscape components that combine in visual patterns. Intactness is the visual integrity of the natural and constructed landscape and its freedom from encroaching elements. This factor can be present in urban and rural landscapes as well as natural settings. Unity is the visual coherence and compositional harmony of the landscape resources of the study area.

For purposes of this analysis, the visual resources of the Study area have been divided into the following three subareas where the program alternatives could alter existing viewscapes:

- Folsom Reservoir
- The Lower American River
- The Sacramento and Yolo Bypass areas

Visual quality in these areas is evaluated based both on the relative degree of vividness, intactness, and unity apparent in views, and on visual sensitivity. Viewer sensitivity or concern is based on several factors:

- Visibility of the landscape
- Proximity of viewers to the visual resources
- Elevation of viewers compared to the elevation of the visual resources
- Frequency and duration of views
- Number of viewers
- Types of individuals and groups of viewers
- Viewers' expectations

2.17.1 Folsom Reservoir Area

Folsom Reservoir is a significant visual entity that contrasts sharply with the nearby foothills to create a vivid viewscape. Set in a landscape of rolling wooded foothills, Folsom Reservoir provides a pleasing visual setting for numerous recreational uses, especially when the reservoir level is high. As summer progresses, however, the reservoir level is typically drawn down an average of 24 feet, exposing a ring of bare soil along the shoreline. During these periods, and in dry years, this ring becomes a dominant negative visual feature that affects the visual quality of the areas (U.S. Army Corps of Engineers 1996).

2.17.2 Lower American River

The Lower American River flows through the heart of the urban Sacramento area. The river corridor has a variety of visual components that include steep bluffs, terraces, islands, backwater areas, and riparian vegetation. High, steep, natural banks confine the upper portions of the river; downstream of Goethe Park, the river is artificially confined by levees. In some portions of the leveed corridor, the north levees are set back as much as one kilometer from the river channel (Jones & Stokes Associates 1997b). This configuration allowed the development of the extensive Parkway trail system. In many places, the southern levees are very close to, or are part of, the riverbank, so that the remnant flood plain is very narrow.

The character of the landscape between the levees, including the river, is predominantly natural. The river and diverse riparian woodlands and grasslands dominate the views. For viewers within the leveed corridor, views of surrounding urban land uses and activities are largely screened by the levees and by taller vegetation. The natural character of the Lower American River corridor contrasts vividly with the surrounding urban setting.

Several bridges cross the river corridor, serving as visual reminders for river user of the urban setting through which the river flows. Conversely, for the thousands of motorists who travel across the bridges, views of the river provide a natural image and relief from the prevalent image of an extensively built environment. Barren rock revetment found in a few locations where emergency bank protection was undertaken is a visual reminder of the intensive human presence nearby and the critical flood control need that often requires intrusion into the natural setting.

The vegetation within the Lower American River corridor gradually changes from species typical of the lower foothills to those of the Sacramento Valley floor, and represents a rich and diverse mosaic. The structure, composition, and variation in the river corridor’s vegetation are directly related to channel dynamics, topography, elevation, distance from the river, and frequency of inundation (U.S. Army Corps of Engineers 1996).

The valley floor vegetation community is characterized by a diverse mix of exclusively deciduous trees, including cottonwood, willow, valley oak, alder, Oregon ash, and sycamore. Away from the river toward the uplands, the riparian forest typically gives way to woodland and grassland habitats. The variation of topography supports evergreen hardwoods, such as canyon and interior live oaks and digger pine (U.S. Army Corps of Engineers 1996).

In the vicinity of the lower 12 miles of the Parkway, vegetation is confined to a narrow band between the river and the levees and constitutes a significant visual feature. The vegetation in the upper 11 miles of the river occupies a broader expanse within the floodway. The variety of native plant communities greatly enhances the visual quality of the parkway and heightens the interest of Parkway users in their natural surroundings. Because it is heavily used, the Parkway is a visually sensitive resource; any degradation of the visual quality of the area would affect many Parkway users.

Wildlife is generally an expected element in the views of a natural landscape. Views of wildlife add vividness to a viewscape because they are typically brief and unpredictable. A diverse wildlife community is present along the Lower American River, including many bird species, several fish species, small mammals, and deer.

The meandering riverbed also contributes to the natural visual character of the Lower American River. Additionally, the changing water levels increase viewer interest in the river. These levels vary greatly, both seasonally and from year to year. During dry years, the winter water levels may not reach the level of the flood plain berm. In contrast, during wet years, the water levels may rise to within one meter of the tops of the levees. Flood events produce exciting visual experiences for viewers undeterred by foul weather.

In general, high-quality views along the Lower American River are characterized by abundant, dense riparian vegetation, a natural riverbank appearance, and minimal visibility of urban infrastructure. Low-quality views result from damaged riparian vegetation, garbage and structural debris, rock revetment, and the channelized appearance of some reaches, and/or some highly visible urban infrastructure. Users of the river potentially concerned about views include:

- Boaters, including both casual boaters and anglers
- Pedestrians, joggers, equestrians, and cyclists on the bicycle/equestrian trails and levees
- Motorists crossing bridges
- Visitors to developed parks
- Residents of the Riverdale Mobile Home Park

<u>Relevant Plans, Policies, and Ordinances.</u> As previously discussed, the Lower American River has been designated as a component of both the National and State wild and scenic rivers systems. Projects along the Lower American River are therefore subject to provisions of the National Wild and Scenic Rivers Act and the California Wild and Scenic Rivers Act. The California Legislature has also purchased lands and enacted the Urban American River Parkway Preservation Act to protect the river and its riparian corridor. The act incorporates the Parkway Plan, previously developed by the City and County of Sacramento, as the planning mechanism to provide policy and agency coordination guidance in managing the "diverse and valuable natural land, water, wildlife, and vegetation resources" of the Parkway. Projects within the Parkway

must be consistent with the policies set forth in the Parkway Plan. Other relevant goals and policies related to community design and scenic resources in the study area are found in the Sacramento County General Plan (Sacramento County 1993) and the City of Sacramento General Plan (City of Sacramento 1988).

The National and State wild and scenic rivers systems were created to preserve designated rivers that possess "extraordinary" or "outstandingly remarkable" resources. Generally, under the National Wild and Scenic Rivers Act and the California Wild and Scenic Rivers Act, projects can be developed if they do not adversely affect the river's "free-flowing." status or the resources for which the river was designated. Agencies that have approval authority should not approve projects that would have adverse effects on these resources.

Neither the State nor the National Wild and Scenic Rivers Act specifically identifies the scenic values of the Lower American River as those responsible for the river's designation. The EIS for the inclusion of the river in the National Wild and Scenic Rivers Act describes the recreational and anadromous fishery values of the American River as "outstandingly remarkable." The California Wild and Scenic Rivers Act of 1972 states that its purpose is to preserve certain rivers having extraordinary scenic, recreational, fishery, or wildlife values in their free-flowing condition, together with their immediate environments, for the benefit and enjoyment of the people of the State. This legislation does not specify which of these particular values the Lower American River meets to merit inclusion in the State wild and scenic rivers system.

In 1985, the California Legislature enacted the Urban American River Parkway Preservation Act, which requires local and State agencies' actions regarding land use decisions to be consistent with the Parkway Plan developed by the City and County of Sacramento. With respect to flood control, the act states that it is not to be construed to impair the authority and responsibilities of State or local public agencies in maintaining and operating the flood channel, levees, and pump stations, except that these operations, as nearly as practicable, shall be consistent with the Parkway Plan (Section 5584[(1)]).

Policies 3.4.1 and 3.4.2 of the Parkway Plan address the protection of the Parkway's aesthetic values from the negative effects of flood control measures. Policy 3.4.1 states: Levee protection and slope stabilization projects shall include a revegetation program which screens the project from public view and assures naturalistic appearance on site.

Policy 3.4.2 states: Gabions, rock and wire mattresses, or wire mesh over stone, may be used where vegetative measures alone are insufficient, but the erosion control program shall include measures to minimize damage to riparian vegetation and wildlife. Rock revetment shall not be used unless slope, current, and existing native vegetation are favorable to provide substantial vegetative screening of the rock revetment. Rubble, cement or sandbags, bulkheads, fences, used tires, and similar materials or structures are prohibited.

The Conservation Element of the Sacramento County General Plan contains numerous policies designed to preserve the natural characteristics of flood channels, stream courses, and waterways. These policies include retaining riparian vegetation, discouraging the use of concrete liners within watercourses, and providing a transition or buffer zone immediately adjacent to stream corridors that contain riparian or wetland vegetation. In addition, Policy CO-107 requires that some topographic diversity and variation be retained when flood channels are realigned or modified (Sacramento County 1993).

Goals and policies in the City of Sacramento General Plan that relate to flood control include retaining riparian woodlands and grasslands along the waterways in North and South Sacramento and establishing standards for water-related open space to enhance the visual amenity of the area's water resources.

2.17.3 Sacramento and Yolo Bypasses

The Sacramento and Yolo Bypass areas are almost entirely developed for agriculture; they have little visual diversity and lack vividness. Views of the bypass areas are not considered sensitive. Because the land within and surrounding the bypasses is mostly rural, the bypass areas are not visible to viewer groups for extended periods. Travelers on the I-5 and I-80 Yolo causeways have only passing views of the bypasses and the bypass levees while traveling between the Sacramento metropolitan area and Yolo County. Visitors to the Vic Fazio Wildlife Area in the Yolo Bypass have extended views of the levees from within the bypass. However, the general public visits the wildlife area mainly during guided tours to view bird populations and habitat restoration sites; the area is not typically visited for the enjoyment of its general scenic qualities.

2.18 Public Health and Safety

This section describes public health and safety concerns, including risks posed by hazardous, toxic, and radiological waste sites study area that are relevant to the alternatives. The study area includes the Folsom Reservoir area, the Lower American River, and the Sacramento and Yolo Bypasses. The Upper Sacramento River and Delta areas are not discussed in this section because the alternatives do not have the potential to affect public safety in those areas.

2.18.1 Hazardous, Toxic, and Radiological Waste Sites

Potential sources of hazardous, toxic, and radioactive materials may exist in urbanized portions of the study area where levee modifications are proposed under each of the alternatives. Hazardous, toxic, or radioactive materials may be present in a variety of common contexts, including the following:

- Asbestos
- Construction and demolition debris
- Drums
- Landfills or solid waste disposal sites
- Pits, ponds, or lagoons
- Wastewater
- Fill, dirt, depressions, and mounds
- Underground storage tanks

- Wastewater treatment plants
- Stormwater runoff structures
- Transformers that may contain PCBs

Folsom Reservoir Area and the Lower American River. The County of Sacramento, through the Department of Environmental Management, maintains a composite list of State and Federal toxic and hazardous waste sites within the county. Although there are an estimated 1,800 hazardous or toxic waste sites within Sacramento County, a preliminary review of the county's list indicated that there are no toxic or hazardous waste sites within the boundaries of the study area around Folsom Reservoir or the Lower American River. It should be noted, however, that the county's list of hazardous and toxic waste sites is based on a database maintained by State and Federal agencies involved in hazardous, toxic, or radiologic waste (HTRW) control, and does not include many small-scale aboveground chemical and petroleum storage facilities.

Sacramento and Yolo Bypasses. Since the primary land use both within and adjacent to the Sacramento and Yolo Bypasses is agricultural, there may be agricultural chemical residue or deposits along the levees. The East Yolo County landfill, a dumpsite previously used by the City of West Sacramento, lies adjacent to and north of the Sacramento Bypass. This sanitary landfill lies within 1,000 feet of the northern levee and occupies a parcel about 400 feet wide by 2,200 feet long, averaging about 5 feet deep. Records show that the landfill began operation in 1940 as a private business known as the "Albericci Dump." It was used to dispose of residential and commercial solid wastes by sequentially burning, crushing, and burying them (U.S. Army Corps of Engineers et al. 1996).

2.18.2 Other Public Safety Concerns

In general, all rivers and water bodies, including all of those in the study area, pose hazards for navigation and recreational activities. Hazards are related to flow velocity, bank and bed material and morphology, instream woody material, accessibility, and water temperature.

Construction of some instream project features could temporarily increase instream hazards resulting from the use of construction equipment within the waterway. This could pose potential safety hazards for boaters, swimmers, and waders in the vicinity of any construction work.

The relevant plans, policies, and laws used to evaluate public health and safety follow. Section 659 of the Harbors and Navigation Code (California Administrative Code, Title 14, Section 7000) regulates construction and placement of structures in navigable waterways. The regulations address the need for adequate signage/notification to reduce the potential for hazardous conditions.

2.19 Public Services

The California Public Utilities Commission mandates several codes and regulations regarding the safety and service requirements of utility facilities. These include General Order

95, which specifies clearance requirements for overhead electrical lines, and General Order 128, which specifies requirements for the construction and maintenance of underground electrical and communication lines. Utility service providers require that any modifications to utility facilities meet all clearance, depth, and maintenance requirements specified in the applicable general orders.

This section provides an overview of public services within the study area, including a discussion of emergency services and utilities infrastructure. Areas addressed include the Folsom Reservoir area, the Lower American River, and the Sacramento and Yolo Bypasses. The Upper Sacramento River and Delta areas are not discussed in this section because the alternatives do not have the potential to affect public services in those areas.

2.19.1 Folsom Reservoir Area

Emergency Services

The City of Folsom Police Department provides police protection for the City of Folsom. Sixty-six members of the department serve a population of approximately 54,000, including the Folsom State Prison population of 7,500 inmates (Roloff pers. comm. 2000).

The City of Folsom's Fire Department provides firefighting, paramedic, and other emergency services to a population of 53,000 persons (City of Folsom 2000a).

Utilities and Other Infrastructure

Water Supply. Folsom Reservoir provides water through a diversion at Folsom Dam to the Cities of Folsom and Roseville, the SJWD (including the Citrus Heights Water District, the Orangevale Mutual Water District, the Fair Oaks Water District, and the Placer County Water Agency), and Folsom State Prison. An 84-inch pipeline, part of the North Fork distribution system, passes through the right abutment of the dam, providing water to the City of Roseville and SJWD. A second, 42-inch pipeline, part of the Natoma distribution system or Natoma pipeline, passes through the left abutment, serving the City of Folsom and Folsom State Prison (Jones & Stokes 2000a). In addition, El Dorado Irrigation District (EID) operates a raw water pump station along the eastern shore of Folsom Reservoir. The actual facility sits at an elevation of 474 feet, but is designed to operate within the range of 367–467 feet (Hutchings pers. comm. 2000). The Placer County Water Agency also plans to place a pump station near the Auburn Dam. This station would sit at an elevation of 560 feet, with an intake at 490 feet (Reinhardt pers. comm. 2000).

Sewage Systems. The EID has four sewage-lift stations located near Folsom Reservoir. Three of the four sewage-lift stations are located at Browns Ravine Marina. Two of these three, Browns Ravine #1 and Browns Ravine #2, serve the bathroom facilities at the marina. The third, Marina Village #1, is a regional facility that receives flow from 12 satellite stations. The fourth station, Southpointe, is located off Fitch road in El Dorado Hills. Table 2-13 summarizes the wet well bottom elevation and the rim elevation of each of these lift stations (Hutchings pers. comm. 2000).

TABLE 2-13. Critical Elevations of EID Sewage Lift Stations

Name	Browns Ravine #1	Browns Ravine #2	Marina Village #1	Southpointe
Wet well bottom elevation (feet)	462.2	456.9	473	463.6
Rim elevation (feet)	472.3	467.5	490	488

Other Utilities. The Newcastle Powerhouse is located on the right bank of the North Fork of the American River approximately four miles downstream from its entrance into Folsom Reservoir. This multilevel, reinforced concrete and steel building is owned by PG&E and operated as part of the Drum Regional Bundle. Water passing through the Newcastle Powerhouse is primarily used for irrigation and domestic water use, and for maintaining minimum flows for fish habitat within the South Canal Spill Channel (Aspen Environmental Group 2000). The powerhouse was designed based on a maximum flood elevation of 472 feet and is flooded at water elevations higher than 473 feet (ESA Consultants 1994).

2.19.2 Lower American River

Emergency Services

Police services in the study area are supplied by several jurisdictions. The City of Sacramento Police Department provides protection for most of the urbanized portions of the study area. Two stations composed of 643 sworn officers and 392 civilian personnel provide services to more than 392,000 Sacramento residents (Sacramento Police Department 1998).

The Sacramento City Fire Department provides emergency response, including paramedic services, from 18 stations to more than 435,000 people within the City of Sacramento and surrounding contract areas (Sacramento City Fire Department 1999a). The City of Sacramento also has four hazardous materials teams that respond to incidents involving hazardous materials within the both the City and County of Sacramento. These teams are responsible for stabilizing conditions and performing rescues at incident sites and are available for response within a 50-mile radius (Sacramento City Fire Department 1999b).

Utilities and Other Infrastructure

Water Supply. The City of Sacramento obtains its water supply from both surface- and ground-water sources. The city has water rights to both the American and Sacramento Rivers under a perpetual contract with the Bureau (City of Sacramento 1988).

Other Utilities. Various utilities components including water intake structures, storm drain outfalls, sanitary sewer lines, water lines, natural gas lines, and cable television, electrical, and telephone lines pass through or under levees along the Lower American River. Although the specific locations of each of these utilities are not presented in this document, it is possible to obtain a parcel-by-parcel delineation of buried infrastructure from the major utility companies within several days of a request.

2.19.3 Downstream from the American River

Emergency Services

The remaining portions of the study area lie in unincorporated areas of Sacramento County and are under the jurisdiction of the Sacramento County Sheriff's Department. The Sheriff's department employs 1,789 sworn officers and 543 civilian employees to protect the 1,800,000-person population living in unincorporated Sacramento County and in Citrus Heights (Sacramento County's Sheriff's Department 1998).

Utilities and Other Infrastructure

Water Supply. More than twenty public and private water purveyors provide water-supply service in the unincorporated areas of Sacramento County, primarily in the urbanized areas between the American and Cosumnes Rivers. The county's water supply system serves approximately 18,000 customer connections and consists of four water-storage facilities and more than 40 wells (County of Sacramento Department of Water Resources 2000).

Solid Waste. The only solid waste facility in the study area is the sanitary landfill that lies within 1,000 feet of the northern levee of the Sacramento Bypass. This dumpsite, no longer in use, but previously utilized by the City of West Sacramento, occupies a parcel about 400 feet wide by 2,200 feet long, averaging about 5 feet deep. When in operation, the dumpsite was used to dispose of residential and commercial solid wastes by sequentially burning, crushing, and burying them (U.S. Army Corps of Engineers et al. 1996).

Other Utilities. Various utility components including water intake structures, storm drain outfalls, sanitary sewer lines, water lines, natural gas lines, and cable television, electrical, and telephone lines pass through or under levees along the Sacramento and Yolo Bypasses. Although the specific locations of each of these utilities are not presented within this document, it is possible to obtain a parcel-by-parcel delineation of buried infrastructure from the major utility companies within several days of a request.

2.20 Without-Project Future Conditions

The purpose of the without-project conditions section of this chapter is to describe the changes expected in the study area over the 50-year period of analysis used for this study, assuming that a long-term flood protection project is not built. This without-project condition serves as the baseline against which alternative flood protection plans will be evaluated to determine their effectiveness and to identify effects that would result from them.

2.20.1 Facilities and Projects

The authorized actions and other conditions described below are conditions that are expected to be completed by the time a long-term project is implemented. The effects and benefits associated with these actions and conditions are part of the without-project condition.

Folsom Dam and Reservoir

Folsom Modification Project. Modifications will be constructed in accordance with provisions contained in the WRDA of 1999. These modifications at Folsom Dam include enlarging existing river outlets and modifying use of surcharge storage space. When this project is completed, the risk of flooding will be reduced to about a 1-in-140 exceedance probability in any given year. Construction of these features is expected to be completed in 2008. The following is a description of the two fundamental components of these features.

Enlarge Existing River Outlets. Currently, only 35,000 cfs can be released when the lake level is below the spillway crest. Upon implementation of the outlet component of the Folsom Modification Project, the outlets will be enlarged from 5 feet wide by 9 feet high to 9 feet 4 inches wide by 14 feet high. Two additional 9 feet 4 inches wide by 14 feet high outlets will be added to the upper tier. The lower level outlets will be enlarged to 9 feet 4 inches wide by 12 feet high. With the enlarged outlets in place, the release capacity would be large enough to allow releases up to the objective release (115,000 cfs) at a water surface elevation of 418 feet, which is the spillway crest elevation.

Modify Use of Surcharge Storage Space. Surcharge storage is the space above the normal gross pool elevation of a reservoir that is designed to ensure that the dam can safely pass floodwaters without overtopping. Currently at Folsom Dam, the emergency spillway release diagram dictates how the surcharge space is used to prevent the dam from being overtopped. The existing emergency release diagram and the physical features of the dam allow for surcharge storage up to an elevation of 470 feet without overtopping the emergency spillway gates while they are in the closed position. When the reservoir elevation exceeds 470 feet, the emergency spillway gates must be opened, and releases will exceed downstream design capacity. The surcharge storage component of the Folsom Modification Project would modify the emergency release diagram and some physical features of the dam. Surcharge operation would allow controlled releases up to a water surface elevation of 474 feetand an additional 46,000 acre-feet of space to be credited for flood control. This would allow releases to be maintained below the probable nonfailure point of downstream levees for a longer period. Modification of the physical features includes replacing the three emergency spillway gates with new, taller gates. The top of the new spillway gates would be 476 feet. The support structures for the gates would be designed to allow for expansion of the gates to accommodate a dam raise. In addition, the impervious core in Mormon Island Dam and Dikes 5 and 7 would be raised to the crown crest, and the Newcastle Powerhouse would be floodproofed.

Operations. Folsom Dam regulates stormwater runoff from approximately a 1,860-square-mile watershed. The total capacity of the reservoir is approximately 975,000 acre-feet. As mentioned under "Existing Conditions" above, Folsom Dam is operated under a flexible rule curve operation of 400,000–670,000 acre-feet. After the outlet capacity and surcharge storage have been increased, variable storage operation would be modified to 400,000–600,000 acre-feet. This reduced variable space will balance the relationship between credited flood space in upstream reservoirs and flood space in Folsom Reservoir. "Balanced" flood protection means that Sacramento would receive the same flood protection anywhere in the variable space ranging from 400,000 to 600,000 acre-feet. Plate 2-6 shows a preliminary revised operation diagram.

The O&M of Folsom Dam would continue to be performed by the Bureau in coordination with the State Flood Operations Center. The water control manual used in the daily operation of the dam would be revised by the Corps to incorporate the new flood control regime.

Folsom Dam Safety. Based on consultation with the Bureau, it is assumed that Folsom Dam's current safety deficiency would be corrected under the without-project future condition. The Bureau, the Corps, and the State of California are working to develop a mutually acceptable dam safety plan. As discussed in Chapters 1.0 and 2.0, the Bureau is preparing a dam safety study that will result in development of its Dam Safety Plan and Corrective Action Report. Thus, although dam safety is part of the without-project condition, a specific dam safety plan has not been identified. The Corps has, however, developed a least cost measure that would, if implemented, correct dam safety. This plan would involve the following:

- Correct L. L. Anderson Dam spillway – L. L. Anderson Dam, owned by Placer County Water Agency, is a water supply and recreation dam on the Middle Fork of the American River. The Corps' PMF model indicates that this dam would fail during a PMF, thus increasing inflows to Folsom Dam. Folsom Dam's safety deficiency could thus be addressed in part by improving L. L. Anderson Dam so as to avoid a failure of this upstream facility during the PMF. The needed improvements would entail widening and extending the spillway and constructing a parapet wall along the crest of the dam so that the dam's emergency storage and release capacity are increased. The existing spillway gates would be replaced. These improvements would reduce the PMF at Folsom Dam from 1,000,000 cfs to 900,000 cfs. The first cost would be $8 million. This would be less than the cost of upgrading Folsom Dam to accommodate the resulting difference in inflow.

- L. L. Anderson Dam spillway may be enlarged and dam safety corrected through California Division Safety of Dams (DSOD) requirements and Federal Energy Regulatory Commission (FERC) licensing. Currently DSOD and FERC do not recognize a dam safety problem, but they have not yet reviewed L. L. Anderson Dam in light of the Corps' new estimates of the PMF (Hydrometeorological Report No. 58). Due to the uncertainty of L. L. Anderson Dam safety being corrected through DSOD or FERC, the above-described improvements to the dam would be included in all Folsom Dam enlargement plans to ensure the completeness of such plans. If DSOD or FERC requires implementation of dam safety improvements for L. L. Anderson Dam within a reasonable period of time, these improvements would not be carried forward as part of the enlargement of Folsom Dam and the cost of the enlargement would be reduced accordingly.

- Lower Folsom Dam spillway, and construct a parapet wall – Assuming PMF inflows to Folsom Dam are reduced, the additional improvements needed for Folsom Dam to safely pass the PMF would include lowering the spillway crest by 6 feet, and raising the dam 3.5 feet through construction of a parapet wall. Toward this end, the spillway bridge, piers, and gates would be replaced. Taller gates would be required for the lowered spillway and higher storage pool. This work would affect traffic over the spillway bridge (Folsom Dam Road). Traffic effects would be mitigated by building a temporary construction bridge downstream of the dam. The cost of these improvements is $139 million.

The total first cost of correcting Folsom Dam's safety deficiency, including improvements to the L. L. Anderson Dam spillway, would be $147 million. The additional storage provided by the 3.5-foot parapet wall could be used for normal flood control operations, thus providing incidental flood damage reduction benefits.

Folsom Dam Roadway. As mentioned under "Existing Conditions" above, the Folsom Dam roadway's current vehicle loading exceeds the design vehicle load capacity. The traffic is expected to continue to increase significantly in the future. The Bureau expects that traffic and associated maintenance costs will soon be so great that a major upgrade of the existing roadway system will be required. Public traffic would be curtailed either temporarily or permanently during the upgrade. Public traffic would be required to find alternative routes. A study of the current and expected future traffic patterns shows that permanently closing the roadway would have severe effects on the local community. Roadway closure would result in longer routes between Auburn, Folsom, and Green Valley roads. Primarily because of these expected effects and associated opposition to such action by local communities, the dam roadway would not likely be closed in the future without implementation of an alternative traffic route.

The Bureau has completed the Folsom Dam Bridge Appraisal Report, which looked at the broader needs for removing traffic on top of the dam, including safety and security reasons. However, even though the Bureau is concerned about public traffic on the existing roadway system, there is neither Federal authority nor appropriations for construction of a new bridge. Thus, the future condition for the Folsom Dam Road is that the existing dam road will be maintained as required to meet current and future traffic needs.

Flood Management Plan. The Department of Defense Appropriations Act of 1993 directed the Secretary of Defense, in cooperation with the Secretary of the Interior, to develop a flood management plan to examine what could be done within existing authorities to improve the operation of Folsom Dam for flood control. In March 1995, the Corps and the Bureau completed the "Flood Management Plan, American River and Folsom Dam, California," which examines the operation and facilities at Folsom Dam and the conditions downstream that limit releases.

The objective of this flood management plan is to maximize the flood control capability of Folsom Dam. The plan made recommendations to improve the stream gage network and flood forecast system for the Upper American River watershed. In addition, the plan recognizes that reservoir releases need to be made as quickly as possible in anticipation of incoming flow and in accordance with existing water control manuals.

To accomplish this objective, the following alternatives were recommended:

- An allowable rate of increase in Folsom Dam outflow of 30,000 cfs in a 2-hour period
- An increase in outflow to equal inflow when the flood reservation is encroached so that outflow will equal inflow within 4 hours (as capability and other criteria permit)

- A flood warning system addressed to public users in the American River floodway (this system is now part of the Common Features project. The need for this system is currently being reevaluated by the Corps, Bureau, and the County of Sacramento

- Telemetered streamflow gages to improve emergency operations based on reservoir inflow

- Automated gates at Folsom and Nimbus Dams

- Modification of the river outlets at Folsom Dam to ensure that the outlets can be used in combination with the main spillway (this will be further modified under the Folsom Modification Project, which is described below in Section 2.1.20, "Without-Project Future Conditions"). Of these alternatives, only one has already been implemented. The automatic gates at Folsom and Nimbus Dams have been built

Folsom Flood Management Plan Update. Section 101(a)(6)(E) of the WRDA of 1999 directed the Corps and the Bureau to update the flood management plan to reflect the operational capabilities created by the Folsom Dam Modification Project and improved weather forecasts based on the Advanced Hydrologic Prediction System of the National Weather Service. After the Folsom Dam Modification decision document is complete, the Corps and the Bureau will update the flood management plan.

The Corps is leading the efforts of a multiagency team (National Weather Service, State of California, the Bureau, SAFCA, and local flood control interests) to develop new flood control operating rules for Folsom Dam that would implement state-of-the-art weather forecasting and real time computer modeling of reservoir operations. This innovative program is reviewing the possibility of eliminating reliance on simple rule curves and instead using on-the-go flood operation decisions based on the best available data. This new procedure has the potential for improving flood operation efficiency and conservation operation. The methodology will include using uncertainty estimates along with best estimate forecast hydrographs. The authorized enlargement of the flood control outlets at Folsom Dam provides the opportunity to implement this innovative approach to flood operations. The flood management plan will be updated and implemented concurrent with the completion of the Folsom Modification Project.

With the Folsom Modifications Project in place, the enlarged outlets will be capable of draining water from the reservoir at 115,000 cfs, a much higher rate than under existing conditions. This gives Folsom Dam the capability to increase flood storage space by quickly emptying the flood pool and part of the water supply space in advance of inflow. The existing 35,000 cfs release is not great enough to make an advance release operation effective as the time required to make up reservoir capacity would be greater than the time between expected peak inflows.

The flood management plan update could result in changes to the release schedule, which currently is based on observed inflow to Folsom Reservoir. Releases instead could be based on inflow forecast by measuring precipitation in the watershed, which would advance releases by as much as 18 hours. Releases may alternatively be based on precipitation forecasts by observing incoming storms, which could allow for releases as many as three days in advance.

The effect of advance release is to create additional flood space in Folsom Reservoir by temporarily reducing water supply storage. Because advance release is still being formulated and is not yet approved by the Corps or the Bureau, it is uncertain what the advance release would be. Because the differing sizes of the advance release would affect the economic benefits of the different alternatives, a reasonable range of advance release possibilities was evaluated for this study.

Advance release would be implemented only for storms that threaten to exceed Folsom Dam's capacity to control nondamaging flows. These are extreme, highly infrequent events with about a 1-in-100 chance of occurring in any year.

Timely creation of space by advance release will depend on operation decisions that will be based on special rules guiding releases, which will depend on incoming forecast data. Advance release rules will be designed to minimize the chance that the conservation pool would not be refilled. A tolerated risk of non-refill would be agreed upon before implementation of advance release.

Reservoir conditions and the inflow and outflow conditions preceding a major storm event would be the determining factors in how much additional flood control storage space could be created. There are risks inherent with advance release that do not exist with flood space that is physically available and ready to be used without special releases. These risks include the following:

- <u>Inability to recognize a storm that generates high inflow.</u> There are storms with shape and timing that would not trigger advance release because the predicted peak inflow or inflow volume would be too small, but they would still be large enough to result in uncontrolled downstream flow. These storms "fall under the radar" of the operational rules.

- <u>Inability to make releases to create adequate space.</u> There could be instances when advance release is called for, but the downstream channel is already at or near capacity. This would occur as Folsom Dam releases water to empty the flood control pool filled by the previous storm. In this case, there would be limited opportunity to create additional flood space through advance release.

Folsom Dam's advance release capabilities are also limited by the dam's infrastructure. As the reservoir pool drops, the outlet release capacity also drops because of the decrease in head pressure at lower pool elevations. The outlet flow capacity drops steeply as storage drops below 400,000 acre-feet.

Three advance release scenarios were developed for this study. The first scenario is that no advance release would be instituted and that the dam would continue to make releases based on observed inflow. The second scenario, moderate advance release, is considered the most likely without-project future condition. It incorporates risk and uncertainty to reflect the current development of advance release as a flood control measure. For this scenario, a 3-day forecast presents a reasonable opportunity to create 100,000 acre-feet of additional flood control storage space but with a lower bound of 0 acre-feet and an upper bound of 190,000 acre-feet. The lower bound represents the potential that no advance release would be made because of inaccurate forecast, inability to release additional flow, or inability to recognize major inflow. The third scenario, upper bound advance release, is very optimistic and serves as a maximum, upper bound advance release. The bounds for this release are 100,000/140,000/250,000 acre-feet.

It is uncertain what advance release will be instituted through the Flood Management Plan update. Since advance release affects pre- and post-project damages, this study evaluates flood control alternatives against all three scenarios. The most likely without-project condition, however, is that a moderate advance release that would not affect other Folsom Dam project purposes and would have no or minimal downstream impacts would be instituted. Thus this study's conclusions are based on the 0/100,000/190,000-acre-foot moderate advance release.

American and Sacramento Levee System

American River Project Common Features. In accordance with provisions contained in the WRDA of 1996 and WRDA of 1999, the north and south levees of the American River will be strengthened through the installation of seepage cutoff walls. Some levees will be raised so that all levees will have at least 3 feet of freeboard during a 160,000-cfs flow. These improvements are intended to increase the reliability of these levees and reduce the risk of flooding from the American River into downtown Sacramento. The east levee of the Sacramento River downstream of Verona will be raised and strengthened, and the south levee of Natomas Cross Canal will be modified to reduce the risk of flooding from the Sacramento River into Natomas. This project will reduce the risk of flooding from the American River from approximately a 1-in-85 chance in any given year to approximately a 1-in-100 chance in any given year. Construction of these features is expected to be completed in 2004.

North Area Local Project. Congress authorized a Natomas Federal project in 1993. Since then, SAFCA has completed levee improvements and a pumping facility to protect the Natomas Basin from flooding from the American River, Sacramento River, and lower Dry Creek and Arcade Creek. A main feature of this project was improvements to the North East Main Drainage Canal. SAFCA is receiving Federal reimbursement for some of this work, as authorized in the 1993 law. The improvements by SAFCA, combined with the American River Project Common Features, described above, are designed to reduce the annual risk of flooding in Natomas to approximately a 1-in-400 chance in any given year.

South Sacramento County Stream Group Project. This flood control project would protect urban areas in the southern portion of the city and adjacent areas in the county from high flows along four local streams and high water from Beach Stone Lakes farther south. The project includes raising and extending 24 miles of levees and floodwalls and retrofitting 17 bridges. The project is in the design phase and is scheduled to be completed in 2005. Portions of the south Sacramento flood plain overlap the American River flood plain in the southern part of the study area.

Sacramento River Bank Protection Project. The currently-funded Sacramento River Bank Protection Project includes 13,000 linear feet of bank protection work along the Lower American River. The purpose of the work is erosion control, primarily to prevent undermining of the flood control levees. Additional bank stabilization work is anticipated in the future.

2.20.2 Environmental Resources

Topography and Climate. The future without-project topography and climate conditions would be similar to those described in Section 2.2, "Topography and Climate." The issue of global warming was not a consideration in this report; however, the subject is discussed in briefly below.

Global warming is leading to an overall trend toward more intense rainstorms and drier soils due to the increase in the earth's average surface temperature triggering additional climate changes that can result in increased evaporation and precipitation. Recent studies indicate that California is faced with more frequent major storms and less reliable water supplies. Changes that may seem benign and gradual in some geographic areas can have significant impacts in an area such as Sacramento that frequently faces the threat of flooding. Each of these effects has implications for flood control and water resources. Drier, hotter summers will result in the potential for increased drought, loss of water resources (since the snow pack will no longer be as great to store water), and higher water demands. Unfortunately, actions to prevent flooding as a result of global warming (e.g., early release of water stored in the reservoir) can cause the loss of water resources needed at potential periods of drought at other times of the year. Although, warmer, wetter winter storms require increased flood capacity, their affect on American River flow frequency cannot be quantified; thus, the hydrological studies performed for this project do not reflect issue of global warming.

Hydrology and Hydraulics. The future without-project hydrologic characteristics of the American River basin are not expected to change compared to existing conditions. Over time, more hydrologic information will be collected, and the understanding of the hydrologic characteristics of the American River basin will become more accurate. This enhanced knowledge should result in more accurate forecasting of hydrologic conditions in the basin, which will lead to more effective planning for water supply purposes and flood control.

Geology, Seismicity, and Soils. The characteristics of the geology, seismicity, and soils of the American River basin are not expected to change compared to existing conditions. However, as more geological information is collected, the understanding of the geology of the American River basin is expected to increase. Increasing this understanding could lead to more effective planning and development in the basin.

Water Supply. Water use in the Sacramento River region during an average water year in 2020 is expected to total approximately 14.9 million acre-feet, an increase of approximately 3 million acre-feet from use in 1995 (California Department of Water Resources 1999). Developed surface water and groundwater in the region will fall short of meeting this demand.

No plans are in place to substantially increase water storage in the American River Basin. Storage could be increased by constructing new dams or increasing the storage capacity of existing reservoirs; however, environmental and cost considerations may make the development of future large water supply projects difficult.

The ability to fill Folsom Reservoir each year would increase if flood control operations at the reservoir were changed from the 400,000- to 670,000-acre-foot flood rule curve to a 400,000- to 600,000-acre-foot flood rule curve. The Corps is expected to change flood control operations at Folsom Reservoir to the 400,000- to 600,000-acre-foot flood rule curve after the proposed modifications to the Folsom Dam outlets and other improvements are complete (U.S. Army Corps of Engineers 2001).

Hydropower. Hydropower production is related to the amount of water stored in Folsom Reservoir. As indicated in the "Water Supply" section above, future changes in operation at Folsom Reservoir would increase the likelihood that the reservoir would fill. Increasing the frequency that Folsom Reservoir fills would benefit hydropower production.

Land Use and Socioeconomics. No substantial changes in land use are expected around Folsom Reservoir, along the Lower American River, or in the Sacramento and Yolo Bypasses. Lands around Folsom Reservoir and Lake Natoma are expected to continue to be managed by the California Department of Parks and Recreation as open space with an emphasis on recreation. Similarly, the Parkway will continue to be managed as an open space corridor. Agriculture is expected to continue to be the primary use of the Yolo Bypass although the Service and other wetland creation and habitat enhancement projects will convert some of the area through establishment of the North Delta Wildlife Refuge. The Sacramento Bypass will continue to be managed as open space.

The population of Sacramento, Yolo, and Placer Counties is expected to increase substantially by 2020. The population of Sacramento County is expected to increase from 1.2 million in 2000 to 1.8 million by 2020. Yolo County's population is expected to increase from 165,000 in 2000 to 248,000 by 2020. Placer County's population, excluding the Lake Tahoe Basin, is expected to increase from 237,000 in 2000 to 398,000 by 2020 (Sacramento Area Council of Governments 2000b). The increase in the regional population will result in increased demand for housing, transportation, and other services and in turn will result in changes in some land uses in the counties.

Recreation. Recreation use of Folsom Reservoir, the American River, and the Parkway is expected to increase. Sacramento County estimates that use of the Parkway will increase from 5.3 million people in 2000 to approximately 9 million in 2020. Recreational use of the FLSRA during peak season (from Memorial Day to Labor Day) is 2.3 million visitors, a number that is expected to increase.

As the population of the Sacramento metropolitan area increases, the importance of Folsom Reservoir, the American River, and the Parkway as regional recreation areas will increase. Recreation opportunities in the Yolo Bypass would increase with creation of the North Delta National Wildlife Refuge and other areas that allow public access.

Fisheries. Management of Folsom Reservoir is not expected to change from current conditions. The existing suitability of the reservoir as warm-water and cold-water fish habitat is not expected to change compared to current conditions.

Habitat for fish along the Lower American River has been changed substantially since Folsom and Nimbus Dams began operation. Estimating the future condition of fish habitat in the Lower American River is very difficult; however, the operation of Folsom Reservoir, including releases to the Lower American River, is not expected to change. In addition, after the modifications to the Folsom Dam outlets are complete, flood control operations will reduce adverse effects on fish habitat.

Other State and Federal programs, such as CALFED and the Central Valley Project Improvement Act (CVPIA), have stated objectives of improving fish habitat throughout Sacramento River watershed, including the American River.

Vegetation. The condition of vegetation around Folsom Reservoir, along the Lower American River, and in the Sacramento and Yolo Bypasses is expected to be similar to existing conditions. Vegetation around Folsom Reservoir could be affected as a result of improvements to existing recreation facilities; however, the amount and type of vegetation resources in the FLSRA are not expected to be reduced because this area is managed as open space.

Similar to the FLSRA, the Parkway is managed as open space, so substantial changes to vegetation attributable to recreation-related activities in the parkway are not expected. Changes in flows in the Lower American River as a result of construction and operation of Folsom and Nimbus Dams and gold and gravel mining operations along the river have resulted in changes in the structure, composition, and regeneration patterns in the vegetation. These changes include reduced recruitment of cottonwoods, increased overall age of cottonwoods, and increased abundance of white alders. Changes in the vegetation structure, composition, and regeneration patterns are expected to continue. Predicting the future composition of vegetation in the parkway is difficult.

Vegetation resources in the Sacramento and Yolo Bypasses either would remain similar to existing conditions or would be enhanced. Because development in the bypasses is not allowed, agriculture is expected to continue as the primary land use. However, projects such as the North Delta National Wildlife Refuge could be implemented that would increase the amount of vegetation that is native to the bypasses.

Regional losses of oak woodland, riparian vegetation, and grasslands are expected to continue as a result of residential and commercial development. The importance of vegetation in the FLSRA and Parkway will increase if regional losses continue.

Wildlife. The condition of wildlife around Folsom Reservoir, along the Lower American River, and in the Sacramento and Yolo Bypasses is expected to be similar to existing conditions. Habitat types could be affected as a result of improvements of existing recreation facilities; however, a major change in habitat types in the FLSRA is not expected because this area is managed as open space.

Similar to the FLSRA, the Parkway is managed as open space, so substantial changes in wildlife habitat attributable to the recreation-related activities in the parkway are not expected. As discussed in the "Vegetation" section above, changes in vegetation and, in turn, habitat types have occurred along the Lower American River, and changes in the vegetation structure, composition, and regeneration patterns and wildlife habitat are expected to continue.

Wildlife habitat in the Sacramento and Yolo Bypasses either would remain similar to existing conditions or could be enhanced. Waterfowl habitat would be enhanced as a result of projects such as the North Delta National Wildlife Refuge and enhanced management of existing agricultural lands.

Regional losses of oak woodland, riparian vegetation, and grasslands are expected to continue as a result of residential and commercial development. These losses would result in a loss of habitat for the wildlife species associated with these habitat types. The importance of the remaining wildlife habitat in the FLSRA and Parkway would increase as regional losses continue.

Water Quality. Water quality would likely remain the same as under current conditions. However, increased upstream water diversions in combination with the discharge of treated wastewater into downstream receiving waters could reduce water quality.

Cultural Resources. Cultural resource sites have been identified and recorded in the FLSRA, the Parkway, and the Sacramento and Yolo Bypasses. These sites probably represent a small percentage of the actual number of sites in the area because the FLSRA, Parkway, and bypasses have not been surveyed systematically. The FLSRA and Parkway provide protection for known sites because of law enforcement efforts by the State and Sacramento County. However, damage to some known sites has occurred and is expected to continue. Estimating the future condition of all sites in the FLSRA, Parkway, and bypasses is impossible without completion of an extensive survey program.

Traffic and Circulation. The SACOG estimates that the population of the Sacramento metropolitan area will increase substantially by 2020 (Sacramento Area Council of Governments 2000b). The number of jobs in the area will increase by more than 0.5 million over the same period. The region's strong population and job growth will add stress to a highway system that is already overburdened, especially during commute hours.

SACOG developed the 1999 Metropolitan Transportation Plan, a 24-year blueprint for $15 billion worth of transportation improvements and programs for the metropolitan area through 2022. The plan requires $2.8 billion in unfunded revenue measures that would have to be passed by the region's voters. Without the measures included in SACOG's plan, the congestion and mobility problems in the region will continue to worsen as the region grows. Operation of the proposed project would not generate a significant number of vehicle trips. However, even without the project, the region will face future challenges in trying to minimize road congestion and mobility impacts associated with population and job growth.

Air Quality. Air quality in the Sacramento region has improved over the past 20 years, largely as a result of reductions in harmful emissions from automobiles and trucks. Smog inspections for automobiles and the State's stringent emissions standards for new vehicles sold in California have helped to reduce vehicle-related pollution. In addition, local air districts have enacted numerous controls on stationary sources of pollution, such as processing plants and other industries that create air pollution. These controls have contributed greatly to the reduction in the number of ozone violations each year since the late 1970s. For example, in 1978 and 1979, the Sacramento area violated the Federal standard for ozone levels approximately 20 times per year. The number of Federal ozone violations dropped to seven in 1999 and six in 2000.

The Sacramento region is in attainment for the State and Federal carbon monoxide, nitrogen oxide, and sulfur dioxide standards and the Federal inhalable particulate (PM10) standards. However, the region continues to violate the State standards for PM10 and the State and Federal standards for ozone.

The State Implementation Plan (SIP) details how the State of California intends to clean up its air. It includes a list of measures to reduce air pollutants. The plan is a call to action that draws on the resources of Federal, State, and local governments to improve air quality in California. Projections in the current SIP indicate that the area will achieve the Federal ozone standard by 2005, despite large increases in regional population growth and vehicle miles traveled.

Noise. Noise conditions at Folsom Reservoir, along the Lower American River, and in the Sacramento and Yolo Bypasses are expected to be similar to existing conditions because the FLSRA, parkway, and bypasses will continue to be managed as open space. Development that would result in a substantial increase in noise in these areas is not expected to occur. Noise generated from sources adjacent to these areas is not expected to change substantially from existing conditions because lands adjacent to the FLSRA and the parkway generally have been built out or are zoned as open space.

Visual Resources. The visual character of the area around Folsom Reservoir, along the Lower American River, and in the Sacramento and Yolo Bypasses is not expected to change substantially from current conditions. The area around Folsom Reservoir is expected to maintain its visual character because changes within the boundaries of the FLSRA would most likely be restricted to modifying existing recreation facilities. Most of the FLSRA is expected to retain its open space character. Areas adjacent to the FLSRA have already been developed or are in public ownership. No substantial change in the visual character of these areas is expected.

The visual character of the Lower American River and Parkway would be similar to existing conditions. Most of the area on both sides of the parkway has been developed, and the parkway itself has been preserved as open space. Some change in the visual character of the parkway may occur as a result of either natural changes in vegetation types or vegetation restoration projects.

The visual character of the Sacramento and Yolo Bypasses is expected to remain the same because the bypasses would continue to be designated as floodways. Development would not be allowed although some land use changes may occur if the North Delta National Wildlife Refuge and other restoration projects are established. These changes in land use would not alter the existing visual character of the bypasses.

Public Services. As indicated in the "Land Use and Socioeconomics" section above, the population of Sacramento, Placer, and Yolo Counties is expected to grow substantially by 2020, increasing the demand for public services.

Public Health and Safety. Public health and safety may improve as hazardous and toxic waste sites that are considered to be a "serious threat" are slated for cleanup or further monitoring; however, effects on public health and safety as a result of flooding would not change.