DRAFT RESOURCE INVENTORY

Folsom Lake State Recreation Area

April 2003

Prepared for:

California Department of Parks and Recreation
United States Bureau of Reclamation

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RESOURCE INVENTORY DRAFT
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INTRODUCTION

Folsom Lake State Recreation Area

April 2003

by

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INTRODUCTION

Purpose

The purpose of the Folsom Lake State Recreation Area Resource Inventory (RI) is to provide a thorough, accurate and comprehensive body of information on the environmental conditions, natural, cultural, aesthetic and recreational resources, land use, and infrastructure of the unit. This information will identify, record, and evaluate these resources in a comprehensive, usable form that is readily available to Department and Bureau personnel. The Resource Inventory provides the necessary resource data to inform the general planning process. The Resource Inventory is a dynamic document that will be updated as more information is collected.

The Resource Inventory is prepared to satisfy requirements of Division 5, Chapter 1, Section 5002.2 (b) of the Public Resources Code as cited below:

> *Section 5002.2(a). Following classification or reclassification of a unit by the State Park and Recreation Commission, and prior to the development of any new facilities in any previously classified unit, the department shall prepare a general plan or revise any existing plan, as the case may be, for the unit. The general plan shall consist of elements that will evaluate and define the proposed land uses, facilities, concessions, operation of the unit, any environmental impacts, and the management of resources, and shall serve as a guide for the future development, management, and operation of the unit. The general plan constitutes a report on a project for the purposes of Section 21100. The general plan for a unit shall be submitted by the department to the State Park and Recreation Commission for approval.*
>
> *Section 5002.2(b) The resource element of the general plan shall evaluate the unit as a constituent of an ecological region and as a distinct ecological entity, based upon historical and ecological research of plant-animal and soil-geological relationships and shall contain a declaration of purpose, setting forth specific long-range management objectives for the unit consistent with the unit's classification pursuant to Article 1.7 (commencing with Section 5019.50), and a declaration of resource management policy, setting forth the precise actions and limitations required for the achievement of the objectives established in the declaration of purpose.*

Furthermore, Division 3, Chapter 1 of the California Code of Regulations notes that the Resource Element must be formulated, exposed to public comment, and approved by the director before substantial work is done on any other element of a general plan.

> *4332. Preparation of a General Plan. After classification or reclassification of a unit of the state park system, the department shall obtain public comment and prepare a general plan. The general plan shall consist of a resource element, a land use element, a facilities element, and an operations element. In order that it shall act as a guide and constraint, the resource element will be prepared, made available for public comment, and approved*

by the director before substantial work is done on the other elements of the plan.

The objectives of the Resource Inventory are to provide information sufficient to:

- Inform the public
- Develop resource management policy
- Develop resource management and protection programs
- Serve as a reference to clarify and solve resource problems
- Serve as background information to plan improvements and/or new facilities in the Unit
- Assess environmental impacts
- Develop interpretive program
- Provide background information for maintenance and operation

Background

The California Department of Parks and Recreation (CDPR) first entered into an agreement with the U.S. Bureau of Reclamation (BOR) in 1956 to manage recreation facilities at Folsom Lake and Lake Natoma. The area was later designated as Folsom Lake State Recreation Area (the Unit). Most of the lands around both lakes are owned by the BOR and managed by the CDPR. The current General Plan for Folsom Lake State Recreation Area was completed in 1979. Growth and development in the Sacramento Metropolitan Area over the past 20 years in addition to a number of proposed projects in the vicinity of the Unit have prompted this update of the Folsom Lake State Recreation Area General Plan. Public Resources Code 5006.6, as summarized below, clarifies the participating agency roles.

5006.6. The department, with the approval of the Administrator of the Resources Agency and the Department of Finance, is authorized to cooperate and participate with the federal government pursuant to Public Law 89-161 in the development of recreation facilities, or with the approval of the Department of Fish and Game, fish and wildlife enhancement facilities, or both, at Auburn Dam and Reservoir, Folsom Dam and Reservoir, Nimbus Dam and Lake Natomas, and County Line Dam and Reservoir, and stream areas in the immediate vicinity of these facilities. The department, with the approval of the Administrator of the Resources Agency and the Department of Finance, is authorized to administer unit land and water areas for recreation or fish and wildlife enhancement, or both, and to contract with the federal government for the operation, maintenance, and replacement of unit facilities, to assume all costs of such operation, maintenance, and replacement, and to accept transfer of unit lands or facilities by lease or exchange upon such terms and conditions as will best promote the

development and operation of such lands or facilities in the public interest for recreation or fish and wildlife enhancement purposes, or both. ... The department shall cooperate with any local public body authorized to contract with the federal government pursuant to Public Law 89-161, including, but not limited to, the Counties of El Dorado, Placer, and Sacramento, in planning of any proposed participation with the federal government. The state may contract with any or all of such counties or other local public bodies for the operation, maintenance, and replacement of unit facilities, or any portion thereof, if requested by any or all such counties or other local public bodies.

Project Description

With approximately 1.5 million visitors annually, the Folsom Lake State Recreation Area is one of the most popular and heavily visited units within the California State Park System. Lake Natoma and portions of the popular 32-mile American River Bike Trail are part of the Unit. The Unit offers 12,000 water surface acres for water-oriented use including, swimming, sailing, boating, water skiing and fishing. Its 85 miles of shoreline provide opportunities for picnicking, camping, horseback riding, hiking and biking along the scenic lakeside.

The Unit is located at the confluence of the North and South Forks of the American River in the Sierra Nevada Foothills, just outside the Sacramento Metropolitan Area. The Unit itself resides in three different counties: El Dorado, Placer and Sacramento as well as the City of Folsom. (Figure I-1) The Unit is located between two major east-west freeways, State Highway 50 on the south and Interstate 80 on the north. These highways converge in the City of Sacramento, 25 miles west of the project area and extend eastward through the Sierra near Lake Tahoe. Figure I-2 shows the different parcels of land that compose the Unit.

The Unit is a part of the larger American River System that stretches nearly the entire width of the state. The rivers have cut through the rugged central Sierra Nevada, carving the rugged canyons and oak-covered foothills of the Auburn-Folsom area, stretching across the grasslands of the Central Valley, past Lake Natoma to join the Sacramento River, San Francisco Bay and the Pacific Ocean.

Folsom Lake and Lake Natoma are the primary physical features of the Unit and its main attractions. Folsom Lake was created in 1955 by Folsom Dam, a concrete dam flanked by earth wing dams and dikes with a total length of about 9 miles. The lake features some 10,000 surface acres of water when full and has 75 miles of shoreline. It extends about 15 miles up the North Fork, and about 10 1/2 miles up the South Fork of the American River. The Lake level normally varies from 466 feet elevation in early summer to a low of 405 feet in early winter depending on the releases of water from Folsom Dam. Figure I-3 provides an enlarged aerial view of the Folsom Lake portion of the site.

Lake Natoma, formed by the waters held by Nimbus Dam, is an afterbay or regulating reservoir for Folsom Dam. Two 6,750-kilowatt generators produce power from Nimbus Dam water releases. Lake Natoma is a smaller water body than Folsom Lake but its water level fluctuates very little (4' - 7'). A 5-mph speed limit is in effect for the entire lake. This limit

regulates motorized boat use on Lake Natoma. Figure I-4 provides an enlarged aerial view of the Lake Natoma portion of the site.

Inventory Study Area

The reservoirs and their environs support a variety of natural, cultural, scenic and recreational resources. Environmental conditions in the region, such as climate, noise, traffic and land use, affect the quality and quantity of these resources. The Resource Inventory provides baseline information on current conditions within the Unit and its vicinity as well as an assessment of the Unit's resources. Information is organized by major subjects such as geology, climate and plant life. Each of the major subjects is summarized below:

Meteorology & Air Quality. The Unit's climate is characterized by cool, wet winters and hot, dry summers. Temperatures range from an annual average minimum of 43-48 degrees F to an annual average maximum of 70-74 degrees F. In the summer, temperatures can range into the mid-90 degrees F. Air quality in the unit is characterized as good. However, over the past three years, monitoring stations in the vicinity of the Unit have recorded levels of ozone and particulate matter that exceed both state and federal standards. The presence of these pollutants is generally attributed to winds from the south transporting pollutants from urban areas such as the San Francisco Bay area and the Sacramento Metropolitan area into Placer County and other northern counties.

Geology. The Unit is located at the western extent of the Sierra Nevada foothills between the Central Sierra Nevada and the Central Valley geomorphic provinces. The geology of the Unit is characterized by rolling hills and upland plateaus located between major river canyons. The Unit contains three geologic divisions: a north-northwest trending belt of metamorphic rocks with included ultramific rocks, younger granitic intrusive plutons that intruded and obliterated some of the metamorphic belt and nearly flat-lying deposits of volcanic ash, debris flows, and alluvial fan deposits that overlie the older rocks. These divisions have created a varied and interesting geology within the boundaries of the Unit.

Soils. Soils within the Unit are generally well-drained, silty, sandy and gravelly mixtures developed over either granitic or metamorphic bedrock. Higher elevation soils are thin with numerous outcropping of igneous and metamorphic rock and have limited permeability. The northwest side of Folsom Lake contains loose soils of decomposed granite that can be characterized by erosion and excessive drainage. The south side of Folsom Lake contains denser, clay soils. Serpentine rock and soil can be found at the Peninsula area of Folsom Lake and south of the South Fork of the American River. These soils contain high levels of nickel, chromium and manganese which are toxic to most plants but can support several special status plant species. Much of the area around Lake Natoma has been modified by large-scale dredging for gold, resulting in extensive deposits of dredge tailings composed of small to large cobbles and boulders.

Hydrology. The Unit is a part of the American River Watershed, which covers approximately 2,100 square miles northeast of Sacramento. Folsom Dam regulates a drainage area of about 1,875 square miles. and has a normal full-pool storage capacity of 975,000 acre-feet. Several small creeks and streams flow directly into Folsom Lake and Lake Natoma including Willow, Alder, Hinkle, Sweetwater, New York and Hancock Creeks. Although the primary

function of Folsom Dam is flood control, the reservoir stores water for irrigation and domestic use and for electrical power generation. Lake levels can fluctuate significantly depending on hydrological and meteorological conditions, water demands and flood control and hydropower needs. Lake Natoma is a regulating afterbay used to regulate flow fluctuations from Folsom Powerplant into the American River and to generate electricity from water releases. As a result, water levels in Lake Natoma do not vary significantly. Implementation of several proposed projects, especially the Folsom Dam Modification Project and the Folsom Dam Raise Project, will result in both physical and operational changes to the dam and reservoir, alter lake level fluctuations and impact the water resources and hydrology of the Unit.

Water Quality. The vast majority of water entering Folsom Lake and Lake Natoma is well-oxygenated, cold water of high quality. Monitoring at the Unit indicates that water quality rarely exceeds State of California water quality objectives related to temperature, bacteria, dissolved oxygen, pH, oil and grease, total dissolved solids, and turbidity. Water quality concerns that do exist in the Unit include excessive sediment inflow from surrounding development into local drainages, nutrient inflow to Alder Pond, mercury bioaccumulation in fish from abandoned mining tailings, bacterial contamination of waters heavily frequented by waterfowl and occasional sewage spills in the watershed from wastewater treatment plants.

Noise. Noise monitoring data indicates that noise levels within the Unit are generally low to moderate, typical of rural areas. Primary noise sources within the Unit include traffic along neighboring roadways, airplanes flying overhead, boats on the lake and construction. Noise is known to have several adverse effects on people including hearing loss, speech and sleep interference, physiological responses, and annoyance. Based on these known adverse effects, the federal government, the State of California and many local governments have established criteria to protect public health and safety and to prevent disruption of certain activities. Although the Unit is part of the State Park System and owned by the BOR, it is subject to the noise ordinances of the municipalities in which it resides.

Plant Life. The Unit is dominated by aquatic habitat within Folsom Lake and Lake Natoma, however, significant stands of terrestrial vegetation surround the lakes including several fine examples of native plant communities. The Unit is located within the California Floristic Province and supports nine major terrestrial types that are typical of the foothills of California's Central Valley. These types include: chamise chaparral, interior live oak woodland, blue oak woodland and savanna, annual grassland, cottonwood/willow riparian, freshwater marsh, seasonal wetland and northern claypan/hardpan vernal pool. The Unit's mix of vegetation communities is a product of complex interactions of natural and human influences that have shaped the region including climate, soil type and depth, elevation, slope, aspect (topographic position), grazing and browsing, fire, physical disturbances by humans, reservoir fluctuations, and invasive exotic vegetation.

Animal Life. The Unit supports many native plant communities that provide suitable habitat for a large number of native fauna including special status species. The primary habitat types that occur within the Unit include upland (grass and oak savanna, chaparral, oak woodland, and riparian woodland), ruderal/barren, and aquatic (lake, pond, creek and stream, freshwater marsh and seasonal wetland). Unfortunately, alteration in composition and structure of native vegetation is very likely to have depleted populations of native foragers and pollinators of these native plants. The addition of non-native species and the increase in native species that have adapted to changes in vegetation have intensified changes in the natural ecosystems of

the Unit. Furthermore, development of land adjacent to the Unit and construction within the Unit (i.e. the dams themselves) have created significant barriers to wildlife movement and altered patterns of animal migration.

Recreation. The Unit is a significant local, regional and state recreation resource. While aquatic activities such as boating, water skiing, sailing and swimming are the most popular activities in the Unit, land-based activities such as hiking, biking, picnicking, camping and horseback riding also attract visitors. Although the Unit accommodates year-round recreation, 75 percent of all visits occur during the warmer spring and summer months. The peak recreation season begins around Memorial Day when lake-levels are highest and ends at Labor Day. Recreational activities in the Unit have changed significantly since the first facilities were opened to the public in 1958. The rise in popularity of personal watercraft (jetskis), sailing, kayaking and paddling sports and the introduction of new sports such as mountain biking have transformed the character of the Unit, increased its level of use, and prompted discussions about conflicts in recreation use.

Scenic Resources. The Unit is a significant visual and scenic resource within the region. It provides dramatic panoramas of the lakes and the surrounding foothill landscape from several key vista points at Lake Overlook and Observation Point and offers views of impressive natural features such as the steep river gorges along the North and South Forks of the American River and the rugged Peninsula. The Unit affords views of several distinctive built features including Folsom and Nimbus Dams, Rainbow Bridge, the historic truss bridge, the Lake Natoma crossing and the Folsom Powerhouse. Unfortunately, urban and rural development adjacent to the Unit and built features within the Unit (i.e. dams, parking lots, utility corridors) detract from the overall visual quality of the Unit and the experience of Unit visitors.

Cultural Resources. At present, a total of 258 archaeological sites have been identified within the Unit. These sites reveal the rich history of the region from its settlement by prehistoric people 4,000 years ago to the construction of Folsom and Nimbus dams in 1955. Prehistoric sites identified within the Unit contain remnants of semi-permanent villages established by the Nisenan, the earliest settlers of the region. Remnants include midden, bedrock mortars, milling slabs, handstones, pestles, projectile points, scrapers, bifacial tools, cores and debitage. European settlement of the region began circa 1822 and increased rapidly when gold was discovered at Sutter's Mill in 1848. Historic sites identified within the Unit contain remnants of activity related to mining, settlement and water development. Remnants include debris scatters (glass, metal, ceramic), structural remains, dredge tailings and hydraulic mining remnants. The Folsom Powerhouse, one of the oldest hydroelectric facilities in the country, is located within the boundaries of the Unit. In 1895, the powerhouse marked the first long-distance transmission of high voltage electricity for commercial use and continued to operate until 1952. The powerhouse is a state historic landmark and is listed on the National Register of Historic Places. Although the Folsom Powerhouse State Historic Park is a separate designated unit within the State Park System, it is administered by Unit staff and is included in the Unit's General Plan.

Land Use. Land uses within the Unit are primarily recreation-related and reflect a range of activity and intensity of use. Non-recreation uses within the Unit are associated with the operation of Folsom and Nimbus Dams. These two types of uses (recreation and dam operation) are closely related as water level fluctuation associated with the Folsom Lake reservoir directly affects the availability of boat ramps, beaches, mooring sites, and other

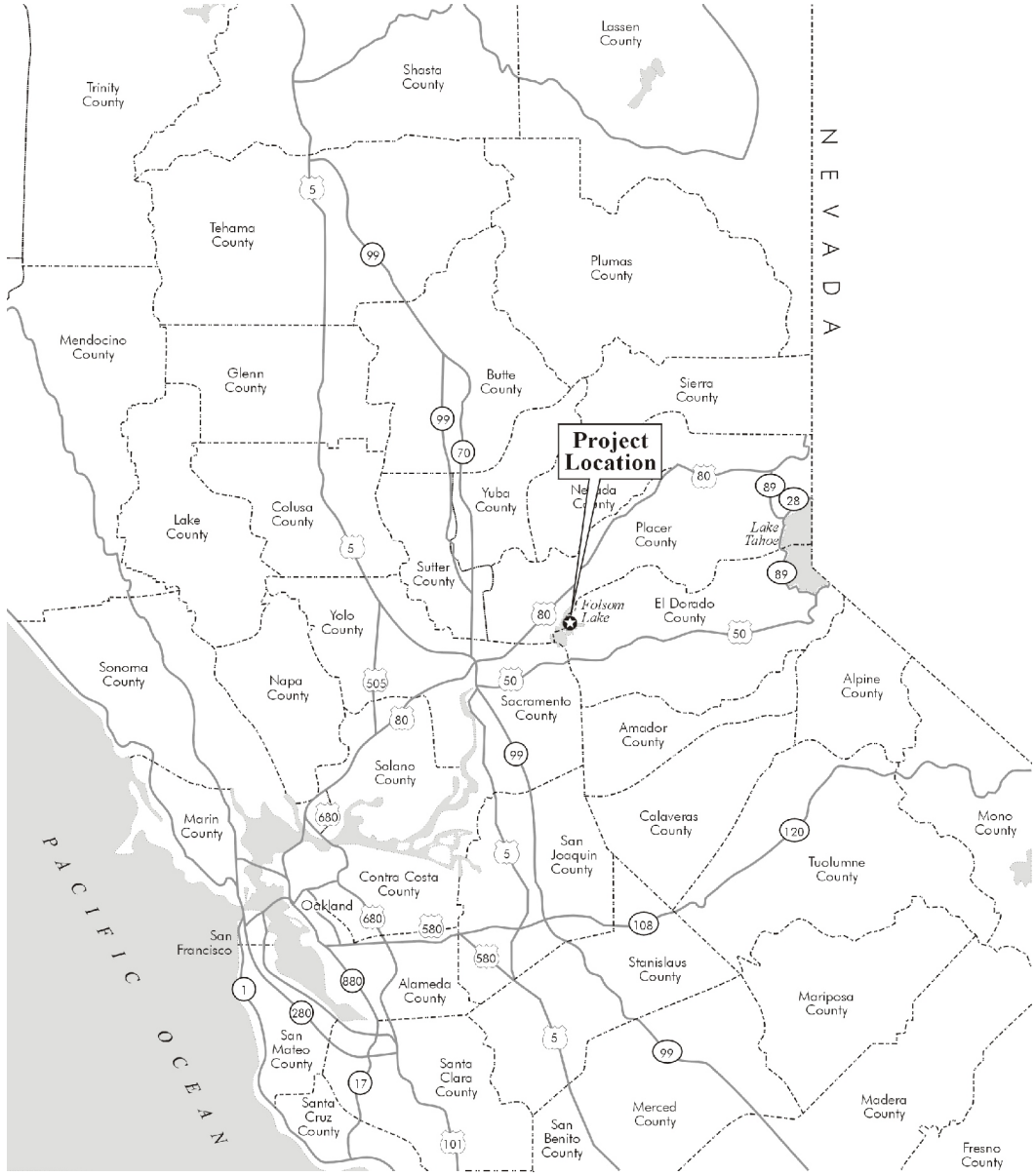
facilities that depend largely on water depth or surface area. Implementation of the Folsom Dam Raise project may further impact recreation use within the Unit by increasing the maximum flood pool level from 474 feet to 482 feet. Land use surrounding the Unit is characterized by development that increases in density from rural in the north to urban in the south. The proximity of development to the Unit raises several complex issues including land use and intensity, visual intrusion, access, noise and fire hazard.

Traffic & Circulation. Most visitors access the Unit by car. Interstate 80 and U.S. Highway 50 provide regional access to the Unit via interchanges at Douglas Boulevard and Folsom Boulevard, respectively. Local roadways provide access for nearby residents. These roadways include Douglas Boulevard, Auburn-Folsom Road/Folsom Boulevard, Natoma Street, Green Valley Road, and El Dorado Hills Boulevard. In addition to vehicular access, visitors may take advantage of bicycle lanes that exist on several roadways in the vicinity of the Unit including Auburn-Folsom Road/Folsom Boulevard, Natoma Street and Green Valley Road. In addition, public transportation provides access to the Unit via bus and light rail service. Access to individual recreation areas within the Unit is provided by the surrounding public roadway system and trails; there is no internal roadway system within the Unit itself. DPR staff have indicated that traffic congestion occurs at several of the recreation facilities during peak summer weekends.

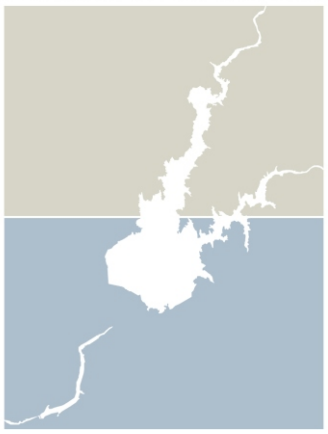
Utilities. The utility infrastructure of the Unit consists of CDPR-owned systems that provide water, sewer, electricity and telephone service to some of the day use, campground, and boat launch facilities and access points. Levels and types of service vary for each recreation area. In addition, several companies and agencies own utility lines that pass through Unit land. The CDPR and BOR have granted easements to utility owners that guarantee them permanent access to utility lines for maintenance and repair purposes. Development within these easements is prohibited, however, new roads, trails and utilities can be constructed across easements provided permission has been granted. Utilities and related maintenance activities may impact the visual, recreational or natural resources of the Unit.

The attached Resource Inventory provides the framework for the planning process, following the *Guidelines for Resource Documents* prepared by the California Department of Parks and Recreation, Resource Protection Division (September 1991). Individual sections can be updated at any time without affecting the other sections, thus each major section has a title, date and its own reference section. Individual chapters are organized, or grouped, to begin this planning process for Folsom Lake State Recreation Area within the following major headings: Environmental Conditions; Natural Resources; Recreation, Scenic and Cultural Resources; and Land Use, Traffic and Circulation, and Utilities.

Each section ends with recommendations to outline the need for additional data, mapping or resource monitoring. Specific policy recommendations that might result from an analysis of the information included in the Resource Inventory will be included in the Resource Element to be prepared as the next step in this planning process.



FOLSOM/LAKE/NATOMA



FIGURE

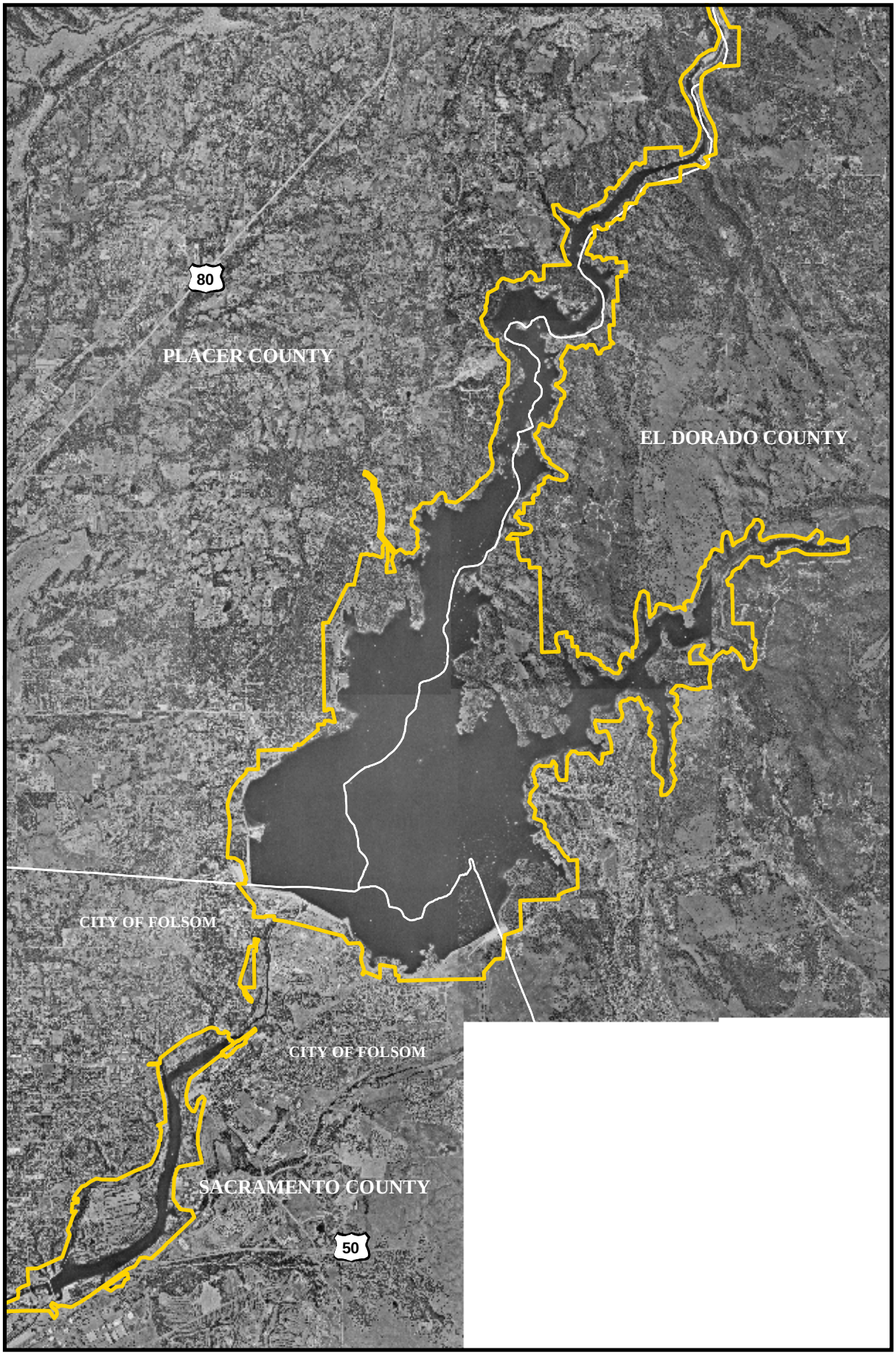
I-1

REGIONAL LOCATION

Prepared by LSA Associates, Inc.

N

0 750 41.03 82.06 MILES



FOLSOM LAKE STATE RECREATION AREA RESOURCE INVENTORY

FIGURE

I-2

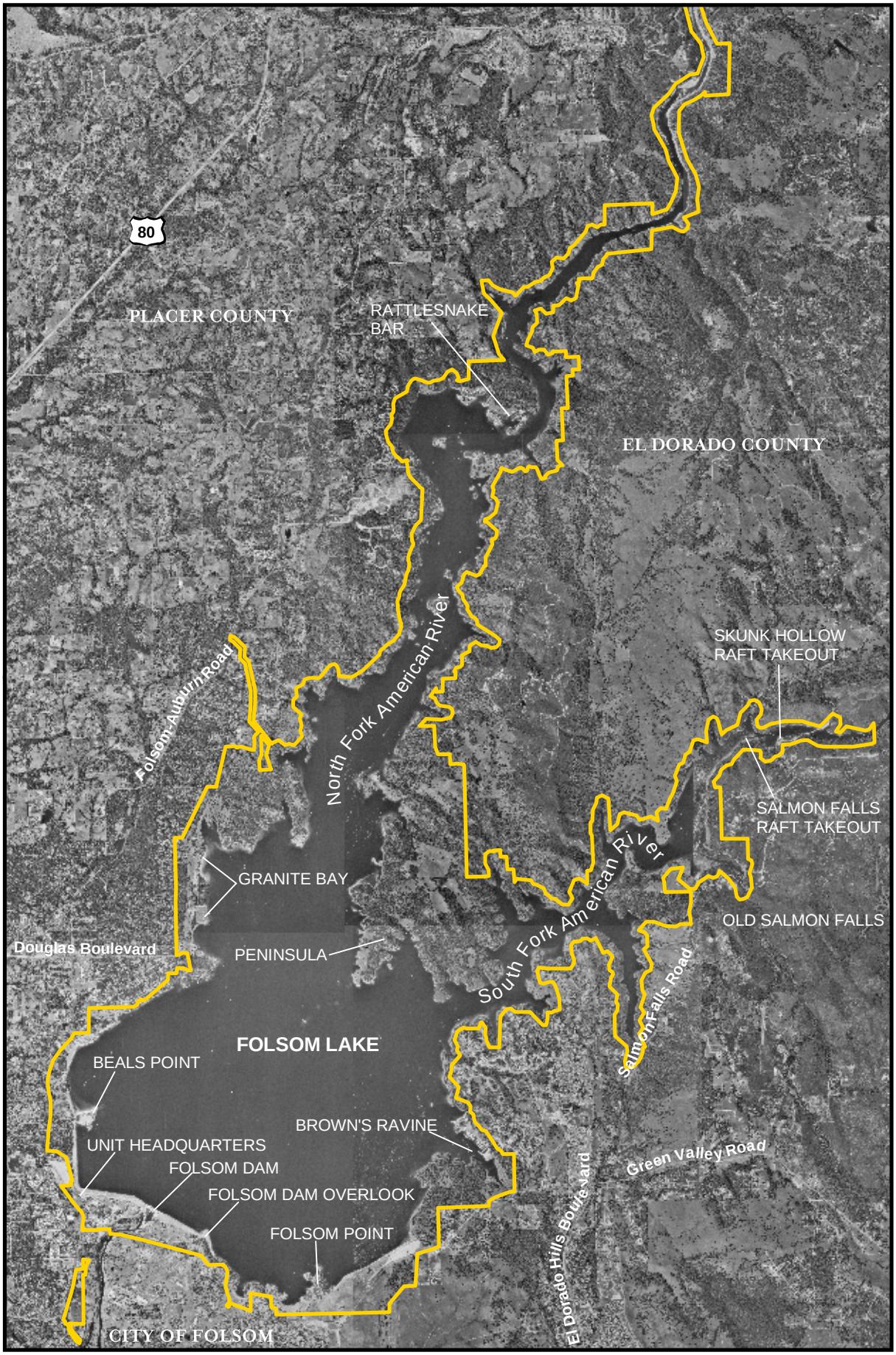
PROJECT LOCATION

Prepared by: LSA Associates, Inc.
Source: CDPR, BOR

N

0 0.5 1 2 3 4 Miles

FOLSOM LAKE STATE RECREATION AREA RESOURCE INVENTORY



FIGURE

I-3

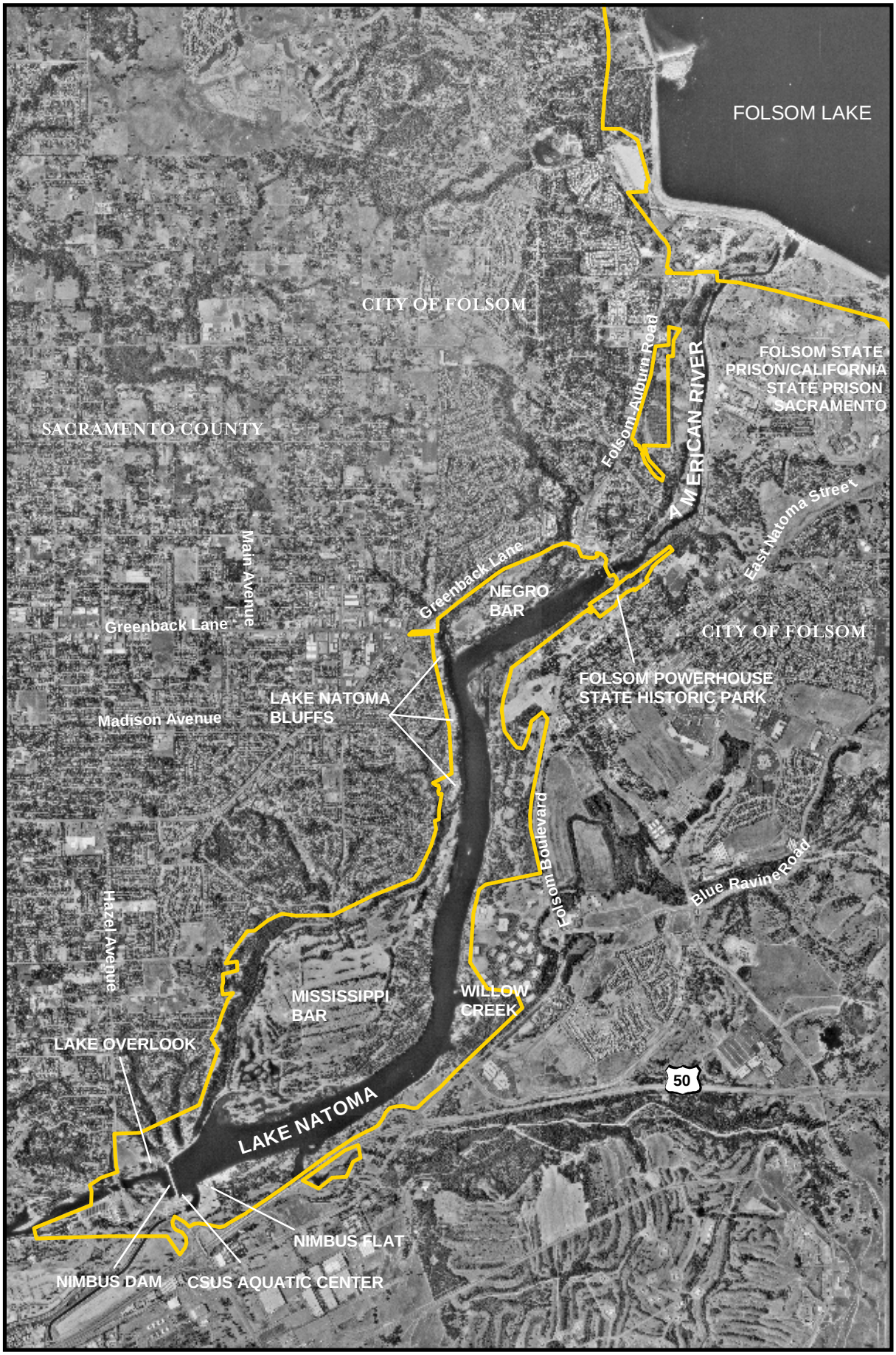
AERIAL VIEW FOLSOM LAKE

Prepared by: LSA Associates, Inc.
Source: CDPR, BOR

N

0 0.4 0.8 1.6 2.4 3.2 Miles

FOLSOM LAKE STATE RECREATION AREA RESOURCE INVENTORY



N

0 0.2 0.4 0.8 1.2 1.6 Miles

FIGURE

I-4

AERIAL VIEW LAKE NATOMA

Prepared by: LSA Associates, Inc.
Source: CDPR, BOR

ENVIRONMENTAL CONDITIONS

GEOLOGY

Folsom Lake State Recreation Area

April 2003

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GEOLOGY

Introduction

This summary documents the geologic and subsurface conditions at the Folsom Lake State Recreational Area (the Unit). Fieldwork consisted of a brief site reconnaissance. Literature reviewed included published scientific articles, maps, files, and previous studies pertaining to the Unit. No subsurface investigations were performed as part of this Resource Inventory. The purpose of this summary is to:

- Describe the geology, mineral resources, and geologic hazards of the Unit,
- Identify the types and locations of geologic and geotechnical concerns for inclusion in the General Plan.

The primary sources for the background research were the California Division of Mines and Geology (now the State Geological Survey) Regional Geologic Map 1A (Figure G-1), Mineral Resources maps, and various other publications available from the United States Geological Survey (USGS) or University of California at Berkeley Earth Sciences libraries. We also reviewed documents provided by LSA and WRT. A list of source documents is included in the reference subsection.

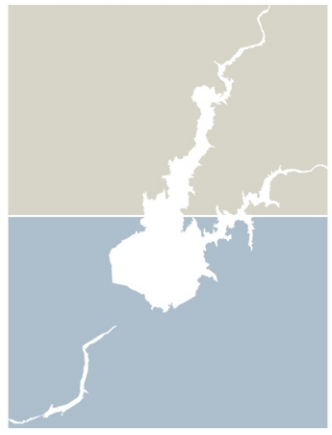
Topography

The Unit lies within the American River watershed. Folsom Lake occupies the deep, narrow, V-shaped canyons of the North and South Forks of the American River and the valley at the confluence of the two forks. At the spillway elevation of 466 feet, Folsom Lake extends upstream on the North Fork to just south of Auburn, and about a mile east of where Salmon Falls Road crosses the South Fork. Lake Natoma lies in the wide gulch of the American River cut into Tertiary sedimentary rocks below Folsom Dam.

Elevations in the upper Folsom Lake area range from around 1,500 feet along the ridge tops between the North and South Forks of the American River, though this ridge does not lie within the Unit boundary. The highest elevation within the Unit is just over 800 feet and occurs in the hills surrounding the Peninsula Campground. The rolling hills above the canyon of the North Fork range from 800 to 900 feet, but the highest elevation in the Unit in the upper reaches of the North Fork is between 600 to 800 feet. The low terraces surrounding lower Lake Natoma are about 100 feet in elevation. Slopes are generally steep to moderately steep along the margins of Folsom Lake, the exceptions are at the Peninsula Campground area, Goose Flat, and the Granite Bay area.

FOLSOM LAKE STATE
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FOLSOM/LAKE/NATOMA

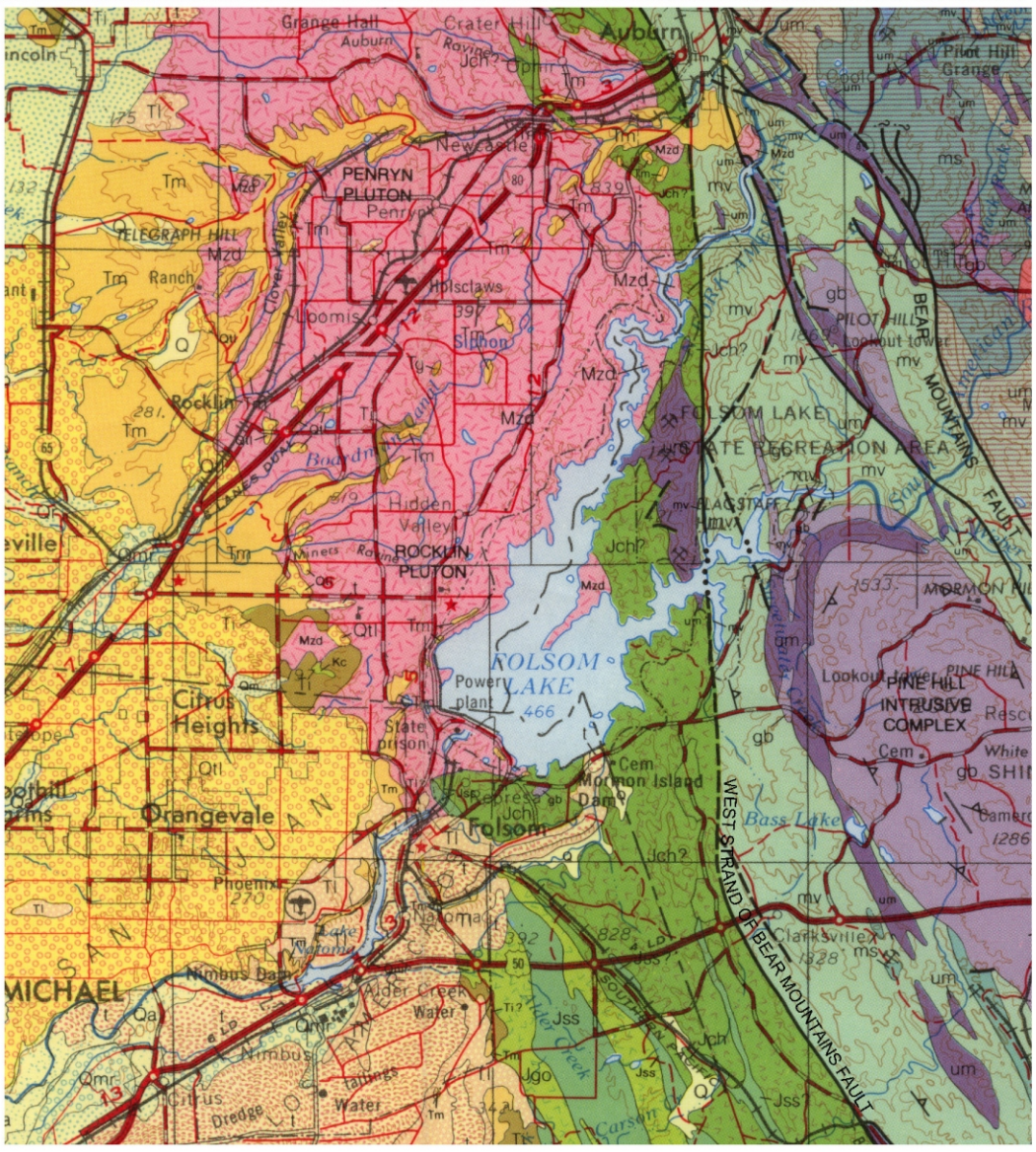


Scale 1:250,000

5 0 5 10 15 20 Statute Miles

5 0 5 10 15 20 25 30 Kilometers

5 0 5 10 15 Nautical Miles



Quaternary Sediments

- Q — Alluvium
- t — Mine and dredge tailings
- Qa — Levee and channel deposites
- Qm — Modesto Formation (alluvium)
- Qr — Riverbank Formation (alluvium)
- Qmr — Modesto-Riverbank Formation (Arkosic alluvium)
- Qtl — Turlock Lake Formation (sand, silt, and gravel)

Tertiary Sedimentary Rocks

- Tl — Laguna Formation consolidated alluvial deposits
- Tm — Mehrten Formation andesitic conglomerate, sandstone, and breccia
- Ti — Ione Formation quartzose sandstone and kaolinitic clay

Cretaceous Metasedimentary Rocks

- Jss — Salt Spring Slate
- Jch — Copper Hill Volcanics
- Jgo — Gopher Ridge Volcanics

Mesozoic Metamorphic Rocks

- ms — metasedimentary rocks in melange
- mv — metavolcanic rocks in melange

Plutonic Rocks

- Mzd — Mesozoic dioritic rocks
- gb — Gabbroic rocks
- um — Ultramafic rocks

N

FIGURE
G-1

GEOLOGIC MAP OF THE FOLSOM AREA

Prepared by LSA Associates, Inc.

SOURCE: WAGNER ET AL. (CDMG) 19

Regional Geology

The Folsom Lake State Recreation Area is situated within the westernmost extent of the Sierra Nevada Foothills, between the Central Sierra Nevada and the Central Valley Geomorphic Provinces. The Sierra Nevada is a geomorphic region in California characterized by a north-northwest trending mountain belt with a broad region of foothills along the western slope (Harden, 1997). The Folsom Lake Region is dominated by rolling hills and upland plateaus located between major river canyons. Folsom Lake is impounded above Folsom Dam; it occupies the lower reaches of the canyons of the North and South Forks of the American River, with a peninsula extending between the two arms of the lake. Lake Natoma, downstream of Folsom Dam and behind Nimbus Dam, occupies a broad river valley that is incised into sedimentary rocks.

The margin of Folsom Lake has considerable topographic relief as shown by the hill slopes depicted in the slope map of Figures G-2 and G-3. Steep bluffs occur on a portion of the north side of Lake Natoma; elsewhere, the topography is subdued.

One major fault zone traverses the Unit; it is the west trace of the Bear Mountains Fault Zone. In the Unit area, the fault trends nearly north-south from Auburn to El Dorado Hills, crossing Folsom Lake in the upper reaches of the North Fork arm near Manhattan Bar Road, and crossing the South Fork arm at about New York Creek. This portion of the fault zone is characterized as not active (Jennings, 1994).

Three major geologic divisions occur in the Unit area. From oldest to youngest, these are: 1) a north-northwest trending belt of metamorphic rocks with included ultramafic (dense, and rich in iron and magnesium) rocks, 2) younger granitic intrusive plutons that intruded and obliterated some of the metamorphic belt, and 3) nearly flat-lying deposits of volcanic ash, debris flows, and alluvial fan deposits that overlie the older rocks. These divisions have created a varied and interesting geology within the boundaries of the Unit.

Unit Geology and Mineral Resources

The overall trend of the regional structure is defined by the predominantly northwest-southeast-trending belt of metamorphic rocks and the strike-slip faults that bound them. The structural trend influences the orientation of the feeder canyons into the main canyons of the North and South Forks of the American River. This trend is interrupted where the granodiorite plutons outcrop (north and west of Folsom Lake) and where the metamorphic rocks are blanketed by younger sedimentary layers (west of Folsom Dam) (Wagner *et al*., 1981).

The four primary rock divisions found in the Unit area are: 1) ultramafic intrusives, 2) metamorphics, 3) granodiorite intrusives, and 4) volcanic mud flows. Each is associated with a particular part of the tectonic history; each has distinct mineral resources. These are described below.

Ultramafic intrusive rocks: Ultramafic rocks are not commonly found at the surface of the

Figure G-2A: Slope Map of the Unit (Folsom Lake)

Figure G-2B: Slope Map of the Unit (Lake Natoma)

Earth. The ultramafic rocks found in the Unit represent the lowest part of the Earth's crust. These rocks have been lifted as much as 20 miles vertically by the faulting and underthrusting of other pieces of crust, which probably occurred when crust was added to North America by accretion. The term "ultramafic" indicates enrichment of magnesium, manganese, and iron in the minerals that form the rock. The rock names of these units are dunite, pyroxenite, and peridotite. Outcrops of ultramafic rocks tend to be resistant to erosion and often form topographic highs. Outcrops are gray or green in color if fresh, tan if weathered. They are identified easily in the field by the extraordinary density of the rock. The largest exposure of ultramafic rocks occurs on Flagstaff Mountain on Folsom Lake Peninsula, with a small outcrop found south of the lake on the hill known as "Iron Mountain". Some geologists assert the Pillikin ore deposit may be part of a larger ultramafic intrusive body known as the Pine Hill Complex that intruded the pre-existing rocks about 157 to 175 million years ago (Jurassic). The main body of the Pine Hill Complex occurs south of the South Fork of the American River east and south of Salmon Falls.

Ultramafic rocks occur as the base of a sequence of oceanic sediments that include volcanically derived materials such as pillow basalts and andesite breccia. Oceanic sediments generally occur above the volcanics, examples of which include deepwater limestone, chert, shale, and greywacke sandstone.

Mineral resources for the area are described in Loyd (1984) and Kohler (1984); both of their works are publications of the California Division of Mines and Geology (now known as the State Geological Survey). Minerals associated with ultramafic rocks include chromite, minor nickel, talc, and asbestos. The richest chromite mining area in the western foothill region occurs on Flagstaff Hill (just northeast of the Peninsula Campground), where chromite (Cr_2O_3) occurs in pod-shaped deposits within the ultramafic unit. Mining occurred sporadically from numerous sites on and around Flagstaff Hill between 1894 and 1955 (El Dorado County Library website). Presently, the mines are idle or abandoned. Several mine or prospect workings occur in the Unit: Zantgraf mine, about a mile south of Goose Flat; an unnamed adit about ½ mile south of Goose Flat; a mineshaft in Granite Ravine and another about ¼ mile south of Anderson Creek in the Peninsula Campground area. One of the more well-known old mines is the Pilliken Chrome Mine, accessed from Rattlesnake Bar Road, the access road to the Peninsula Campground. Some of the abandoned mines are still open and may pose a hazard to Unit users. The locations and status of these mines may become important in the future if future acquisitions are made on the Peninsula.

The entire belt of ultramafic rock is designated MRZ-2b for chromite and MRZ-3a for asbestos and talc. MRZ-2b is defined as "areas containing deposits where geologic information indicates significant inferred resources are present". MRZ-3a is defined as "areas in which undiscovered mineral deposits similar to known deposits in the same producing district or region may be reasonably expected to exist (hypothetical resources). Such areas may include prospects of undetermined significance".

Metamorphics: A north-northwest trending band of metamorphosed sediments and slightly metamorphosed igneous rocks occurs east of Rattlesnake Bar, through most of the peninsula between the two arms of the lake, and all along the southern margin of the Unit. These metamorphic rocks, known as the Copper Hill Volcanics, make up the western part of a long belt of metamorphic rocks that occurs generally west of the main batholith (granitic body) of the Sierra Nevada and east of the more flat-lying sedimentary rocks of the Central Valley. The metamorphic rocks represent ancient chains of volcanic islands (island arcs) and the

associated seafloor sediments; these have since been buried, squeezed, and heated to form metasedimentary and metavolcanic (metamorphosed volcanic) rocks. The island arcs were added (accreted) to the western margin of North America during a long time period (Jurassic and Cretaceous) when a vast ocean plate was being subducted beneath the continent. Each related set of accreted rocks is known as a "terrane"; terranes are separated by faults. The Melones Fault and Bear Mountains Fault are examples of major faults that separate adjacent terranes. The metamorphic rocks exhibit nearly vertically dipping foliation in most areas, creating tombstone-like outcrops where thin soil covers the bedrock around the bases of tablet-shaped protuberances.

The age of the volcanic rocks has been measured as 160 ±5 million years (Clark, 1964; Saleeby, 1982; Day *et al*., 1985). The timing of the metamorphic deformation ranges from about 153 ±2 to 139 million years ago (Schweickert *et al*., 1984; Paterson *et al*., 1987).

Mineral resources associated with the metamorphic rocks include disseminated gold, lode gold, copper, and zinc. A small limestone body that occurs within the metamorphics is also mined; it is located on the north side of the peninsula opposite Rattlesnake Bar. Mines and small pits are found away from the lake margins. The entire metamorphic belt is designated MRZ-3a, defined as "areas in which undiscovered mineral deposits similar to known deposits in the same producing district or region may be reasonably expected to exist (hypothetical resources). Such areas may include prospects of undetermined significance".

Granodiorite intrusive rocks have slightly more iron and magnesium-bearing minerals and less quartz than granite. Crystal sizes range from less than a millimeter to several millimeters; overall, the rock is fairly coarse-grained. Two bodies of granodiorite have intruded the older metamorphic rocks along the north and west side of Folsom Lake; they are named the Rocklin and Penryn Plutons. The Penryn Pluton occurs upstream from the Rocklin Pluton, though there is some interfingering of the two rock masses near the boundary (at about Granite Bay). The Rocklin Pluton is present on both sides of Folsom Dam, extending to the upper reaches of Lake Natoma.

Dark-colored mafic dikes (containing magnesium and iron-rich minerals) occur near the edges of the granodiorite plutons. Some of the dikes consist almost completely of the mineral hornblende. Some good examples of these are found at low water along the peninsula near the contact between the Rocklin Pluton and the metamorphics. Additional rock types found in the mafic dikes include amphibolite and gabbro. Also associated with the plutons are light-colored aplite (granite with very small crystal sizes) and pegmatite dikes. These are most common at the contact between the two plutons.

Ages of the plutons and dikes are summarized in Table G-1**,** Ages of the Intrusions. An interesting point is that these small plutons are younger than the usual age of intrusions in the high Sierra; and that the typical gold-bearing quartz veins associated with other Sierran granitic intrusions do not occur in association with these plutons.

Table G-1: Ages of the Intrusions

Unit	Age	Reference
Rocklin	128 to 131 ± 3.3 my*	Wagner and others, 1981
Penryn	139.5 ± 0.2 my	Wagner and others, 1981
Other mafic intrusions (hornblende and aplite dikes)	≤128 my	Swanson, 1978
Sierra Nevada	96 to 143 my (highly variable)	Wagner and others, 1981

*my = million years

No indications of identified mineral resources associated with the granodiorite plutons are noted on the mineral resource maps of Loyd (1984) or Kohler (1984).

Volcanic mud flows and consolidated alluvial deposits occur below Folsom Dam and are best exposed along the bluffs on the northwest side of Lake Natoma and at Nimbus Dam. Two units are identified on the regional geologic map – the Miocene to Pliocene-aged Mehrten Formation and the Pliocene Laguna Formation. The bulk of the bluff on the west side of Lake Natoma exposes Merhten, a complex unit of volcanically derived sediments mixed with volcanic mudflows. Above the Merhten is the Laguna Formation, a sequence of gravel, sand, and silt derived mainly from granitic and metamorphic sources. The mode of deposition of both these units was by debris flow and stream deposits.

The mineral resource associated with the Mehrten Formation is placer gold, which occurs in the bases of ancient stream deposits. The only place within the Unit where Mehrten deposits are exposed is in the bluffs northwest of upper Lake Natoma.

Dredge deposits are man-made as a result of placer gold-mining activities. The dredge deposits cover the entire southeast side of Lake Natoma as well as a large portion of the northwest side. These deposits are mainly well-washed large gravel, cobbles, and boulders that have been washed clean of finer-grained sediment and left in large, unorganized heaps along the river banks.

The deposits themselves are their only mineral resource. The well-rounded cobbles and boulders could be mined for landscape rock.

Lithology

The geologic units are described below in stratigraphic order (oldest to youngest) in Table G-2, Stratigraphic Column. Descriptions are taken largely from Wagner *et al* (1981).

Table G-2: Stratigraphic Column

Age	Geologic Unit
Pleistocene	Riverbank–Modesto Formation
Pliocene	Laguna Formation
Pliocene Miocene	Mehrten Formation
Early Cretaceous Latest Jurassic	Rocklin Granodiorite
Early Cretaceous Latest Jurassic	Penryn Granodiorite
Jurassic	Copper Hill Volcanics
Jurassic	Salt Springs Slate
Triassic	Ultramafic rocks

Ultramafic rocks – The ultramafic rocks were originally formed as intrusive bodies of peridotite, pyroxenite, and gabbro as deep as 10 miles below the surface approximately 157 to 175 million years ago (Page, *et al*., 1982). Over time, and with tremendous tectonic forces, these rocks have been uplifted and exposed by erosion of the overlying rocks. Most of the original minerals have been altered to serpentine minerals (light- to dark-green aggregates of antigorite, chrysotile, and chlorite). Where the majority of minerals are serpentine, the rock is called serpentinite. Some occurrences of talc schist and magnesite are found locally near Flagstaff Hill. Ultramafic rock is resistant and generally forms topographic highs. Soil developed over serpentinized ultramafic rocks tends to be high in nickel and cobalt, creating toxic conditions for many plants. Consequently, a limited variety of plants are found over these rocks.

Salt Springs Slate – Minor outcrops of Salt Springs Slate are mapped on either side of the river just east of the bridge over Lake Natoma along Folsom-Auburn Road. The slate is mainly dark gray with some mica schist. Salt Springs Slate was originally shale that was metamorphosed during accretion onto the continent and subsequent deformation. Slate is resistant to erosion and breaks into thin tablets.

Copper Hill Volcanics – Copper Hill volcanic-related rocks occur all along the southern margin of Folsom Lake as well as in a small patch on either side of the river just east of the bridge over Lake Natoma along Folsom-Auburn Road. These rocks are described as metamorphosed basaltic breccia and ash (mafic pyroclastic) rocks, pillow lava, and minor bodies of granitic composition (felsic porphyrite). The origin of most of these rocks is at or near an oceanic island volcanic arc that was later added (accreted) to the continent and deformed. These rocks are generally resistant to erosion and form thin, clayey soil.

Penryn and Rocklin Granodiorite – These intrusive bodies were emplaced within the existing metamorphic belt at a relatively shallow depth (2 to 5 miles). Quartz diorite and diorite make up the primary rock types of the Penryn Pluton (Wagner *et al*., 1981). Light gray silica-rich quartz diorite makes up the Rocklin Pluton (Olmsted, 1971). Crystal sizes range from several

centimeters for some potassium feldspars to a millimeter or less. Weathering breaks down the feldspar and the hornblende of the granodiorite causing the more resistant quartz crystals and remaining feldspars to separate from the main rock and form "decomposed granite". This coarse, sandy material is easily weathered and moved by water. The areas of worst erosion in the Unit are those underlain by granodiorite.

Mehrten Formation – This complex unit is comprised of mainly volcanic conglomerate and ash-rich (tuffaceous) sandstone and siltstone derived from andesitic sources (likely the ancient Sierran volcanic mountains). Coarse stream deposits are also found within the Mehrten; some of these contain placer gold in beds with the coarsest material. The most resistant beds in the Mehrten are andesite mudflow breccias that form steep cliffs where they are exposed along the Lower American River north of Lake Natoma. The age is late Miocene to early Pliocene.

Laguna Formation – This unit consists of consolidated alluvial gravel, sand, and silt composed of granitic, metamorphic, and some volcanic detritus. It was deposited mainly as debris flows and as alluvial fan and stream deposits. Some of the sediment was derived from eroded Mehrten Formation. Some of the beds of the Laguna Formation represent flood deposits and were deposited under high energy conditions. Such beds may contain placer gold that has been reworked from older placer deposits or eroded from lode gold deposits upstream. The age is Pliocene. Land vertebrate fossils have been found in other locations along the Foothills in finer-grained deposits of the Laguna Formation.

Quaternary Modesto-Riverbank Formations – These units occur nested within the lower valley of the American River downstream of Folsom Dam. Modesto and Riverbank Formations are young and largely unconsolidated. The bulk of their sediment is derived from decomposed granite and metamorphic rock of the western Sierra. The age is Pleistocene. Where fine-grained deposits occur, land vertebrate fossils may be found.

Structure

Structures of the metamorphic belt are, in general, parallel to the main through-going faults of the Bear Mountains Fault Zone. Within the metavolcanic and metasedimentary units, contacts are nearly vertical and often lie nearly parallel to the cleavage planes. Isoclinal folds have been identified along the same trend, some miles south of the Unit. The Bear Mountains Fault Zone itself is nearly vertical, with a slight east dip.

The granodiorite plutons are fairly young and undeformed, indicating that most of the deformation associated with the metamorphic belt had ceased by the time of emplacement of the plutons. The plutons cut across the northwesterly trend of the metamorphics. Small faults and shears have been described by Olmstead (1971) in both plutons. The relative sense of displacement is strike-slip with a nearly vertical fault plane. Individually, the faults show only minor displacement, but the offsets add up over hundreds or thousands of microfaults. Also, joint sets have been measured in the plutons by Olmsted (1971).

The sedimentary Mehrten Formation lies unconformably above the Rocklin Pluton and the metamorphics. These beds dip to the west at a very low angle and do not appear to be cut by any faults.

The relationships of these units and their relative positions are depicted in Figure G-4, Cross-Section of the Area Just South of the Folsom Lake State Recreation Area.

Geologic History

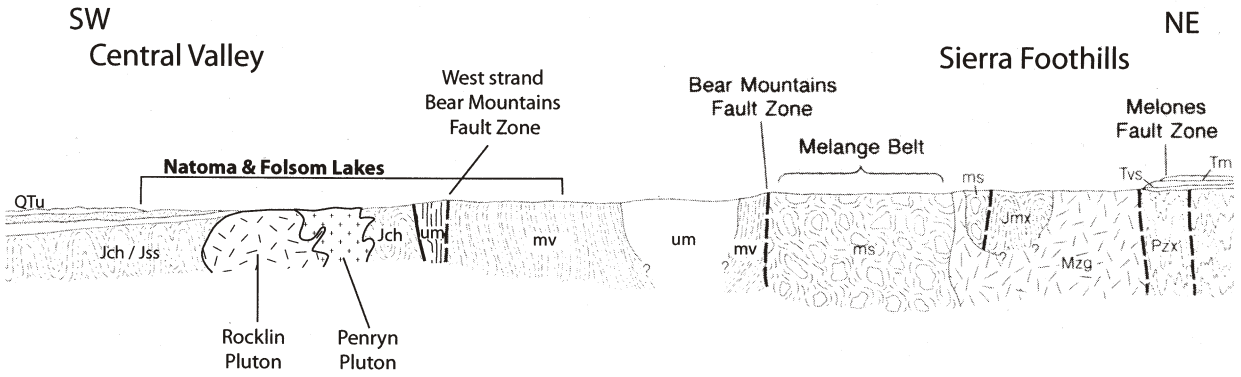
The following geologic history is based on that provided by Chapter 3 of Norris and Webb (1990).

During the Jurassic period, from about 160 to 140 million years ago, several volcanic island arcs were accreted as the ocean plate in which they were embedded was subducted beneath western North America. These rocks are interpreted to have originated as crystalline and volcanic oceanic crust, and deep ocean sediments. As they were attached to the continent, they were folded and metamorphosed. Near the end of the Jurassic or early in the Cretaceous, the subduction zone shifted west of the modern Great Valley. The magma generated by the subducting oceanic slab came up as isolated plutons in the western Sierra rather than coming up as part of the main Sierran Batholith. In the early Cretaceous, the Penryn and then the Rocklin plutons were emplaced within the western metamorphic belt. A long period of erosion wore away the volcanic peaks and metamorphic cover of the ancient Sierra Nevada, eventually exposing the granitic core beneath. By Eocene time (about 50 million years ago), the Sierra was a relatively subdued mountain range, much like the modern Coast Ranges, with a shallow sea flanking the western side where the Great Valley lies today. Deep canyons and incised river valleys carried eroded rock away from the mountains. Lode gold was exposed by the downcutting rivers, and bits of gold were washed into the streams.

By the close of Oligocene time (about 24 million years ago), the west-flowing stream valleys and ridges became buried under thick deposits of quartz-rich volcanic ash probably derived from volcanoes to the east in Nevada. Another phase of canyon-cutting and erosion took place before a second volcanic episode blanketed the landscape with basaltic and andesitic flows, breccias, and volcanic-rich mud flows (lahars) of the Mehrten Formation.

Sometime in the Pliocene, the Sierra Nevada started to rise. The most uplift probably occurred on the east side, where huge normal faults separated the massive batholith from the faulted, broken crust of the Great Basin. With uplift came the erosion of new canyons. These canyons formed generally between the old river valleys and canyons which had been filled with volcanic flows and were slightly more protected than bare rock. These rivers were the ancestors of the modern American River.

In the Pleistocene, glaciers formed in the high elevations of the Sierra Nevada. Their movement gouged and scoured the upland valleys. The meltwater rivers carried the sediment to what was by then a shallow inland bay (the Great Valley).



EXPLANATION
(Units simplified from the geologic map)

CENOZOIC

- Q — Quaternary alluvial deposits
- TQu — Undifferentiated Tertiary and Quaternary continental deposits
- Tm — Mehrten Formation
- Tg — Tertiary "Auriferous" gravels

PALEOZOIC – MESOZOIC

- Ku — Upper Cretaceous Great Valley Sequence
- Kl — Lower Cretaceous Great Valley Sequence
- Jss — Jurassic sandstone
- Mzg — Mesozoic plutonic rocks of the Sierra Nevada
- Jch — Jurassic Copper Hill metavolcanics and metasediments
- mv — Jurassic metavolcanics and metasediments
- um — ultamafic instrusive rocks, now mostly serpentinite
- ms — Sheared Mesozoic-Paleozoic rocks of Foothill melange belt

FOLSOM/LAKE/NATOMA

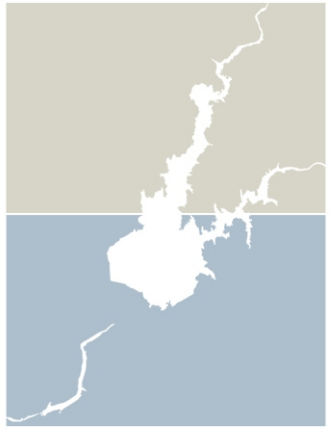


FIGURE
G-3
CROSS-SECTION OF THE AREA JUST SOUTH OF THE FOLSOM LAKE SRA

Prepared by LSA Associates, Inc.

SOURCE: MODIFIED FROM et al., 1981

N

NOT TO SCALE

Geologic Hazards, Constraints, and Sensitivities

Significant Features

Paleontological – There are no paleontological resources in the metamorphic, ultramafic, or igneous rocks. Some fossils of vertebrate land mammals have been recovered from the Laguna Formation in other areas along the western edge of the Foothills; similar fossils could be found on the north side of Lake Natoma at the outcrops of Laguna Formation. The Society of Vertebrate Paleontology has determined that such fossils are significant and important. California law protects significant fossils when found on State land.

Mineralogical – Economical mineral resources have been mined in the region in the past, and mining may become economical or feasible again in the future. Abandoned chromite mines occur on Flagstaff Mountain on the Peninsula of Folsom Lake. Abandoned or idle pit mines for talc and asbestos occur on the peninsula between the forks of the river. Placer gold occurs in the active streambeds of the American River upstream of the lake. Dredge tailings represent the past activity of dredging for placer gold; reworking of the tailings may occur in the future.

Structural and Other Features– The most interesting geologic feature of the Folsom Lake area is the contact between the younger, intruded plutons and the older, pre-existing metamorphic rocks. This boundary is well exposed near the Peninsula campground and at Rattlesnake Bar. Interpretive signs at the contact could be used to explain the relationship.

Another significant geologic and structural feature is the large exposure of ultramafic rocks on Flagstaff Mountain. Both top and bottom of this unit are fault contacts that represent the juxtaposition of rock that formed as deep as 20 miles into the crust against sediments that were deposited on the sea floor and later heated and squeezed to become the metamorphic belt.

Dredge tailings are a historical relict of the gold mining heyday of California and are well exposed in the Unit. Again, interpretive signs could tell the story of the occurrence of placer gold and the methods used to recover it.

Landslide Hazards

Factors influencing slope stability in the Unit include slope inclination, bedrock geology, geologic structure, geomorphology, weathering, vegetation, and precipitation. In studies of landslides along the Highway 50 corridor, Wagner and Spittler (1997) noted that many slides originated at the contact between metamorphic and granitic rocks. They also described landslides that occurred at the contact between Tertiary sedimentary rocks (Mehrten Formation) and the underlying metamorphic and granitic rocks. Similar conditions may be present in the Unit where the sedimentary Laguna Formation overlies metamorphic bedrock. Examples of this relationship can be found in places along the north side of Folsom Lake where granite hills are topped with Mehrten Formation (Mooney Ridge), and near the upper reaches of Lake Natoma east of the river (near Folsom) where Laguna Formation overlies metamorphics.

Wagner and Spittler (1997) described examples of landslides caused by geologic structures. When joints in the granodiorite or foliation in the metamorphics are oriented parallel to the

slope, zones of weakness tend to develop along the joints or foliation, and landslides often result. Slides often occur along roads where steep cuts have been made into rock with natural joint sets that create surfaces inclined toward the road. Specific examples of where such landslides may occur in the Unit would require site-specific studies, though it is likely that jointed and fractured rock will be encountered throughout the portion of the Unit in metamorphic rock (south and east of Folsom Lake and on the Peninsula). Prior to design of new trails or roads, the local geologic conditions should be examined to determine if the proposed cuts might trigger a landslide.

Debris flows generally form from the rapid movement of thick collections of colluvium and soil that develop in swales between ridges or hills. Further field investigation will be necessary to identify colluvium-filled swales or valleys in the Unit.

Heavy rains increase the weight of soil and colluvium by adding water. Water also reduces the amount of friction within a soil and colluvial mass, increasing the likelihood of a slide or debris flow. More shallow slides and debris flows should be expected during wet weather associated with El Niño winters.

Landslides, mudflows, and rockfalls are not considered a major hazard in the Folsom Lake portion of the Unit as most soils are too thin and slopes are too low to create conditions for mass wasting; however, the steep bluffs along the northwest side of Lake Natoma are unstable based on observations made during the Unit visit. These bluffs could spill rocks or chunks of loosely consolidated material onto the popular walking and cycling path at the base of the slope, especially after a rain storm or during groundshaking from a distant earthquake. Further studies should be performed on the Natoma bluffs to determine the best method to protect Unit users from rockfalls.

Subsidence

Land subsidence is the sudden sinking or gradual downward settling of the Earth's surface. Subsidence can be due to natural geologic processes such as cavern collapse or peat oxidation or by human activity such as mine collapse or extraction of oil, gas, or water from the subsurface. A form of subsidence called hydrocompaction can also occur when unconsolidated materials are irrigated, resulting in gradual collapse of the originally loose soil structure.

The possibility for hazard from subsidence is very low around the Unit as the conditions required for many of the subsidence processes do not exist. Local collapse of small mines around Flagstaff Mountain is unlikely as the extent of the mine shafts is limited and the surrounding rock appears to be stable (based on local field experience).

Volcanic Hazards

Volcanic hazards include ash fall and lava flows. The Unit is not in any danger of flows, but there are several dormant volcanic centers in California that could, under the right conditions, create an ash fall hazard. One example is the Clear Lake volcanic center; ages of deposits in the volcanic field range from 1.9 to 0.09 million years old (Jennings, 1994), and the geothermal gradient remains anomalously high. Clear Lake volcanism could generate an eruption that is about 80 miles upwind of the Unit. The Long Valley Caldera region

(Mammoth Lakes) could also generate an eruption with large amounts of ash, though the prevailing wind direction is more to the east and south of the study area.

The closest recent volcanic event is a lava flow mapped near Dardanelle on Highway 108, 75 miles east-southeast from the Unit. The age of the flow is 0.15 million years old (Jennings, 1994).

Seismicity

The U.S. Army Corps of Engineers (ACOE) Waterways Experiment Station conducted seismic stability analyses of all features of the Folsom project in the 1980s. Eight reports published between 1987 and 1989 indicated a seismic stability deficiency due to the liquefaction hazard at Mormon Island Auxiliary Dam. All other features of the project were declared stable considering a Maximum Earthquake (Mmax) of Magnitude 6.5, occurring at a distance of 15 kilometers on the East Branch of the Bear Mountains Fault Zone. Calculations by the ACOE estimated that the earthquake would generate 0.35 g (gravity) peak acceleration on rock outcrops, 20 centimeters/second peak velocity, and a 16-second duration of ground motion above 0.05 g. Extensive liquefaction of the dredged alluvium foundation under Mormon Island Auxiliary Dam was anticipated from this level of shaking (USACE Long Term Study, Chapter 2). This worst-case scenario earthquake for the Bear Mountains Fault Zone has a low probability of occurrence, and the State Geological Survey has not designated the Bear Mountain as an active fault. The only recorded moderate earthquake in the Foothills is the 1975 Oroville earthquake with a Richter magnitude of 5.7 (University of California at Berkeley Seismicity Catalog).

Quaternary faults that could affect the Unit include the following:

Fault name	Closest distance to fault from Folsom Dam	Maximum expected earthquake (Richter magnitude)
Bear Mountains Fault Zone	11 miles ENE	6.5
Concord Fault	67 miles WSW	6.9
Northern Hayward Fault	82 miles WSW	6.9
San Andreas Fault	102 miles WSW	7.9
Buried thrust fault near Vacaville	about 50 miles WSW	6.5

From Jennings, 1994; USGS, 1996.

While all of these faults have the potential to generate magnitude 6 to 7 earthquakes (the San Andreas could generate a magnitude as high as 7.9) (U.S.G.S., 1996), the risk of shaking at the Unit is very low due to the distance from major faults, the hard bedrock, and the thin soil cover. The California Division of Mines and Geology (CDMG) Seismic Shaking Hazard Map (1999) shows the Unit to lie within a zone labeled as having a 10 percent probability of exceeding 0 to 10 percent g (gravity) in 50 years. Another method of estimating the hazard from the overall seismicity is comparing rates. The rate of seismicity of the western Sierra

Nevada Foothills is about 3 percent of the seismicity rate of the Central Coast Region of California (Uhrhammer, 1983).

Shoreline Erosion

While the Unit is not on an oceanic coast, it does have a lake shoreline that is subject to similar erosion processes. Erosion appears to be caused mainly by wind-generated and boat-generated waves lapping along a margin with no sand armor. Changing lake water levels and wave action have effectively stripped the soil from most areas around the lake margin ranging from the high to low lake levels. The sediment is redeposited within the lake basin.

Areas undergoing greater than normal erosion are those where runoff from land is funneled into gullies and streams surrounding the lake basin. In places, runoff from paved surfaces (streets, driveways, and roofs) surrounding the lake has caused considerable erosion. The locations where this is occurring, as noted on the site reconnaissance, is around the new neighborhoods (area of homes on and around Francisco Drive off Green Valley Road and area of homes on and around Lakehills Drive off Salmon Falls Road).

Another cause of erosion is off-road vehicle activity. For example, at Rattlesnake Bar, numerous random roads expose bare ground. During rainstorms, no vegetation is present to slow the runoff and allow percolation into the soil. Instead, water rushes down the roads, carrying fine-grained soil along. Some of the roads are so heavily rutted, that off-roaders have created new roads to bypass the old ones, thereby exacerbating the problem.

Unlike oceanic coasts, there is no longshore current in the lake to naturally replenish sand on the beaches. When too much sand has been removed by wave action at popular beaches, artificial replenishment is the only way to re-sand the beaches; however, this is a costly undertaking that would probably be reserved only for popular bathing beaches.

Control of erosion within the Unit will be an ongoing effort. Gullying should be controlled through methods such as closing some areas to off road vehicles, redirecting natural drainages and street runoff into settling ponds, and installing devices or materials to slow water flow within drainages. In some areas, revegetation programs could help by stabilizing bare ground. Erosion control plans should be designed for each area identified by CDPR personnel as at risk from continued erosion.

Recommendations

The primary recommendations in this report are for further study of the bluffs over Lake Natoma, resolving erosion problems along Folsom Lake caused by off-road vehicle use, and resolving erosion problems caused by suburban storm water releases into the lake basin.

Changing economic conditions may cause some of the abandoned mines to once again become viable. If a larger portion of the Peninsula is added to the Unit (a portion that includes many old mines), the legal implications of the rights of mining claim owners should be reviewed so that CDPR staff are aware of potential legal and access issues.

Due to the constraints of the budget, no fieldwork was performed for this analysis. Thus, before any facilities are proposed, a geotechnical investigation should be performed to address the relevant issues associated with the Unit and the particular site.

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ENVIRONMENTAL CONDITIONS

SOILS

Folsom Lake State Recreation Area

April 2003

by

Geotechnical Consultants, Inc.

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SOILS

Introduction

Geotechnical Consultants, Inc. prepared this summary of the soil information for the region within and immediately around the Folsom Lake State Recreation Area (the Unit). The soil information presented here is derived from the U.S. Department of Agriculture's soil surveys of Placer and Eastern Sacramento Counties and the El Dorado Area. Geotechnical Consultants, Inc. did not conduct field exploration to examine soils.

The Unit is located along the western margin of the Sierra Foothills, 15 to 20 miles east of the City of Sacramento. The foothills are subdued in the western portion of the Unit but are steeper and more deeply incised in the eastern part, especially in the upper reaches where the North and South Forks of the American River meet Folsom Lake. The soil region occupied by the Unit (CDC, 1979) occurs at the boundary between Regions III (Sierra Nevada) and IV (Sacramento Valley).

Soil Descriptions and Interpretations

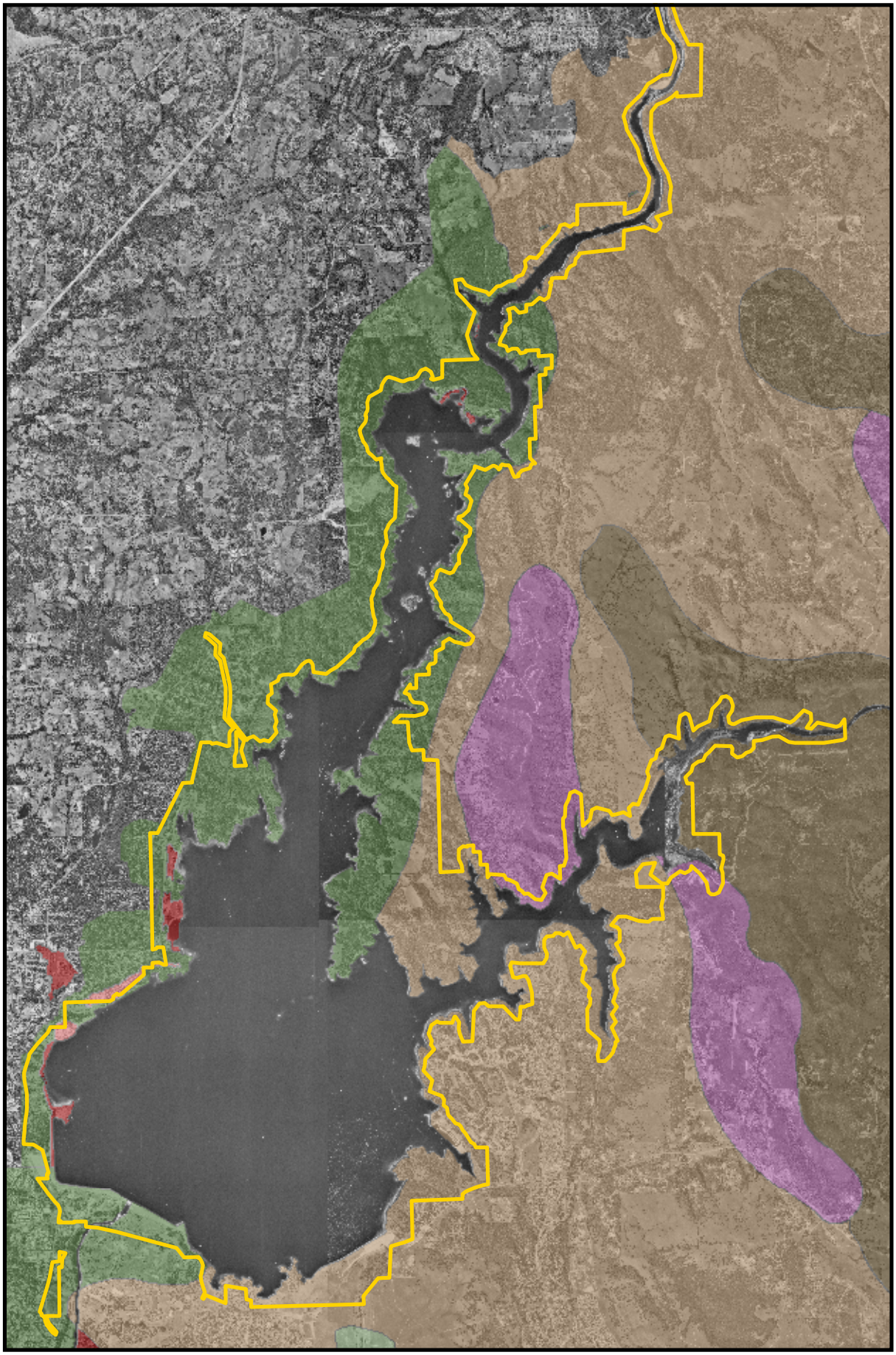
General Description

Soil surveys are generally prepared for a single county. As the study area straddles three counties, we compiled the data from three county soil surveys. Each county has a unique nomenclature with no common designations with the adjacent counties; thus, the list of soil units for the study area is long and soils that are basically identical may have different names and designations when they occur in different counties. The soils are summarized in Table S-1. Soils in the higher elevations of the Unit are mostly thin, with numerous outcroppings of igneous and metamorphic rock. The bedrock strongly controls the type of soil. For example, loose soils of decomposed granite are common on the north and west side of Folsom Lake, while clayey, denser soils are common on the south side of the Lake. Much of the area around Lake Natoma has been modified by large-scale dredging for gold, resulting in extensive deposits of dredge tailings.

A map of soils in the study area is shown in Figures S-1A and S-1B: Soils of Folsom Lake State Recreation Area.

Table S-1: Comparison Table of Soils for Three Counties in the Project Area:

El Dorado Co.	Placer Co.	Sacramento Co.	Parent rock / underlying geology
Ahwahnee	Andregg Caperton Sierra	Andregg	Crystalline granite or granodiorite bedrock
Auburn Boomer Sobrante	Auburn	No equivalent	Metavolcanic and metasedimentary bedrock
Rescue	No equivalent	No equivalent	Crystalline mafic rock (gabbro)
Serpentine rock land	No equivalent	No equivalent	Serpentinite
No equivalent	Redding	Natomas – often with Urban Land on top	Tertiary sedimentary rocks
No equivalent	Inks	No equivalent	Tertiary volcanic rocks
No equivalent	No equivalent	Xerolls (terraces of alluvium)	Quaternary terrace deposits near river
Tailings	Xerorthents	Xerorthents	Tailings from dredging



FOLSOM LAKE STATE RECREATION AREA RESOURCE INVENTORY

Unit Boundary

SOIL TYPE

- --/ INKS/--
- --/ REDDING/NATOMAS & URBAN LAND
- --/--/XEROLLS (ALLUVIAL TERRACES)
- AHWAHNEE/ ANDREGG, CAPERTON, SIERRA/ ANDREGG
- AUBURN, BOOMER, SOBRANTE/ AUBURN, SOBRANTE/--
- RESCUE/--/--
- SERPENTINE ROCK LAND/--/--
- TAILINGS/XERORTHENTS/ XERORTHENTS

FIGURE

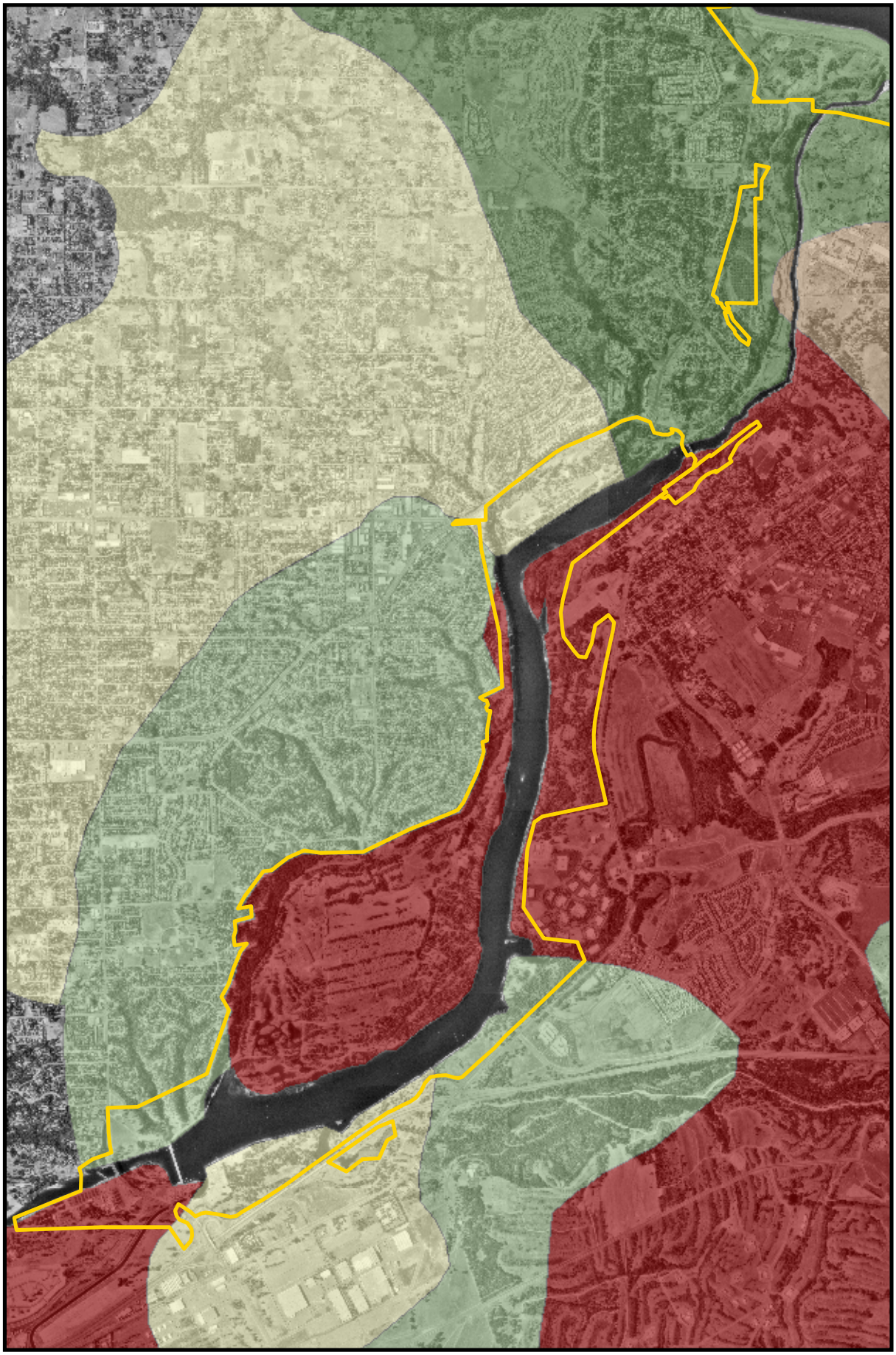
S-1a

SOIL TYPES FOLSOM LAKE

Prepared by: LSA Associates, Inc.
Source: CDPR, BOR, Geotechnical Consultants

N

0 0.45 0.9 1.8 2.7 3.6 Miles



FOLSOM LAKE STATE RECREATION AREA RESOURCE INVENTORY

Unit Boundary

SOIL TYPE

- --/ INKS/--
- --/ REDDING/NATOMAS & URBAN LAND
- --/--/XEROLLS (ALLUVIAL TERRACES)
- AHWAHNEE/ ANDREGG, CAPERTON, SIERRA/ ANDREGG
- AUBURN, BOOMER, SOBRANTE/ AUBURN, SOBRANTE/--
- RESCUE/--/--
- SERPENTINE ROCK LAND/--/--
- TAILINGS/XERORTHENTS/ XERORTHENTS

FIGURE

S-1b

SOIL TYPES LAKE NATOMA

Prepared by: LSA Associates, Inc.
Source: CDPR, BOR, Geotechnical Consultants

N

0 0.2 0.4 0.8 1.2 1.6 Miles

El Dorado County Soils

Soils of El Dorado County are described in the U.S. Department of Agriculture Soil Conservation Survey of 1974. Descriptions are presented in Appendix A – Soil Descriptions. A brief list follows, along with Table S-2: Engineering Index Properties - El Dorado County Soils, and Table S-3: Physical and Chemical Properties of Soils - El Dorado County**,** that show soil characteristics. Some of the soil characteristics requested in the scope can not be presented because they represent *in situ* conditions that are time- and location-specific; these include wetness, porosity, and density. Wetness is highly variable, depending on location and time of year. Porosity is also highly variable and is better characterized through Capacity. Limited data were available for some of the other requested characteristics. The tables are as complete as the available literature allows.

The term "loam" is frequently used in the Soil Conservation surveys. Loam is defined as a combination of clay, silt, and sand with some organic material. This broad definition is not compatible with usage of the Unified Soil Classification System, and in recent years, use of this term has been avoided by geotechnical workers because of its inexactness. Nevertheless, the soil surveys have used the term extensively, and rather than reinterpret all the soil descriptions, the wording has been left as it is used in the published soil surveys.

<u>Auburn-Argonaut association</u>

AxD Auburn very rocky silt loam, 2-30% slopes

AwD Auburn silt loam, 2-30% slopes

AxE Auburn very rocky silt loam, 30-50% slopes

<u>Auberry-Ahwahnee-Sierra association</u>

AcC Ahwahnee coarse sandy loam, 9-15% slopes

AdD Ahwahnee very rocky coarse sandy loam, 9-30% slopes

AdE Ahwahnee very rocky coarse sandy loam, 30-50% slopes

AyF Auburn extremely rocky silt loam, 3-70% slopes

<u>Boomer-Argonaut association</u>

BkE Boomer very rocky loam, 3-51% slopes

BhD Boomer very rocky loam, 0-3% slopes

<u>Serpentine rock land-Delpiedra association</u>

SaF Serpentine rock land

Soils not in an association

SuC Sobrante silt loam, 3-15% slopes

TaD Tailings

Table S-2: Engineering Index Properties – El Dorado County Soil Types

Soil Name	Depth from Surface (in)	Texture Parent Rock	Unified Soil Classification System	Percent Passing			
				Sieve Number 4	*Sieve Number* 10	*Sieve Number* 40	*Sieve Number* 200
Ahwahnee soils: AcC, AdD, AdE	0-8	Coarse sandy loam	SM	100	85-100	40-50	20-30
	8-26	Heavy coarse sandy loam	SM	100	85-100	50-60	25-35
	26	Weathered granodiorite bedrock	--*	--	--	--	--
Auburn soils: AxD, AwD, AxE, AyF	0-14	Silt loam	ML or CL	90-100	85-95	75-80	70-80
	14	Metavolcanic and schist bedrock	--	--	--	--	--
Boomer soils: BhD, BkE, BkF	0-13	Gravelly loam	SM	80-90	70-80	50-70	40-50
	13-52	Gravelly clay loam, gravelly sandy clay loam	SC	65-90	50-85	25-35	35-50
	52	Mafic schist bedrock	--	--	--	--	--
Rescue soil: RgE2	0-10	Sandy loam from gabbrodiorite	SM or SC	100	90-100	65-75	40-50
Serpentine rock land: SaF		Serpentine bedrock	--	--	--	--	--
Sobrante soils: SuC	0-11	Silt loam	M or CL	100	95-100	80-90	70-80
	11-24	Clay loam	CL	95-100	90-95	80-90	70-80
	24	Mafic schist bedrock	--	--	--	--	--
Tailings: TaD	0	River cobbles	--	--	--	--	--

U.S.D.A. Soil Conservation Service, 1974, Soil Survey of El Dorado Area, California.

* The symbol "–" indicates no data were reported for this soil type.

Table S-3: Physical and Chemical Properties of Soil Types – El Dorado County

Soil Name	**Depth to bedrock** (ft)	**Depth from surface** (inches)	**Permeability** (In/hr)	**Available water capacity** (IN/in)	**Salinity** (Mmhos/cm)	**Mineral Content**	**pH**	**Shrink-Swell Potential**	**Erodibility** (K)	**Fertility** (T)	**Clay Content** (%)
Ahwahnee soils: AcC, AdD, AdE	2.0-3.5	0-8	2.0-6.3	0.11-0.13	--	--	6.1-7.3	Low	--	--	<50
		8-26	2.0-6.3	0.13-0.15	--	--	6.1-6.5	Low	--	--	>50
Auburn soils: AxD, AwD, AxE, AyF	1.0-2.0	0-14	0.63 – 2.00	0.16-0.20	--	--	6.1-7.3	Low	--	--	--
Boomer soils: BhD, BkE, BkF	2.0-4.5	0-13	0.63-2.00	0.15-0.17	--	--	5.6-6.5	Low	--	--	>50
		13-52	0.20-0.62	0.15-0.17	--	--	5.6-6.5	Moderate	--	--	>50
Rescue soil: RgE2	0-10	0-10	0.62-2.00	0.12-0.14	--	--	5.6-6.5	Low	--	--	>50
Serpentine rock land: SaF	--		properties too variable to be estimated	--	--	High in nickel and chromium	--	--	--	--	--
Sobrante soils: SuC	2.0-3.0	0-11	0.63-2.00	0.18-0.20	--	--	5.6-6.5	Low			
		11-24	0.63-2.00	0.18-0.20	--	--	6.1-6.5	Moderate		Low	--
Tailings: TaD	--	--	properties too variable to be estimated	--	--	--	--	Low	--		

USDA Soil Conservation Service, 1974, Soil Survey of El Dorado Area, California.
* The symbol "–" indicates no data were reported for this soil type

Placer County Soils

Soils of western Placer County are described in the U.S. Department of Agriculture Soil Conservation Survey of 1980. These descriptions are presented in Appendix A – Soil descriptions. A brief listing follows, along with Table S-4: Engineering Index Properties – Placer County Soils and Table S-5: Physical and Chemical Properties of Soil Types – Placer County, showing soil characteristics. Some of the soil characteristics requested in the scope can not be presented because they represent *in situ* conditions that are time- and location-specific; these include wetness, porosity, and density. Wetness is highly variable, depending on location and time of year. Porosity is also highly variable and is better characterized through Capacity. Limited data were available for some of the other requested characteristics. The tables are as complete as the available literature allows.

106 Andregg coarse sandy loam, 2-9% slopes

107 Andregg coarse sandy loam, 9-15%slpoes

108 Andregg coarse sandy loam, 15-30% slopes

109 Andregg coarse sandy loam, rocky, 2-15% slopes

110 Andregg coarse sandy loam, rocky. 15-30% slopes

111 Andregg coarse sandy loam, rocky, 30-50% slopes

112 Andregg-Rock outcrop complex, 5-30% slopes

113 Andregg-Shenandoah complex, 2-15% slopes

120 Auburn-Sobrante-rock outcrop complex, 30-15% slopes

133 Caperton-Rock outcrop complex, 30-50 slopes

152 Inks cobbly loam, 2-30% slopes

176 Redding and Corning gravelly loam, 2-9%slopes

177 Redding and Corning gravelly loams, 9-18% slopes

185 Sierra Sandy loam, 15-30% slopes

196 Xerorthents, cut and fill areas

197 Xerothents, placer areas

The term Xerorthents refers to man-modified material, either soils rearranged in a cut and fill or as tailings heaps.

Table S-4: Engineering Index Properties - Placer County Soils

Soil Name	Depth (inches)	Texture / bedrock type	Classification Unified System	Percent Passing			
				Sieve Number 4	*Sieve Number* 10	*Sieve Number* 40	*Sieve Number* 200
Andregg soils: 106, 107, 108, 109 ,110, 111, 112, 113*	0-29	Coarse sandy loam	SM	95-100	85-95	50-60	25-45
	29	Weathered granodiorite					
Auburn soil: 120	0-20	Silt loam	ML	95-100	75-95	70-85	20-40
	20	Unweathered bedrock	---	---	---	---	---
Caperton soil: 133	0-18	Gravelly coarse sandy loam	SM	95-100	65-75	45-65	20-30
	18	Weathered granite	---	---	---	---	---
Inks soil: (rubble land) 152	0-5	Cobbly loam	GM, SM, GM-GC, SM-SC	60-80	55-75	40-65	25-50
	5-18	Very cobbly clay loam.	GC to SC	55-75	50-75	45-70	35-50
	18	Unweathered andesitic conglomerate	---	---	---	---	---
Redding soils: 176, 177	0-14	Gravelly loam	SC, SM-SC, GC, GM-GC,	65-90	60-75	55-70	35-50
	14-28	Clay, clay loam	CH, CL	80-95	75-90	70-90	60-75
	28	Indurated sediment or hardpan	---	---	---	---	---
Sierra soil: 185	0-23	Sandy Loam	SM	95-100	90-100	60-75	35-50
	23-41	Loam, clay loam, sandy clay loam	CL, SC	95-100	95-100	65-80	35-70
	41	Weathered granite	---	---	---	---	---
Xerorthents: 196, 197	0-60	Variable – cut and fill material	---	---	---	---	---

* indicates rock outcrop within soil unit.

The symbol "---" indicates no data were reported for this soil type.

Source: USDA Soil Conservation Service, 1980, Soil Survey of Placer County, Western Part, California.

Table S-5: Physical and Chemical Properties of Soils - Placer County

Soil Name	**Depth** (inches)	**Permeability** (inches/hr)	**Available water capacity** (inches/inch)	**Salinity** (Mmhos/ cm)	**Mineral Content**	**pH**	**Shrink-Swell potential**	**Erodibility** (K)	**Fertility** (T)	**Clay Content** (%)
Andregg soils: 106, 107, 108, 109, 110, 112, 113*	0-29	20-6.0	0.10-01.3	--	--	5.6-7.3	Low	0.24	2	<40
Auburn soil: 120	0-20	0.6-2.0	0.14-0.17	--	--	5.6-6.5	Low	0.32	1	approx 50
Caperton soil: 133	0-18	2.0-6.0	0.08-0.11	--	--	5.6-6.5	Low	0.20	1	<40
Inks soil: (rubble land) 152	0-5	0.6-2.0	0.07-0.12	--	--	5.6-6.5	Low	0.20	1	approx 50
	5-18	0.6-2.0	0.08-0.12	--	--	5.6-6.5	Low	0.24	--	>50
Redding soils: 176, 177	0-14	0.6-2.0	0.10-0.14	--	--	5.1-6.0	Low	0.20	2	>50
	14-28	<0.06	0.04-0.04	--	--	4.5-6.0	Moderate	0.28	--	>50
Sierra soil: 185	0-23	0.6-2.0	0.10-0.12	--	--	5.6-7.3	Low	0.28	3	<50
	23-41	0.2-0.6	0.15-0.18	--	--	5.6-6.5	Moderate	0.32	--	approx 50
Xerorthents: 196, 197	0-60	--	--	--	--	--	--	--	--	

* indicates rock outcrop within soil unit.

The symbol "–" indicates no data were reported for this soil type.

Source: USDA Soil Conservation Service, 1980, Soil Survey of Placer County, Western Part, California.

Sacramento County Soils

Soils of Sacramento County are described in the U.S. Department of Agriculture Soil Conservation Survey of 1993. These descriptions are presented in Appendix A – Soil Descriptions. A brief listing follows, along with Table S-6: Engineering Index Properties - Sacramento County Soils and Table S-7: Physical and Chemical Properties of Soils - Sacramento County showing soil characteristics. Some of the soil characteristics requested in the scope can not be presented because they represent *in situ* conditions that are time- and location-specific; these include wetness, porosity, and density. Wetness is highly variable, depending on location and time of year. Porosity is also highly variable and is better characterized through Capacity. Limited data were available for some of the other requested characteristics. The tables are as complete as the available literature allows.

103 Andregg coarse sandy loam, 2 to 8 % slopes

104 Andregg coarse sand loam, 8 to 15 % slopes

105 Andregg-Urban land complex, 8 to 15 % slopes

136 Dumps

181 Natoma loam, 0 to 2 % slopes

182 Natoma –Xerorthents, dredge tailings complex 0 to 50%slpoes

227 Urban land

228 Urban land- Natoma complex, 0-2% slopes

243 Xerolls, 30-70% slopes

245 Xerorthents, dredge tailings, 2-50% slopes

246 Xerorthents, dredge tailings-Urban land complex, 0-2% slopes

Table S-6: Engineering Index Properties - Sacramento County Soils

Soil Name	Depth (in)	Texture Parent Rock	Unified Soil Classification System	Percent Passing			
				Sieve Number 4	*Sieve Number* 10	*Sieve Number* 40	*Sieve Number* 200
Andregg soils: 103, 104, 105	0-11	Coarse sandy loam	SM	95-100	85-100	50-60	25-45
	11-32	Coarse sandy loam, sandy loam	SM	95-100	85-100	50-60	25-40
	32	Weathered bedrock	–	–	–	–	–
Dumps soil: 136	–	–	–	–	–	–	–
Natomas soils: 181, 182	0-17	Loam	Cl, Cl-Ml	100	95-100	80-90	50-65
	17-33	Loam , clay loam	CL	100	95-100	80-90	50-65
	33-78	Clay loam	CL	100	95-100	80-90	50-65
	78-84	Stratified gravelly coarse sandy loam to sandy loam	SM-SC	65-100	60-100	45-70	25-50
Urban land: 227-228	–	–	–	–	–	–	–
Xerolls: 243, 246	–	–	–	–	–	–	–
Xerorthents: 245	–	–	–	–	–	–	–

The symbol "–" indicates no data were reported for this soil type.

Source: U.S.D.A. Soil Conservation Service, 1993, Soil Survey of Sacramento County, California.

Table S-7: Physical and Chemical Properties of Soils - Sacramento County

Soil Name	Depth (in)	Permeability (In/hr)	Available water capacity (IN/in)	Salinity (Mmhos/ cm)	Mineral Content	pH	Shrink-Swell potential	Erodibility (K)	Fertility (T)	Clay Content (%)
Andreg soils: 103, 104, 105	0-11	2.0-6.0	0.10-0.13	--	--	5.6-7.3	Low	2	8	7-18
	11-32	2.0-6.0	0.10-0.13	--	--	5.6-7.3	Low	--	--	10-18
Dumps: 136	--	--	--	--	--	--	--	--	--	--
Natomas soils: 181, 182	0-17	0.6-2.0	0.14-0.17	--	--	6.7-7.3	Low	5	8	15-25
	17-33	0.6-2.0	0.15-0.18	--	--	5.6-7.3	Low	--	--	20-30
	33-78	0.2-0.6	0.17-0.19	--	--	5.1-6.5	Moderate	--	--	27-35
	78-84	0.6-2.0	0.10-0.12	--	--	6.1-7.3	Low	--	--	15-20
Urban land: 227-228	--	--	--	--	--	--	--	--	--	--
Xerolls: 243, 246	--	--	--	--	--	--	--	--	--	--
Xerorthents: 245	--	--	--	--	--	--	--	--	--	--

The symbol "–" indicates no data were reported for this soil type.

Source: U.S.D.A. Soil Conservation Service, 1993, Soil Survey of Sacramento County, California.

Recommendations

In this subsection, specific areas of concern have been described and brief recommendations have been provided. As with any specific project, a site-specific geotechnical and soil survey should be conducted prior to foundation design and design of other surface and subsurface facilities.

Shrink-swell soils: In general, all soils in the Unit have low shrink-swell potential of the surface layer. Moderate shrink-swell potential was identified in Redding soil in the 1-2 foot depth, in Sierra soil in the 2-3 foot depth, in Natomas soil in the 3 to 6 foot depth, and in the Boomer and Sobrante soils at 1 to 4 foot depth. If developments are planned in those areas where moderate shrink-swell potential has been identified approximately 1 to 3 feet below the surface, the geotechnical characteristics of the soil should be described through field and laboratory tests prior to foundation design.

Coarse soils over granite: Most of the northern and northwestern margin of Folsom Lake is underlain by granite. The soils developed over granite bedrock (Ahwahnee, Andregg, Caperton and Sierra) are extremely coarse and sandy and drain rapidly; consequently, granitic soils are highly erodible. Evidence of excessive erosion was observed at numerous places along the north shore; most of it appears to have been worsened by off-road vehicle users as well as by use of unpaved trails. Another problem associated with granitic soils is excessive drainage. Leach fields should not be constructed in this soil type, because leachate will travel rapidly through the soil and emerge at the surface downslope.

Serpentine rock and soil: Serpentine soil forms over serpentine bedrock, the bulk of which lies in a north-south swath through the Peninsula (between the North and South Forks at Flagstaff Hill) and south of the South Fork of the American River at Iron Mountain. Serpentine soils (Serpentine rock land in El Dorado Co.) are high in nickel, chromium, and manganese that limit the varieties of plants that can grow in it. Serpentine soil is generally unsuitable for construction of leach fields due to the corrosive qualities of the soil.

Dredge tailings: Adjacent to Lake Natoma, dredge tailings ('Tailings' in El Dorado Co., Xerorthents in Placer and Sacramento Counties) are generally composed of small to large cobbles to small boulders of smooth rock occurring in a hummocky or lumpy pattern. Water washes through these cobbles so quickly, that any fine-grained material is soon washed away, leaving the tailings piles largely unvegetated. Some of these tailings piles could be removed through quarrying operations that mine the cobbles for landscaping rock. This process would flatten out the topography, reduce the thickness of cobble accumulation, and eventually allow revegetation of the native soil when they have been uncovered.

Groundwater: Areas of thin soil over bedrock will have limited permeability. This characteristic must be factored in when designing facilities on bedrock. Thin soils are likely to occur in the uplands or steeply sloping portions of the Unit along the margins of Folsom Lake. The soil types would include Ahwahnee, Andregg, Caperton and Sierra soils; Auburn Boomer and Sobrante soils; and Rescue and Serpentine rock land soils.

References

California Department of Conservation (C.D.C.), 1979, California Soils: An Assessment, Draft Report by the Soil Resources Protection Unit.

U.S.D.A. Soil Conservation Service, 1974, Soil Survey of El Dorado Area, California.

U.S.D.A. Soil Conservation Service, 1980, Soil Survey of Placer County, Western Part, California.

U.S.D.A. Soil Conservation Service, 1993, Soil Survey of Sacramento County, California.

Appendix

Soil Descriptions and Interpretations

The Folsom Lake–Lake Natoma Region lies within the Lower and Middle Foothills. Soils developed in this setting are generally well-drained silty, sandy and gravelly mixtures developed over either granitic or metamorphic bedrock. An exception is in the area of exposures of serpentine rock where a specialized soil type forms.

The following soil series descriptions and interpretations are taken directly from the published Soil Conservation Service reports for El Dorado, Placer, and Sacramento Counties.

El Dorado County

Ahwahnee Series.

The Ahwahnee series consists of well-drained soils that are underlain by weathered granitic rocks at a depth of 24 to 40 inches. These are rolling to steep soils on foothills. Slopes are 9 to 50 percent. Elevations range from 500 feet to 2,500 feet. The average annual rainfall is 25 to 35 inches, average annual temperature is 60 ° F and the frost-free season is 170 to 270 days. Vegetation is mainly annual grasses, forbs, and oaks; and there are scattered Digger (Gray) and Ponderosa Pines. Ahwahnee soils are associated principally with Auberry, Sierra, and Auburn soils.

In a representative profile, the surface layer is very dark gray and grayish-brown, neutral and slightly acid, sandy loam and coarse sandy loam about 8 inches thick. The subsoil is pale brown and light yellowish brown, slightly acid, heavy coarse sandy loam. Weathered granodiorite occurs at a depth of about 26 inches. Ahwahnee soils are used for annual range.

Ahwahnee coarse sandy loam, 9 to 15 percent slopes (AcC). This soil is strongly sloping. Exposed bedrock occupies less than 5 percent of the surface. A representative profile is located 7 miles southwest of Pilot Hill, 0.1-mile east of the high-water mark on Folsom Reservoir, 0.1-mile southwest of the northeast corner of Section 8, Township 10 North, Range 8 East:

A11 0 to 2 ½ inches from surface, very dark gray (N3/0)1, sandy loam, black (N 2/0) when moist; massive; soft, friable, nonsticky and nonplastic; many very fine roots; many very fine tubular and interstitial pores; neutral; clear, smooth boundary.

A12 2 ½ to 8 inches from surface, grayish-brown (10YR 5/2), coarse sandy loam, dark brown (10YR 3/3) when moist; massive; soft, friable, nonsticky and nonplastic; common very fine and fine roots; common very fine tubular pores; slightly acid; clear, smooth boundary.

1 Letters and numbers within parentheses refer to colors as defined in the Munsel Color System for Soil.

B1 8 to 18 inches from surface, pale-brown (10YR 6/3), heavy coarse sandy loam, dark yellowish brown (10YR 4/4) when moist; massive; hard, friable, slightly sticky and nonplastic; common fine and medium roots; common very fine tubular and interstitial pores and few fine tubular pores; slightly acid; clear, smooth boundary.

B2t 18 to 26 inches from surface, light yellowish-brown (10YR 6/4), heavy coarse sandy loam, brown (7.5YR 4/4), when moist; massive; very hard, friable, slightly sticky and nonplastic; few fine and medium roots; common very fine tubular and interstitial pores; few thin clay films in pores and as bridges; slightly acid; abrupt, irregular boundary

C 26 inches from surface, weathered granodiorite that has many thin clay films in pores and as bridges.

Total thickness of the A horizon is about 6 to 10 inches. Depth to rock is 24 to 40 inches. Included in mapping are small areas of Auberry coarse sandy loam, Sierra sandy loam, Auburn very rocky silt loam, and a soil that is similar to this Ahwahnee soil but has a paler surface layer. Permeability of this Ahwahnee soil is moderately rapid. Surface runoff is medium, and the erosion hazard is moderate to high. The available water-holding capacity is 3.5 to 5 inches. The effective rooting depth is 24 to 40 inches. This soil is used for range. Capability Unit IV3-1(18); Range Site 3; Woodland Suitability Group not assigned.

Ahwahnee very rocky, coarse sandy loam, 9 to 30 percent slopes (AdD). In areas of this soil, rock outcrops occupy 5 to 25 percent of the surface. Included in mapping are small areas of Auberry very rocky coarse sandy loam, Auburn very rocky silt loam, Chawanakee very rocky coarse sandy loam, Chaix very rocky coarse sandy loam, and Sierra very rocky sandy loam. Surface runoff is medium to rapid, and the erosion hazard is high. This soil is used for range. Capability Unit VIs-1(18); Range Site 3; Woodland Suitability Group not assigned.

Ahwahnee very rocky, coarse sandy loam, 30 to 50 percent slopes (AdE). In areas of this soil, rock outcrops make up 5 to 25 percent of the surface. Included in mapping are small areas of Auberry very rocky coarse sandy loam, Auburn very rocky silt loam, Chawanakee very rocky coarse sandy loam, Chaix very rocky coarse sandy loam, and Sierra very rocky sandy loam. Surface runoff is rapid, and the erosion hazard is very high. This soil is used for range and watershed. Capability Unit VIIs-1(18); Range Site 3; Woodland Suitability Group not assigned.

Auburn Series.

The Auburn series consists of well-drained soils that are underlain by hard metamorphic rocks at a depth of 12 to 26 inches. These soils are present on undulating to very steep foothills. Slopes are 2 to 70 percent. Elevations range from 500 feet to 1,800 feet. The average annual rainfall is 25 to 35 inches, average annual temperature is 60 ° F and the frost-free season is 170 to 270 days. Vegetation is mainly annual grasses, forbs, and oaks, and there are scattered areas of Digger (Gray) pine and brush. Auburn soils are associated principally with Argonaut, Boomer, Sobrante, and Whiterock soils. In a representative profile, the surface layer is brown, slightly acid silt loam. Weathered metabasic rock is at a depth of about 14 inches. Auburn soils are used mainly for range. A few small areas are used for irrigated pasture.

Auburn very rocky silt loam, 2 to 30 percent slopes (AxD). This soil is gently sloping to moderately steep. Outcrops of bedrock cover 5 to 25 percent of the surface. A representative profile is located 5 miles west of Shingle Springs, 2,000 feet west and 1,200 feet south of the northeast corner of Section 7, Township 9 North, Range 9 East:

A1 0 to 3 inches from surface, brown (7.5YR 5/4) silt loam, dark reddish brown (5YR 3/3) when moist; massive; slightly hard, friable, nonsticky and nonplastic; many very fine roots; many very fine and fine pores; slightly acid; clear, wavy boundary.

B2 3 to 14 inches from surface, reddish-yellow (5YR 6/8) silt loam, dark reddish brown (5YR 6/8) when moist; massive; hard, friable, slightly sticky and slightly plastic; many very fine and fine roots; many very fine and fine pores; slightly acid; abrupt, wavy boundary.

R 14 inches from surface, weathered metabasic rock.

Depth to bedrock ranges from 12 to 26 inches. As much as 25 percent of the soil mass consists of gravel- and cobblestone-sized rock fragments. The color of the A horizon ranges from reddish brown or brown to yellowish red. The texture is loam or silt loam. The total thickness of the A horizon is 3 to 10 inches. There is a slight increase in clay content in the B horizon. Reaction is slightly acid or neutral. Included in mapping are small areas of Argonaut very rocky loam, Boomer very rocky loam, and Sobrante very rocky silt loam. In the Folsom Reservoir area, there is a soil similar to this Auburn soil that has a darker colored surface layer and formed on mica schist. Permeability of this Auburn soil is moderate. Surface runoff is slow to medium, and the erosion hazard is slight to moderate. The available water-holding capacity is 2 to 4 inches. The effective rooting depth is 12 to 26 inches. This soil is used for range. A few small areas are used as irrigated pasture. Capability Unit VIs-1(18); Range Site 1; Woodland Suitability Group not assigned.

Auburn silt loam, 2 to 30 percent slopes (AwD). This soil has slopes that are dominantly between 5 and 15 percent. It is similar to Auburn very rocky silt loam, 2 to 30 percent slopes except that less than 5 percent of the surface is exposed bedrock. Included in mapping are small areas of Argonaut gravelly loam; Perkins gravelly loam, moderately deep variant; and Sobrante silt loam.This soil is used for range, irrigated pasture, and some dryland hay and grain. Capability Unit IVe-8(18); Range Site 1; Woodland Suitability Group not assigned.

Auburn very rocky silt loam, 30 to 50 percent slopes (AxE). This soil is steep in the more prominent foothills and slopes that drop into creek channels and drainageways. Included in mapping are small areas of Boomer very rocky loam. In the Folsom Reservoir area, there is a soil similar to this Auburn soil that has a darker surface layer and formed from mica schist. Surface runoff is medium to rapid, and the erosion hazard is moderate to high. This soil is used for range. Capability Unit VIIs-1(18); Range Site 1; Woodland Suitability Group not assigned.

Auburn extremely rocky silt loam, 3 to 70 percent slopes (AyF). This soil has slopes that dominantly range from 15 to 50 percent. It is similar to Auburn very rocky silt loam, 2 to 30 percent slopes, except that 20 to 50 percent of the surface has rock outcrops and the depth to bedrock ranges from 12 to 20 inches. Included in mapping are small areas of Metamorphic rock land.

The available water-holding capacity of this Auburn soil is 2 to 4 inches. Surface runoff is slow to very rapid, and the erosion hazard is slight to very high. The effective rooting depth is 12 to 20 inches.This soil is used for range. Capability Unit VIIs-1(18); Range Site 1; Woodland Suitability Group not assigned.

Boomer Series.

The Boomer series consists of well-drained soils that are underlain by basic2 schists at a depth of 24 to 52 inches. These soils are undulating to very steep on uplands. Slopes are 3 to 70 percent. Elevations are 1,000 to 3,500 feet. The average annual precipitation is 35 to 50 inches, average annual temperature is 57° F and the frost-free season is 170 to 270 days. Vegetation is mainly coniferous forest and annual grasses. Boomer soils are associated principally with Auburn and Sites soils. In a representative profile, the surface layer is yellowish red, medium acid gravelly loam about 13 inches thick. The subsoil is red, medium acid, gravelly clay loam to very gravelly sandy clay loam about 39 inches thick. This is underlain by basic schist at a depth of about 52 inches. Boomer soils are used for woodland and range.

Boomer very rocky loam, 30 to 50 percent slopes (BkE). This soil is the transition zone between areas of grass and oak trees and coniferous forest. Rock outcrops cover 5 to 25 percent of the surface. A representative profile is located, 6 miles northwest of Coloma and 0.25 miles east of the west quarter corner of section 33, Township 12 North, R. 9 East:

O1&O2 1 inch to 0 from surface, pine needles and decomposing litter.

A1 0 to 5 inches from surface, yellowish red (5YR 5/6) gravelly loam, dark reddish brown (5YR ¾) when moist; moderate, medium and fine, granular structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine roots and common fine roots; many very fine tubular pores; medium acid; clear, smooth boundary.

A3 5 to 13 inches from surface, yellowish red (5YR 5/6) gravelly loam, dark reddish brown (5YR ¾) when moist; moderate, medium subangular blocky structure and weak, medium and fine, granular structure; slightly hard, friable, sticky and plastic; many very fine and fine roots and common medium roots; many very fine and fine tubular and interstitial pores and few medium tubular pores; few thin clay films in pores; medium acid; clear, smooth boundary.

B21t 13 to 24 inches from surface, red (2.5YR 4/6) gravelly clay loam, dark red (2.5YR 3/6) when moist; moderate, medium and fine, subangular blocky structure; slightly hard, friable, sticky and plastic; common very fine, fine, medium, and coarse roots; many very fine tubular and interstitial pores and a few fine tubular pores; many thin clay films in pores; medium acid; clear, smooth boundary.

B22t 24 to 37 inches from surface, red (2.5YR 4/8) gravelly sandy clay loam, dark red (2.5YR 3/6) and yellowish red (5YR 4/6) when moist; moderate, medium and fine, subangular blocky structure; hard, firm, sticky and plastic; few fine, medium, and

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2 Basic refers to the relatively low silica content of a rock. A basic schist would have between 44 and 52% quartz , while normal (or Felsic) schists have over 52% quartz.

coarse roots; many very fine tubular and interstitial pores and few fine tubular pores; many thin clay films in pores; medium acid; gradual, smooth boundary.

B31t 37 to 52 inches from surface, red (2.5YR 4/6) very gravelly sandy clay loam, red (2.5YR 4/6 and yellowish red (5YR 4/6) when moist; massive; hard, firm, sticky and plastic; very few fine, medium, and coarse roots; few fine pores; many thin clay films as bridges and coating gravel; medium acid; clear, slightly wavy boundary.

R 52 inches from surface, well-fractured schist that has dark-red (2.5YR 3/6) sandy clay loam in cracks, variable dark red (2.5YR 3/6, yellowish red (5YR 4/6), and strong brown (7.5YR 5/6) when moist; firm, sticky and slightly plastic; many thin clay films as bridges and coats on gravel; medium acid.

As much as 35 percent of the soil mass consists of gravel- and cobblestone-sized rock fragments. The A horizon is 10 to 15 inches thick and is brown to yellowish red in color. The B horizon is reddish brown to red and is medium acid or slightly acid. Depth to rock is 24 to 52 inches. Included in mapping are small areas of Auburn silt loam and Sites loam. Permeability of this Boomer soil is moderately slow. Surface runoff is rapid, and the erosion hazard is high. The available water-holding capacity is 4 to 7 inches. The effective rooting depth is 24 to 52 inches. This soil is used for range and woodland. Capability Unit VIs-1(22); Range Site 2; Woodland Suitability Group 4.

Boomer very rocky loam, 3 to 30 percent slopes (BkD). This soil is similar to Boomer very rocky loam, 30 to 50 percent slopes (BkE), except that it is less sloping. Included in mapping are small areas of Auburn very rocky silt loam, Argonaut very rocky loam, Sites very rocky loam, and Sobrante very rocky silt loam. Surface runoff is medium, and the erosion hazard is slight to moderate.This soil is used for range, irrigated or dryland pasture, and woodland. Capability Unit VIs-1(22); Range Site 2; Woodland Suitability Group 4.

Boomer very rocky loam, 50 to 70 percent slopes (BkF). This soil is adjacent to the major drainageways, and depth to the parent rock ranges from 24 to 40 inches. Included in mapping are small areas of Auburn very rocky silt loam, Sites very rocky loam, and metamorphic rock land. Surface runoff is rapid, and the erosion hazard is high. The available water-holding capacity is 4 to 6 inches for the 24- to 40-inch rooting depth.This soil is used for woodland, range, and watershed. Capability Unit VIIs-1(22); Range Site 2; Woodland Suitability Group 6.

Sobrante Series.

The Sobrante series consists of well-drained soils that are underlain by fine-grained metamorphic rocks at a depth of 22 to 36 inches. These soils are undulating to hilly and are in the foothills. Slopes are 3 to 30 percent. Elevations range from 800 to 1,800 feet. The average annual temperature is 60° F average annual rainfall is 25 to 35 inches, and the frost-free season is 170 to 270 days. Vegetation is chiefly annual grasses and forbs, and there are scattered oaks. Sobrante soils are associated principally with Auburn, Argonaut, and Boomer soils. In a representative profile, the surface layer is reddish brown, medium acid silt loam about 5 inches thick. The subsoil is yellowish red, slightly acid silt loam and light clay loam about 19 inches thick. The substratum is well-weathered basic schist about 6 inches thick. Bedrock is at a depth of 30 inches. The Sobrante soils are used mainly for range. A few small areas are used for irrigated pasture and deciduous orchards.

Sobrante silt loam, 3 to 15 percent slopes (SuC) This soil is gently sloping to strongly sloping. Representative profile, 2 ½ miles south of Shingle Springs, 200 feet west of French Creek Road, and 200 feet south of the north quarter corner of sec. 19, T. 9 N., R. 10 E.:

A1 0 to 5 inches from the surface, reddish brown (5YR 5/4) silt loam, dark reddish brown (5YR 3/4) when moist; massive; slightly hard and hard, friable, slightly sticky and slightly plastic; many micro and very fine roots; common very fine, fine, and medium tubular and interstitial pores; medium acid; clear, smooth boundary.

B1 5 to 11 inches from the surface, yellowish red (5YR 4/6) silt loam, yellowish red (5YR 3/6) when moist; weak, medium, subangular blocky structure; hard, friable, sticky and slightly plastic; common very fine roots; many very fine and fine tubular pores; few thin clay films in pores; slightly acid; clear, smooth boundary.

B2t 11 to 24 inches from the surface, yellowish red (5YR 5/6) light clay loam near silty clay loam, dark red (2.5YR 3/6) when moist; moderate, medium, subangular blocky structure; hard, friable, sticky and slightly plastic; common very fine roots; common very fine tubular pores and many fine and medium tubular pores; many thin clay films in pores and on ped faces; slightly acid; clear, wavy boundary.

C 24 to 30 inches from the surface, soft, well-weathered basic schist; slightly acid.

R 30 inches from the surface, hard basic schist; pockets of slightly weathered material.

The A horizon is reddish brown to strong brown, is slightly acid to medium acid, and ranges from 3 to 9 inches in thickness. The B horizon ranges from reddish brown to yellowish red and from silt loam and light clay loam to light silty clay loam. Included in mapping are small areas of Auburn silt loam, Argonaut gravelly loam, and Boomer gravelly loam. Permeability of this Sobrante soil is moderate. Surface runoff is slow to medium, and the erosion hazard is slight to moderate. The available water-holding capacity is 4 to 7 inches. Effective rooting depth is 22 to 36 inches. This soil is used mainly for range. Small areas are used for pasture and deciduous orchards. Capability Unit IIIe-8(18); Range Site 2; Woodland Suitability Group not assigned.

Tailings

Tailings consist of cobbly and stony tailings from dredge mining and hydraulic mining and in hard-rock mine dumps. All the soil material either has been washed away, as in hydraulic mining, or has been buried, as in dredge mining or mine dumps. Surface runoff is slight, and the erosion hazard is none to slight. This land type is used for water shed and wildlife habitat. It has no farming value. Capability Unit VIIIS-1(18, 22); Range Site and Woodland Suitability Group not assigned.

Serpentine Rock Land (SaF)

Serpentine rock land is in areas of highly resistant serpentine and other ultrabasic rock formations. Rock outcrops and stones make up from 50 to 90 percent of the surface, and there is a thin mantle of soil. This land type is undulating to very steep. At lower elevations it is associated with Delpiedra soils. Included with this miscellaneous land type, above an elevation of 1,000 feet, are small, scattered areas of a soil that has a surface layer of reddish brown, slightly acid loam and a subsoil of reddish brown and yellowish red neutral very

gravelly heavy clay loam and clay. Depth to hard bedrock ranges from 10 to 24 inches. This land type is excessively drained. Surface runoff is very rapid, and the erosion hazard is slight to moderate. Serpentine rock land is used for watershed and wildlife habitat. It has no farming value. Capability Unit VIIIs-1(18, 22); Range Site and Woodland Suitability Group not assigned.

Placer County

Andregg Series.

The Andregg series is part of the Andregg-Caperton-Sierra association. As such, it is described in the Soil Survey as: undulating to steep, well-drained and somewhat excessively drained soils that are deep to shallow over granitic rock. Most of this map unit is in the Loomis Basin. The soils are produced from weathered granitic rock. Slopes are 2 to 50 percent. The plant cover is annual grasses and blue and live oak. Elevations range from 200 to 1,000 feet. This unit makes up about 15 percent of the survey area. It is about 50 percent Andregg soils, 20 percent Caperton soils, 10 percent Sierra soils, and 20 percent Shenandoah soils and Rock outcrop. Andregg soils are moderately deep and well-drained. The surface layer is grayish brown coarse sandy loam. The subsoil is pale brown coarse sandy loam that is underlain at a depth of 24 to 40 inches by weathered granitic rock. This unit is used mostly for deciduous orchards and irrigated pasture. Many of the orchards are being subdivided into rural "ranchettes".

Andregg coarse sandy loam, 2 to 9 percent slopes (106) This is a moderately deep, gently rolling, well-drained soil underlain by weathered granitic bedrock. It formed in residuum on low hills in the Loomis Basin. Elevations are 200 to 1,000 feet. The average annual precipitation ranges from 22 to 33 inches. The average annual air temperature is about 61° F. The average frost-free season is between 250 and 270 days. Natural vegetation is annual grasses, forbs, blue and live oak, and scattered pine.

About 5 percent of the acreage is included areas of a soil that is similar to this Andregg soil but is 35 to 60 inches deep to weathered bedrock and has a light yellowish brown and brown sandy clay loam subsoil; 5 percent is Caperton coarse sandy loam; 5 percent is Sierra sandy loam; 5 percent is a soil that is similar to the Sierra soil but is 20 to 40 inches deep to weathered rock; and 5 percent is a soil that is very similar to this Andregg soil but is 40 to 60 inches deep over weathered bedrock. In some swales and along drainageways, there is a somewhat poorly drained or moderately well-drained soil that is otherwise similar to this Andregg soil.

Typically, the surface layer of this Andregg soil is grayish brown coarse sandy loam about 15 inches thick. The subsoil is pale brown and very pale brown coarse sandy loam. At a depth of 29 inches is highly weathered granodiorite. Permeability is moderately rapid. The available water capacity is 2.5 to 5.0 inches. The effective rooting depth is 24 to 40 inches. Surface runoff is medium. The hazard of erosion is moderate. This soil is used for irrigated pasture, deciduous orchards, and rangeland. Many orchards are being converted to rural or ranchette housing developments. (Some of the SCS description has been skipped) The major limitation to urban use is the depth to rock. Community sewage systems must be constructed in medium and high density subdivisions. Septic tank absorption fields are not practical because the depth to rock is generally less than 40 inches. Capability Unit IIIe-1(18) irrigated and nonirrigated; Storie Index 54.

Andregg coarse sandy loam, 9 to 15 percent slopes (107) This is a moderately deep, rolling, well-drained soil underlain by weathered granitic bedrock. It formed in residuum on low hills in the Loomis Basin. Elevations are 200 to 1,000 feet. The average annual precipitation ranges from 22 to 33 inches. The average annual air temperature is about 61 ° F. The average frost-free season is between 250 and 270 days. Natural vegetation is annual grasses, forbs, blue and live oak, and scattered pine.

About 5 percent of the acreage is included areas of a soil that is similar to this Andregg soil but is 35 to 60 inches deep to weathered bedrock and has a light yellowish brown and brown sandy clay loam subsoil; 5 percent is Caperton coarse sandy loam; 5 percent is Sierra sandy loam; 3 percent is a soil that is similar to the Sierra soil but is 20 to 40 inches deep to weathered rock; and 3 percent is a soil that is very similar to this Andregg soil but is 40 to 60 inches deep to weathered bedrock. Along the contact areas between the granite and volcanic ridges, the soil surface is modified by cobbly dark brown loamy colluvium that has moved downslope. Spot symbols denote scattered rock outcrop.

Typically, the surface layer of this Andregg soil is grayish brown coarse sandy loam about 15 inches thick. The subsoil is pale brown and very pale brown coarse sandy loam. At a depth of 29 inches is highly weathered granodiorite. Permeability is moderately rapid. The available water capacity is 2.5 to 5.0 inches. The effective rooting depth is 24 to 40 inches. Surface runoff is medium. The hazard of erosion is moderate.

This soil is used mainly for irrigated pasture, deciduous orchards, and rangeland. Many orchards are being converted to rural or ranchette housing developments. (Some of the SCS description has been skipped) The major limitation to urban use is the depth to rock. and the slope. Community sewage systems must be constructed in medium and high density subdivisions. Septic tank absorption fields are not practical because the depth to rock is generally less than 40 inches. Capability Unit IVe-1(18) irrigated and nonirrigated; Storie Index 48

Andregg coarse sandy loam, 15 to 30 percent slopes (108) This is a moderately deep, hilly, well-drained soil underlain by weathered granitic bedrock. It formed in residuum on low hills in the Loomis Basin. Elevations are 300 to 1,000 feet. The average annual precipitation ranges from 22 to 33 inches. The average annual air temperature is about 61 ° F. The average frost-free season is between 250 and 270 days. Natural vegetation is annual grasses, forbs, blue and live oak, and scattered pine.

About 5 percent of the acreage is included areas of a soil that is similar to this Andregg soil but is 35 to 60 inches deep to weathered bedrock and has a light yellowish brown and brown sandy clay loam subsoil; 10 percent is Caperton coarse sandy loam; 5 percent is Sierra sandy loam; 5 percent is a soil that is similar to the Sierra soil but is 20 to 40 inches deep to weathered rock; and 3 percent is a soil that is very similar to this Andregg soil but is 40 to 60 inches deep to weathered bedrock. Ad hoc symbols denote scattered rock outcrop.

Typically, the surface layer of this Andregg soil is grayish brown coarse sandy loam about 15 inches thick. The subsoil is pale brown and very pale brown coarse sandy loam. At a depth of 29 inches is highly weathered granodiorite. Permeability is moderately rapid. The available water capacity is 2.5 to 5.0 inches. The effective rooting depth is 24 to 40 inches. Surface runoff is medium to rapid. The hazard of erosion is high.

This soil is used mainly for irrigated pasture and rangeland. It also supports deciduous orchards. Many areas are being converted to rural or ranchette housing developments. (Some of the SCS description has been skipped) The major limitations to urban use are the depth to rock. In locating roads, special care is needed to minimize the heights of cuts and fills. Cuts and fills greater than 6 feet make access to building sites a problem. Because of the erodibility of this soil and its parent material, cuts and fills should be on at least a 2 to 1 slope. Community sewage systems must be constructed in medium and high density subdivisions. Septic tank absorption fields are not practical because of the slope and depth to rock. Capability subclass VIe (18) irrigated and nonirrigated; Storie Index 42.

Andregg coarse sandy loam, rocky, 2 to 15 percent slopes (109) This is a moderately deep, gently rolling and rolling, well-drained soil underlain by weathered granitic bedrock. It formed in residuum on low hills in the Loomis Basin. Five percent of the area is scattered granitic rock outcrop that ranges from 2 to 10 feet in diameter to large areas covering one-half acre. Elevations are 200 to 1,000 feet. The average annual precipitation ranges from 22 to 33 inches. The average annual air temperature is about 61 ° F. The average frost-free season is between 250 and 270 days. Natural vegetation is annual grasses, forbs, blue and live oak, and scattered pine.

About 5 percent of the acreage is included areas of a soil that is similar to this Andregg soil but is 35 to 60 inches deep to weathered bedrock and has a light yellowish brown and brown sandy clay loam subsoil; 5 percent is Caperton coarse sandy loam; 2 percent is Sierra sandy loam; and 3 percent is a soil that is similar to the Sierra soil but is 20 to 40 inches deep to weathered rock. In some swales and along drainageways, there is a somewhat poorly drained or moderately well-drained soil that is otherwise similar to this Andregg soil.

Typically, the surface layer of this Andregg soil is grayish brown coarse sandy loam about 15 inches thick. The subsoil is pale brown and very pale brown coarse sandy loam. At a depth of 29 inches is highly weathered granodiorite. Permeability is moderately rapid. The available water capacity is 2.5 to 5.0 inches. The effective rooting depth is 24 to 40 inches. Surface runoff is medium. The hazard of erosion is moderate.

This soil is used mainly for irrigated pasture, deciduous orchards, and rangeland. Many areas are being converted to rural or ranchette housing developments. (Some of the SCS description has been skipped) The major limitations to urban use are the depth to rock and the occurrence of rock outcrop. Community sewage systems must be constructed in medium and high density subdivisions. Septic tank absorption fields are not practical because the depth to rock is generally less than 40 inches. The rocky areas may dictate the location of building sites. Capability Unit IVe-7(18) irrigated and non-irrigated; Storie Index 34.

Andregg coarse sandy loam, rocky, 15 to 30 percent slopes (110) This is a moderately deep, hilly, well-drained soil underlain by weathered granitic bedrock. It formed in residuum in the Loomis Basin. Five percent of the area is scattered granitic rock outcrop that ranges from 2 to 10 feet in diameter to large areas covering about one-half acre. Elevations are 300 to 1,000 feet. The average annual precipitation ranges from 22 to 33 inches. The average annual air temperature is about 61 ° F. The average frost-free season is between 250 and 270 days. Natural vegetation is annual grasses, forbs, blue and live oak, and scattered pine.

About 5 percent of the acreage is included areas of a soil that is similar to this Andregg soil but is 35 to 60 inches deep to weathered bedrock and has a light yellowish brown and brown

sandy clay loam subsoil; 10 percent is Caperton coarse sandy loam; 2 percent is Sierra sandy loam; 3 percent is a soil that is similar to the Sierra soil but is 20 to 40 inches deep to weathered rock; and 5 percent is a soil that is very similar to this Andregg soil but is 40 to 60 inches deep to weathered bedrock.

Typically, the surface layer of this Andregg soil is grayish brown coarse sandy loam about 15 inches thick. The subsoil is pale brown and very pale brown coarse sandy loam. At a depth of 29 inches is highly weathered granodiorite. Permeability is moderately rapid. The available water capacity is 2.5 to 5.0 inches. The effective rooting depth is 24 to 40 inches. Surface runoff is medium to rapid. The hazard of erosion is high.

This soil is used mainly for rangeland because of the slope and the rock areas. Some areas are used for deciduous orchards and irrigated pasture. Many areas are being converted to rural or ranchette housing developments. The major limitations to urban use are the depth to rock and the slope. In locating roads, special care is needed to minimize the heights of cuts and fills. Cuts and fills greater than 6 feet make access to building sites a problem. Because of the erodibility of the soil and its parent material, all cuts and fills should be on at least a 2 to 1 slope. Community sewage systems must be constructed in medium and high density subdivisions. Septic tank absorption fields are not practical because of the slope and the depth to rock. The rocky areas may dictate the location of building sites. Capability Unit VIs(18) irrigated and non-irrigated; Storie Index 28.

Andregg coarse sandy loam, rocky, 30 to 50 percent slopes (111) This is a moderately deep, steep, well-drained soil underlain by weathered granitic bedrock. It formed in residuum on foothills in the Loomis Basin. Ten percent of the area is granitic rock outcrop that ranges from 2 to 10 feet in diameter to large areas covering about one-half acre. Elevations are 500 to 1,000 feet. The average annual precipitation ranges from 24 to 33 inches. The average annual air temperature is about 61 ° F. The average frost-free season is between 250 and 270 days. Natural vegetation is annual grasses, forbs, blue and live oak, and scattered pine.

About 15 percent of the acreage is included areas of Caperton coarse sandy loam, generally on the steeper slopes; 2 percent is Sierra sandy loam; and 3 percent is a soil that is similar to the Sierra soil but is 20 to 40 inches deep to weathered rock.

Typically, the surface layer of this Andregg soil is grayish brown coarse sandy loam about 15 inches thick. The subsoil is pale brown and very pale brown coarse sandy loam. At a depth of 29 inches is highly weathered granodiorite. Permeability is moderately rapid. The available water capacity is 2.5 to 5.0 inches. The effective rooting depth is 24 to 40 inches. Surface runoff is rapid. The hazard of erosion is high.

This soil is used mainly for annual range.(Some of the SCS description has been skipped) The major limitations to urban use are the depth to rock and the slope. In locating roads, special care is needed to minimize the heights of cuts and fills. Cuts and fills greater than 6 feet make access to building sites a problem. Because of the erodibility of the soil and its parent material, all cuts and fills should be on at least a 2 to 1 slope. Community sewage systems must be constructed in medium and high-density subdivisions. Septic tank absorption fields are not practical because of the slope and the depth to rock. The rocky areas may dictate the location of building sites. Capability subclass VIIs(18) non-irrigated; Storie Index 16.

Andregg-Rock outcrop complex, 15 to 30 percent slopes (112) This rolling to hilly soil and Rock outcrop are on granitic upland in the Loomis Basin near Folsom Lake. This unit is about 65 percent Andregg soil and 15 percent granitic Rock outcrop. Elevations are 200 to 1,000 feet. The average annual precipitation ranges from 22 to 33 inches. The average annual air temperature is about 61 ° F. The average frost-free season is between 250 and 270 days. Natural vegetation is annual grasses, forbs, blue and live oak, and scattered pine.

About 5 percent of this soil type occurs in areas containing an Andregg-type soil that is 35 to 60 inches deep to weathered bedrock and has a light yellowish brown and brown sandy clay loam subsoil; 10 percent is Caperton coarse sandy loam; 2 percent is Sierra sandy loam; and 3 percent is a soil that is similar to the Sierra soil but is 20 to 40 inches deep to weathered rock. The Andregg soil is moderately deep and well-drained. It formed in residuum of granitic rock.

Typically, the surface layer of this Andregg soil is grayish brown coarse sandy loam about 15 inches thick. The subsoil is pale brown and very pale brown coarse sandy loam. At a depth of 29 inches is highly weathered granodiorite. Permeability is moderately rapid. The available water capacity is 2.5 to 5.0 inches. The effective rooting depth is 24 to 40 inches. Surface runoff is medium to rapid. The hazard of erosion is moderate to high. Rock outcrop consists of areas of scattered hard granitic rock ranging in size from 2 to 10 feet in diameter to large areas covering ½ to 2 acres. Surface runoff is very rapid. There is no erosion hazard.

This unit is used mainly for range and rural development. The major limitations to urban use are the depth to rock, Rock outcrop, and the slope. In locating roads, special care is needed to minimize the heights of cuts and fills. Cuts and fills greater than 6 feet make access to building sites a problem. Because of the erodibility of this Andregg soil and parent material, all cuts and fills should be on at least a 2 to 1 slope. Community sewage systems must be constructed in medium and high-density subdivisions. Septic tank absorption fields are not practical because of the slope and the depth to rock and should be located away from rocky areas. The rock outcrop limits the location of building sites. Capability subclass VIs(18) irrigated and non-irrigated; Storie Index 38.

Caperton-Rock outcrop complex, 30 to 50 percent slopes (133) This steep soil and Rock outcrop are on granitic side slopes of volcanic ridges in the Loomis Basin. Elevations are 300 to 1,000 feet. The unit is about 70 percent Caperton soil and 15 percent granitic Rock outcrop. The average annual precipitation ranges from 22 to 33 inches. The average annual air temperature is about 61 ° F. The average frost-free season is between 250 and 270 days. Natural vegetation is annual grasses, forbs, blue and live oak, and scattered brush.

About 15 percent of this unit is included areas of Andregg coarse sandy loam. On the upper slopes, below the volcanic ridges, the surface layer of this Caperton soil is 5 to 20 percent andesitic cobbles. Typically, the surface layer is grayish brown and brown gravelly coarse sandy loam about 12 inches thick. The next 6 inches is pale brown coarse sandy loam. At a depth of 18 inches is weathered granodiorite. Permeability is moderately rapid. The available water capacity is 0.5 to 2.0 inches. Surface runoff is rapid. The hazard of erosion is high. Rock outcrop consists of areas of scattered hard granitic rock ranging from 2 to 5 feet in diameter to areas that cover up to one-half acre. Surface runoff is very rapid. There is no hazard of erosion.

Most areas are used for rangeland and watershed. The steepness of slope, the erosion hazard, and the rock outcrop are the major limitations to be considered in planning home and road construction. Capability Unit VIIs(18) non-irrigated; Storie Index 10.

Inks cobbly loam, 2 to 30 percent slopes (110) This is a shallow, well-drained cobbly soil underlain by andesitic conglomerate. It formed in residuum on long broad volcanic ridges and side slopes at elevations of 200 to 1,200 feet. The average annual precipitation ranges from 20 to 35 inches. The average annual air temperature is about 61 ° F. The average frost-free season is between 250 and 270 days. Natural vegetation is annual grasses, forbs, and blue and live oak.

About 10 percent of the acreage is included areas of Inks Variant cobbly loam, and 10 percent Exchequer very stony loam. In a few places, the surface layer of the Inks soil is reddish brown.

Typically, the surface layer is yellowish brown cobbly loam about 5 inches thick. The subsoil is brown very cobbly clay loam. At a depth of 18 inches is andesitic conglomerate. Permeability is moderate. The available water capacity is 1.0 to 2.5 inches. The effective rooting depth is 12 to 20 inches. Surface runoff is medium or rapid. The hazard of erosion is slight to high.

Most areas are used for annual rangeland. A few are irrigated pasture. (Some of the SCS description has been skipped) Some rural housing has been developed on this soil. The major limitations to rural development are the slope and the depth to rock. Septic tank absorption fields are not practical because of the slope and the depth to rock which is generally less than 20 inches. Capability Unit IVe-8(18) irrigated and nonirrigated; Storie Index 21.

Redding and Corning gravelly loams, 2 to 9 percent slopes (176) These undulating to rolling soils are on high terraces at elevations of 100 to 240 feet. Both soils have a claypan. The Redding soil has a hardpan under the claypan, and the Corning soil has softly consolidated gravelly alluvium under the claypan. A mapped area can consist of only one of these soils or both. The average annual precipitation is about 22 inches. The average annual air temperature is about 62 ° F. The average frost-free season is about 270 days. Natural vegetation is annual grasses, forbs, and few scattered oak.

About 5 percent of this unit is included areas of a deep soil that does not have a clay pan and supports fair stands of oak trees. Another 5 percent is a soil that is similar to this Redding soil but has a yellowish brown subsoil. Along the contact with the low terraces, there are small areas of Cometa, Fiddyment, and San Joaquin soils.

The Redding is a well-drained claypan soil that is moderately deep over a hardpan. It formed in gravelly old valley fill from mixed sources. Typically, the surface layer is strong brown and yellowish red gravelly loam and reddish brown loam about 14 inches thick. The subsoil is dark reddish brown and reddish brown clay. At a depth of about 28 inches is the hardpan. Permeability is very slow. The available water capacity is 1.5 to 3.0 inches. The effective rooting depth is 20 to 34 inches. Most roots in the clay subsoil are along the faces of pads, which reduces the water available to plants. Surface runoff is slow or medium. The hazard of erosion is slight or moderate. After intense rainstorms, the soil is saturated for a short time.

The Corning is a well-drained, very deep claypan soil that is underlain by gravelly alluvium. It formed in old valley fill from mixed sources. Typically, the surface layer is reddish brown, yellowish red, and red gravelly loam about 22 inches thick. The subsoil is red and dark red clay about 18 inches thick. The substratum to a depth of 60 inches is strong brown clay loam. Permeability is very slow. The available water capacity is 4.0 to 6.5 inches. The effective rooting depth is 60 inches or more, but most roots in the clay subsoil are along the faces of peds, which reduces the water available to plants. Surface runoff is slow or medium. The hazard of erosion is slight or moderate. After intense rainstorms, the soil is saturated for a short time.

Most areas are used as annual rangeland. A few areas are used for irrigated pasture and winter grains. (Some of the SCS description has been skipped) The major limitations to urban use of the Redding soil are the very slow permeability of the subsoil and substratum, the moderate depth to a hardpan, and the limited ability of the soil to support a load. The major limitations of the Corning soil are the very slow permeability of the subsoil, the shrink-swell potential of the subsoil, and the limited ability of the soil to support a load. Dwellings and roads can be designed to offset the low bearing strength and the shrink-swell potential. Septic tank absorption fields probably will not function properly on the Redding soil because of the very slow permeability of the subsoil and the underlying hardpan. They will not function properly on the Corning soil because of the very slow permeability of the subsoil and substratum. Capability Unit IVe-3(17) irrigated and non-irrigated; Storie Index Redding 22, Corning 34.

Redding and Corning gravelly loams, 9 to 15 percent slopes (177) These soils occupy prominent mounds and side slopes of high terraces in the Sheridan area. Both soils have a claypan. The Redding soil has a hardpan under the claypan. The Corning soil has gravelly alluvium under the claypan. A mapped area can consist of only one of these soils or both. Elevations are 100 to 240 feet. The average annual precipitation is about 22 inches. The average annual air temperature is about 62 ° F. The average frost-free season is about 270 days. Natural vegetation is annual grasses, forbs, and few scattered oak.

About 5 percent of this unit is included areas of a deep soil that does not have a clay pan and supports fair stands of oak trees. About 5 percent is a soil that is similar to this Redding soil but has a yellowish brown subsoil. Also included are a few small areas where slopes are up to 20 percent.

The Redding is a well-drained claypan soil that is moderately deep over a hardpan. It formed in gravelly old valley fill from mixed sources. Typically, the surface layer is strong brown and yellowish red gravelly loam and reddish brown loam about 14 inches thick. The subsoil is dark reddish brown and reddish brown clay. At a depth of about 28 inches is the hardpan. Permeability is very slow. The available water capacity is 1.5 to 3.0 inches. The effective rooting depth is 20 to 34 inches. Most roots in the clay subsoil are along the faces of pads, which reduces the water available to plants. Surface runoff is medium. The hazard of erosion is moderate.

The Corning is a very deep, well-drained claypan soil that is underlain by gravelly alluvium. It formed in old valley fill from mixed sources. Typically, the surface layer is reddish brown, yellowish red, and red, gravelly loam about 22 inches thick. The substratum to a depth of 58 inches is strong brown clay loam. Permeability is very slow. The available water capacity is 4.0 to 6.5 inches. The effective rooting depth is 60 inches or more, but most roots in the clay

subsoil are along the faces of peds, which reduces the water available to plants. Surface runoff is medium. The hazard of erosion is moderate.

These soils are used mainly as annual rangeland. (Some of the SCS description has been skipped) The major limitations to urban use are the very slow permeability in the subsoil of both soils and the hardpan under the Redding soil. These limitations restrict the proper functioning of septic tank absorption fields. Capability Unit IVe-3(17) non-irrigated; Storie Index Redding 19, Corning 30.

Andregg coarse sandy loam, 15 to 30 percent slopes (108) This is a moderately deep, hilly, well-drained soil underlain by weathered granitic bedrock. It formed in residuum on low hills in the Loomis Basin. Elevations are 300 to 1,000 feet. The average annual precipitation ranges from 22 to 33 inches. The average annual air temperature is about 61 ° F. The average frost-free season is between 250 and 270 days. Natural vegetation is annual grasses, forbs, blue and live oak, and scattered pine.

About 5 percent of the acreage is included areas of a soil that is similar to this Andregg soil but is 35 to 60 inches deep to weathered bedrock and has a light yellowish brown and brown sandy clay loam subsoil; 10 percent is Caperton coarse sandy loam; 5 percent is Sierra sandy loam; 5 percent is a soil that is similar to the Sierra soil but is 20 to 40 inches deep to weathered rock; and 3 percent is a soil that is very similar to this Andregg soil but is 40 to 60 inches deep to weathered bedrock. Ad hoc symbols denote scattered rock outcrop.

Typically, the surface layer of this Andregg soil is grayish brown coarse sandy loam about 15 inches thick. The subsoil is pale brown and very pale brown coarse sandy loam. At a depth of 29 inches is highly weathered granodiorite. Permeability is moderately rapid. The available water capacity is 2.5 to 5.0 inches. The effective rooting depth is 24 to 40 inches. Surface runoff is medium to rapid. The hazard of erosion is high.

This soil is used mainly for irrigated pasture and rangeland. It also supports deciduous orchards. Many areas are being converted to rural or ranchette housing developments. (Some of the SCS description has been skipped) The major limitations to urban use are the depth to rock and the slope. In locating roads, special care is needed to minimize the heights of cuts and fills. Cut and fills greater than 6 feet make access to building sites a problem. Because of the erodibility of this soil and its parent material, cuts and fills should be on at least a 2 to 1 slope. Community sewage systems must be constructed in medium and high density subdivisions. Septic tank absorption fields are not practical because of the slope and depth to rock. Capability subclass VIe(18) irrigated and non-irrigated; Storie Index 42.

Sierra sandy loam, 2 to 9 percent slopes (183) This is a deep, gently rolling, well-drained soil underlain by weathered granitic bedrock. It formed in residuum on low hills at elevations of 200 to 1,000 feet. It occurs as scattered areas throughout the Loomis Basin. The average annual precipitation ranges from 22 to 33 inches. The average annual air temperature is about 61 ° F. The average frost-free season is between 250 and 270 days. Natural vegetation is annual grasses, forbs, blue and live oak, and scattered pine.

About 15 percent of the acreage is included areas of Andregg coarse sandy loam, 5 percent is a soil that is similar to this Sierra soil but is 20 to 40 inches deep to weathered rock, and 5 percent is another soil that is similar to this Sierra soil but has a light yellowish brown and brown sandy clay loam subsoil. In some swales there is dark colored, poorly drained soil.

Near Folsom Lake, there are small areas where this Sierra soil has a thin gravel mantle from old valley fill. About 2 percent of the acreage is scattered rock outcrop. Typically, the surface layer of this Sierra soil is dark grayish brown, brown, and yellowish red sandy loam about 23 inches thick. The subsoil is yellowish red sandy clay loam and red clay loam. At a depth of 41 inches is highly weathered granodiorite. Permeability is moderately slow. The available water capacity is 5.0 to 9.5 inches. The effective rooting depth is 40 to 60 inches or more. Surface runoff is medium. The hazard of erosion is moderate.

This soil is used mainly for irrigated pasture and deciduous orchards. Small, scattered areas are used as rangeland. Many areas in orchards are now being subdivided and used for rural or ranchette housing. (Some of the SCS description has been skipped) There is increasing use of this soil for rural subdivisions. The major limitations to urban use are the moderately slow permeability of the subsoil, the shrink-swell potential of the subsoil, and the limited ability of the soil to support a load. Dwelling and road construction can be designed to offset most of these limitations. Community sewage systems must be constructed in medium and high-density subdivisions. Septic tank absorption fields are not practical because of the moderately slow permeability in the subsoil. Capability Unit IIIe-1(18) irrigated and non-irrigated; Storie Index 62.

Sierra sandy loam, 9 to 15 percent slopes (184) This is a deep, rolling, well-drained soil underlain by weathered granitic bedrock. It formed in residuum on low hills at elevations of 200 to 1,000 feet. It occurs as scattered areas throughout the Loomis Basin. The average annual precipitation ranges from 22 to 33 inches. The average annual air temperature is about 61 ° F. The average frost-free season is between 250 and 270 days. Natural vegetation is annual grasses, forbs, blue and live oak, and scattered pine.

About 15 percent of the acreage is included areas of Andregg coarse sandy loam, 5 percent is a soil that is similar to this Sierra soil but is 20 to 40 inches deep to weathered rock, and 5 percent is another soil that is similar to this Sierra soil but has a light yellowish brown and brown sandy clay loam subsoil, and 2 percent of the acreage is scattered rock outcrop.

Typically, the surface layer of this Sierra soil is dark grayish brown, brown, and yellowish red sandy loam about 23 inches thick. The subsoil is yellowish red sandy clay loam and red clay loam. At a depth of 41 inches is highly weathered granodiorite. Permeability is moderately slow. The available water capacity is 5.0 to 9.5 inches. The effective rooting depth is 40 to 60 inches or more. Surface runoff is medium. The hazard of erosion is high.

This soil is used mainly for irrigated pasture and deciduous orchards. Small, scattered areas are used as rangeland. Many areas in orchards are now being subdivided and used for rural or ranchette housing. (Some of the SCS description has been skipped) There is increasing use of this soil for rural subdivisions. The major limitations to urban use are the moderately slow permeability of the subsoil, the shrink-swell potential of the subsoil, the slope, and the limited ability of the soil to support a load. Dwelling and road construction can be designed to offset most of these limitations. Community sewage systems must be constructed in medium and high density subdivisions. Septic tank absorption fields are not practical because of the moderately slow permeability in the subsoil. Capability Unit IVe-1(18) irrigated and nonirrigated; Storie Index 55.

Sierra sandy loam, rocky, 15 to 30 percent slopes (185) This is a deep, hilly, well-drained soil underlain by weathered granitic rock. It formed in residuum at elevations of 200 to 1,000

feet. The average annual precipitation ranges from about 22 to 33 inches. The average annual air temperature is about 61 ° F. The average frost-free season is between 250 and 270 days. Natural vegetation is annual grasses, forbs, blue and live oak, and scattered pine.

About 15 percent of the acreage is included areas of Andregg coarse sandy loam, 5 percent is a soil that is similar to this Sierra soil but is 20 to 40 inches deep to weathered rock, 5 percent is another soil that is similar to this Sierra soil but has a light yellowish brown and brown sandy clay loam subsoil, 5 percent is Caperton coarse sandy loam, and 3 percent is scattered rock outcrop.

Typically, the surface layer of this Sierra soil is dark grayish brown, brown, and yellowish red sandy loam about 23 inches thick. The subsoil is yellowish red sandy clay loam and red clay loam. At a depth of 41 inches is weathered granodiorite. Permeability is moderately slow. The available water capacity is 5.0 to 9.5 inches. The effective rooting depth is 40 to 60 inches or more. Surface runoff is medium to rapid. The hazard of erosion is high.

This soil is used mainly for irrigated pasture. It supports some deciduous orchards. Small scattered areas are used as rangeland. Many areas are being subdivided for rural or ranchette housing. (Some of the SCS description has been skipped) There is increasing use of this soil for rural subdivisions. The major limitation to urban use is the slope. In locating roads, special care is needed to minimize the heights of cuts and fills. Cuts and fills greater than 6 feet make access to building sites a problem. Because of the erodibility of this soil and its parent material, all cuts and fills should be on at least a 2 to 1 slope. Community sewage systems must be constructed in medium and high-density subdivisions. Septic tank absorption fields are not practical because of the slope and the moderately slow permeability. Capability Unit =VIe(18) irrigated and non-irrigated; Storie Index 48.

Sacramento County (East Part)

Andregg Series.

Andregg coarse sandy loam, rocky, 2 to 8 percent slopes (103) This moderately deep, well-drained soil is on foothills. It formed in material weathered from granitic rocks. Slopes are complex. The native vegetation is mainly oaks, annual grasses, and forbs. Elevation is 250 to 450 feet. The average annual precipitation is 23 to 24 inches.

Typically, the surface layer is grayish brown coarse sandy loam about 15 inches thick. The subsoil is pale brown and very pale brown coarse sandy loam. At a depth of 29 inches is highly weathered granodiorite. Permeability is moderately rapid. The available water capacity is 2.5 to 5.0 inches. The effective rooting depth is 24 to 40 inches. Surface runoff is medium. The hazard of erosion is moderate.

This soil is used mainly for irrigated pasture, deciduous orchards, and rangeland. Many areas are being converted to rural or ranchette housing developments. (Some of the SCS description has been skipped) The major limitations to urban use are the depth to rock. Community sewage systems must be constructed in medium and high density subdivisions. Septic tank absorption fields are not practical because the depth to rock is generally less than 40 inches. The rocky areas may dictate the location of building sites. Capability Unit IVe-7(18) irrigated and nonirrigated; Storie Index 34.

Andregg coarse sandy loam, rocky, 8 to 15 percent slopes (104) This moderately deep, well-drained soil is on foothills. It formed in material weathered from granitic rocks. Slopes are complex. The native vegetation is mainly oaks, annual grasses, and forbs. Elevation is 200 to 600 feet. The average annual precipitation is 23 to 24 inches.

Typically, the surface layer is brown coarse sandy loam about 11 inches thick. The subsoil is light yellowish brown coarse sandy loam about 21 inches thick. Weathered granodiorite is at a depth of about 32 inches. In some area the surface layer is loamy sand, loam, or sandy loam. In other areas the subsoil is sandy clay loam. Included in this unit are small areas of Auburn and Argonaut soils, Rock outcrops, and Urban land. Also included are soils that are less than 20 inches or 40 to 60 inches deep over bedrock and soils that have slopes of 15 to 25 percent. Included areas make up about 15 percent of the total acreage. Permeability is moderately rapid in the Andregg soil. Available water capacity is low. The effective rooting depth and the depth to weathered bedrock are 20 to 40 inches. Surface runoff is medium. The hazard of water erosion is moderate.

Nearly all areas of this unit are used for urban or recreational development. A few small areas are used for irrigated orchards. Where this soil is used for urban development, the main limitations are the depth to bedrock, the slope, and the hazard of erosion. If shallow excavations, such as trenches and holes, or deep cuts are made during construction, the bedrock can be exposed. Heavy equipment may be required to remove the rock. (Some of the SCS description has been skipped) This unit is well suited to recreational development. It is limited mainly by the slope and the moderate hazard of erosion. Areas that have been cut and filled should be seeded or mulched. Erosion and sedimentation can be controlled and the beauty of the area enhanced by maintaining an adequate plant cover. This unit is in Capability Unit IVe-1, irrigated and non-irrigated; The MLRA is 18.

Andregg-Urban land complex, 2 to 8 percent slopes (105) This map unit is on foothills. Slopes are complex and have been shaped for urban uses. The vegetation on the Andregg soil is mainly ornamental plants or oaks, annual grasses, and forbs. Elevation is 300 to 420 feet. The average annual precipitation is 23 to 24 inches. The unit is about 55 percent Andregg soil and 30 percent Urban land. Included in this unit are small areas of altered soils that have been cut or filled during construction, Rock outcrop, and soils that are less that 20 inches or more than 40 inches deep over bedrock. Included areas make up about 15 percent of the total acreage.

The Andregg soil is moderately deep and well-drained. It formed in material weathered from granitic rocks. Typically, the surface layer is brown coarse sandy loam about 11 inches thick. The subsoil is light yellowish brown coarse sandy loam about 21 inches thick. Weathered granodiorite is at a depth of about 32 inches. In some areas the surface layer is loamy sand. Permeability is moderately rapid in the Andregg soil. The available water capacity is low. The effective rooting depth and the depth to weathered bedrock are 20 to 40 inches. Runoff is slow or medium. The hazard of water erosion is slight or moderate.

Urban land consists of areas covered by impervious surfaces or structures, such as roads, driveways, sidewalks, buildings, and parking lots. The soil material under the impervious surfaces is similar to that of the Andregg soil, although it may have been truncated or otherwise altered.

This unit is used for urban development. The main limitation affecting urban uses is the depth to rock. Erosion is a hazard in the steeper area. It can be controlled by revegetating disturbed areas around construction sites. Steep slopes that have been cut and filled are susceptible to erosion and should be permanently protected. No land capability classification is assigned. The MLRA is 18.

Urban land (227) This map unit consists of large areas covered by impervious surfaces or structures, such as roads, driveways, sidewalks, buildings, and parking lots. In most places 90 percent or more of the area is covered by impervious surfaces. The soil material under the impervious surfaces may have been altered during construction. It is similar to that of the nearby soil, although it may have been truncated or otherwise altered. No land capability classification is assigned. The MLRA is 17.

Urban Land-Natoma complex, 0 to 2 percent slopes (228) This map unit is in high areas on low terraces. Slopes have been shaped for urban uses. The vegetation is mainly ornamental plants or oaks, annual grasses, and forbs. Elevation is 45 to 140 feet. The average annual precipitation is 17 to 23 inches. The unit is about 45 percent Urban land and 40 percent Natoma soil.

Included in this unit are small areas of Americanos, Kimball, and San Joaquin soils and Xerarents. Americanos soils are on low stream terraces. Kimball and San Joaquin soils are in the slightly lower areas on the low terraces. Xerarents are in filled areas. Also included, in low areas, are soils that have a subsoil of brown sandy clay loam and a base saturation of more than 75 percent. Included areas make up about 15 percent of the total acreage.

Urban land consists of areas covered by impervious surfaces or structures, such as roads, driveways, sidewalks, buildings, and parking lots. The soil material under the impervious surfaces is similar to that of the Natoma soil, although it may have been truncated or otherwise altered.

The Natoma soil is very deep and well-drained. It formed in alluvium derived from mixed rock sources. Typically, the surface layer is brown loam about 17 inches thick. The upper part of the subsoil is yellowish red and reddish brown loam about 16 inches thick. The lower part is red clay loam about 45 inches thick. The substratum to a depth of 84 inches is yellowish red sandy loam. In some areas the surface layer is sandy loam. Permeability is moderately slow in the Natoma soil. Available water capacity is very high. The effective rooting depth is 60 inches or more. Runoff is slow. The hazard of water erosion is slight.

This unit is used for urban development. The main limitation affecting urban uses is low strength in the subsoil. Properly designing roads and streets helps to compensate for this limitation. Revegetating disturbed areas around construction sites helps to control erosion. (Some of the SCS description has been skipped) No land capability classification is assigned. The MLRA is 17.

Xerolls, 30 to 70 percent slopes (243) These shallow to very deep, somewhat excessively drained and well-drained soils are on terrace escarpments and steep hillslopes along drainageways near the American River. They formed in colluvium derived from mixed and granite or metabasic rocks. Slopes are convex to concave. The native vegetation is mainly oaks, annual grasses, and forbs. Elevation is 60 to 350 feet. The average annual precipitation is 19 to 24 inches.

The texture, color, and thickness of the layers of these soils vary from one area to another. In a reference pedon, the surface layer is about 10 inches of brown loam and very gravelly loam. The upper part of the subsoil is dark yellowish brown gravelly clay loam about 9 inches thick. The lower part is brown and strong brown very gravelly clay loam and very gravelly sandy clay loam. It is about 25 inches thick. The underlying material to a depth of 60 inches is strong brown very gravelly sandy clay loam. The depth to sandstone, siltstone, or granitic or metabasic rocks ranges from 10 to more than 80 inches.

Included in this unit are small areas of Andregg, Auburn, Fiddyment, Kaseberg, and Red Bluff soils on the upper end of escarpments or hillslopes. Also included are areas that have slopes of 15 to 30 percent. Included areas make up about 10 percent of the total acreage. Permeability is moderately rapid to moderately slow in the Xerolls. Available water capacity is very low to high. The effective rooting depth ranges from 10 to more than 80 inches. Runoff is rapid or very rapid. The hazard of water erosion is severe.

This unit is used for recreational development or for wildlife habitat. The main limitations affecting recreational development are the slope and the hazard of water erosion. The slope limits the use of these soils mainly to a few paths and trails, which should extend across the slope. (Some of the SCS description has been skipped) This unit is suited to wildlife habitat. It is limited mainly by the very low or low available water capacity, which limits the growth and diversity of tress and shrubs. Areas of this unit are significant as wildlife habitat because they are adjacent to the riparian habitat along the American River. The best management measures are those that maintain the existing habitat. This unit is in capability subclass VIIe, non-irrigated. The MLRA is 17.

Xerorthents, dredge tailings, 2 to 50 percent slopes (245) These very deep, somewhat excessively drained and well excessively drained soils are in areas of dredge tailings. They formed in material that has a high content of gravel and cobbles derived from mixed rock sources. The material was deposited as tailings after most of the fine-earth material was washed from it and removed during gold dredging activities. Slopes are short, complex, and disturbed. The vegetation is mainly sparse stands of annual grasses and forbs and scattered hardwoods. Many of the youngest deposits are bare. Elevation is 80 to 400 feet. The average annual precipitation is 18 to 24 inches.

The texture, color, and thickness of the layers of these soils vary from one area to another. In a reference pedon, the surface layer is light yellowish brown extremely cobble fine sandy loam about 12 inches thick. The next 9 inches is a poorly sorted zone of well rounded stones, cobbles, and gravel. The underlying material to a depth of 63 inches is pales brown extremely cobbly and very cobbly fine sandy loam.

Included in this unit are small areas of Natoma, Red Bluff, Redding, and Rossmoor soils and Riverwash. Slickens, and Xerofluvents. Included areas make up about 10 percent of the total acreage. Permeability is moderately rapid to very rapid in the Xerorthents. Available water capacity is very low or low. The effective rooting depth is 60 inches or more. Runoff is very slow or slow. Water erosion is a slight hazard or is not a hazard at all.

This unit is used mainly for wildlife habitat. Some areas are used for recreational purposes. If leveled, the unit can be used for urban development. It may provide wetland functions and values. These should be considered when plans are made for enhancement of wildlife habitat or for land use conversion. This unit is poorly suited to wildlife habitat. It is limited by the

very low or low available water capacity and the high content of gravel and cobbles, which limit the growth of tress and shrubs. The best management measures are those that maintain the existing habitat. This unit is in capability subclass VIIIs, non-irrigated. The MLRA is 17.

Xerorthents, dredge tailings-Urban land complex, 0 to 2 percent slopes (246) This map unit is in areas of leveled dredge tailings. Slopes have been shaped for urban uses. The vegetation is mainly ornamental plants or annual grasses and forbs. Elevation is 90 to 200 feet. The average annual precipitation is 18 to 24 inches. The unit is about 45 percent Xerorthents land and 40 percent Urban land.

Included in this unit are small areas of Americanos and Natoma soils and Slickens. Americanos soils are on low stream terraces. Natoma soils are on low terraces. Included areas make up about 15 percent of the total acreage.

The Xerorthents are very deep and are somewhat excessively drained and excessively drained. They formed in material that has a high content of gravel and cobbles derived from mixed rock sources. The material was deposited as tailings after most of the fine-earth material was washed from it and removed during gold dredging activities. The texture, color, and thickness of the layers of these soils vary from one area to another. In a reference pedon, the surface layer is light yellowish brown extremely cobbly fine sandy loam about 12 inches thick. The next 9 inches is a poorly sorted zone of well-rounded stones, cobbles, and gravel. The underlying material to a depth of 63 inches is pale brown extremely cobbly and very cobbly fine sandy loam. Permeability is moderately rapid to very rapid in the Xerorthents. Available water capacity is very low or low. The effective rooting depth is 60 inches or more. Runoff is very slow. The hazard of water erosion is slight. (Some of the SCS description has been skipped) This unit is used for urban development. The main limitation affecting urban uses is low strength in the subsoil. Properly designing roads and streets helps to compensate for this limitation. No land capability classification is assigned.

ENVIRONMENTAL CONDITIONS

HYDROLOGY

Folsom Lake State Recreation Area

April 2003

by

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Psomas

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HYDROLOGY

Introduction

Psomas and Geotechnical Consultants, Inc. (GTC) prepared this section to describe the existing hydrologic and groundwater conditions within the Folsom Lake State Recreation Area (the Unit). The purpose of this summary is to:

- Describe the existing hydrologic conditions within the Unit
- Provide hydrographs and Rosgen classifications of rivers and streams (where available)
- Describe existing dams, hydropower plants, and flood control projects and future projects as to how they affect the Unit
- Identify the minimum, maximum and average lake levels by month
- Describe the existing groundwater conditions within the Unit

The information for this section was gathered from the California Department of Water Resources (DWR), the United States Bureau of Reclamation (BOR), the United States Army Corps of Engineers (ACOE), the Sacramento Area Flood Control Agency (SAFCA), and the National Water Information Service (NWIS, a subdivision of the U.S. Geological Survey). A list of the specific documents reviewed and websites accessed is provided in the reference section.

Watershed Description

Basin Hydrology

The American River watershed covers approximately 2,100 square miles northeast of Sacramento (Figure H-1). The watershed spans portions of three different counties: Sacramento, El Dorado, and Placer. The average annual runoff is approximately 2.7 million acre-feet. In the past, annual runoff has varied from 900,000 acre-feet to 5,000,000 acre-feet. The American River watershed, including all its tributaries, is divided into three major subbasins, the North Fork American River, the South Fork American River and the Lower Fork American River.

The Lower Fork American River subbasin begins at Folsom Dam and extends 30 miles downstream to the mouth of the American River at the confluence of the Sacramento River. The Lower American Basin contains eight dams and has 380 miles of naturally occurring waterways. The precipitation in the Lower American River basin averages 20.83 inches per year (ACOE, 2002).

The North Fork American River subbasin is located above Folsom Lake to the northeast. The basin contains 28 dams, has an annual average precipitation of 58.72 inches, and contains 1,318 miles of naturally occurring waterways (ACOE, 2002).

The South Fork American River subbasin is located east of Folsom Lake and includes the watershed for the Middle and South Forks of the American River. The basin contains 29 dams, has an annual average precipitation of 49.5 inches per year, and contains 1,145 miles of naturally occurring waterways (ACOE, 2002).

The majority of runoff in the basin is generated during the winter months (October -April). From April to July, rainfall runoff is replaced with snowmelt from the upper portions of the American River watershed. A more detailed description of the meteorological conditions in the Unit is provided in the Meteorology/Air Quality Section of this Resource Inventory.

Folsom Dam regulates runoff from a drainage area within the American River watershed, an area of about 1,875 square miles. The normal full-pool storage capacity of Folsom Lake is 975,000 acre-feet, with a seasonally designated flood control storage space of 400,000 acre-feet. If the proposed ACOE dam-raising project occurs, the flood control storage space of Folsom Lake will increase by 95,000 acre-feet (ACOE, 2002)

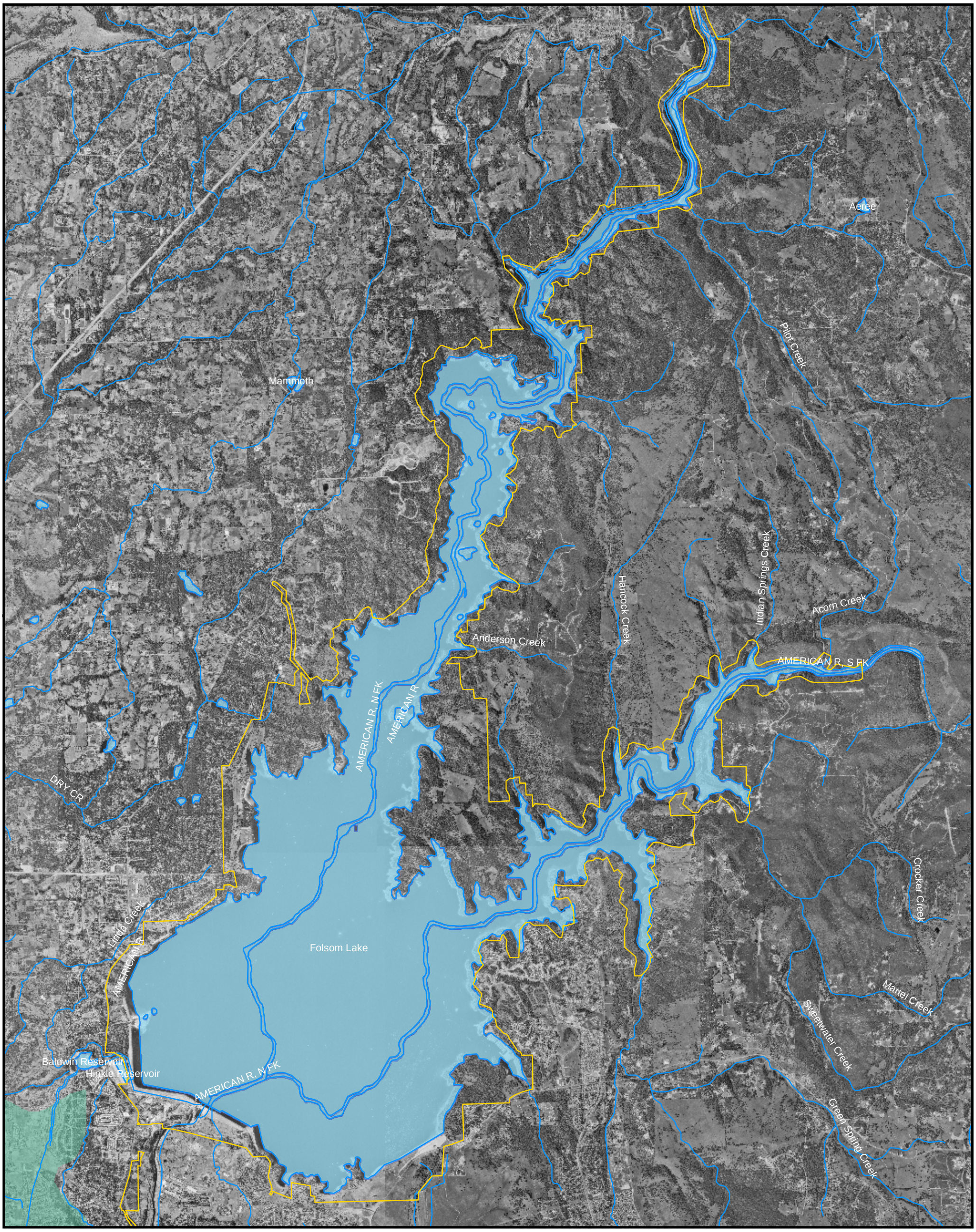
The Folsom Lake area lies within the Sacramento River Basin California Department of Water Resources Hydrologic Unit. The Folsom Lake hydrologic subarea designation is A06.A1. Lake Natoma and the surrounding area is designated A05.B1. The area upstream of Folsom Lake including the North and South Forks of the American River is hydrologic unit A06.A2 (Department of Water Resources, 1981).

Creeks around Folsom Lake

Several small creeks flow directly into Folsom Lake and Lake Natoma. Major creeks include Willow Creek, Alder Creek, Hinkle Creek, Mormon Ravine (fed from Newcastle Powerhouse releases and Placer County Water Agency surplus canal water), New York Creek, Hancock Creek, Sweetwater Creek, Kelly Ravine, Pilot Creek, Cooper Canyon, Anderson Creek, Indian Springs Creek, Deep Ravine, Knickerbocker Creek, and Skunk Canyon. A description of each of these major creeks is included below in Table H-1: Description of Major Creeks within the Unit. The hydrology of the Unit including the creeks and streams is mapped in Figures H-1a and H-1b.

Table H-1: Description of Major Creeks within the Unit

Creek Name	Discharge Point	Watershed Area (Acres)	Description
Willow Creek	Lake Natoma	2,700	"Highly Urbanized" by the City of Folsom; perennial.
Alder Creek	Lake Natoma	1,900	Lower reach – Commercial; Upper reach – Aerojet land and dredging piles; Rapidly developing East Folsom area drains into Alder Creek;
Hinkle Creek	Lake Natoma	1,000	Mostly rural housing and pasture lands; perennial.
Mormon Ravine	American River – North Fork	5,100	Some agricultural areas; seasonal
New York Creek	American River – South Fork	4,900	Some development in upper reaches; perennial
Sweetwater Creek	American River – South Fork	700	No significant development; seasonal
Kelly Ravine	American River – North Fork	4,300	No significant development; seasonal
Pilot Creek	American River – North Fork	500	No significant development; seasonal
Cooper Canyon	American River – North Fork	1,600	No significant development; seasonal
Anderson Creek	American River – North Fork	1,300	No significant development; seasonal
Indian Springs Creek	American River – South Fork	800	No significant development; seasonal
Deep Ravine	American River – South Fork	400	No significant development; seasonal
Skunk Canyon	American River – South Fork	2,200	No significant development; seasonal
Knickerbocker Creek	American River – North Fork	300	No significant development; seasonal



Unit Boundary

Creeks and Streams

Lake

Groundwater

N

0 0.3 0.6 1.2 1.8 2.4 Miles

FOLSOM LAKE STATE RECREATION AREA RESOURCE INVENTORY

FIGURE H-1a

Unit Hydrology

Prepared by LSA Associates, Inc., Psomas
Source: Psomas, USGS



Unit Boundary

Creeks and Streams

Lake

Groundwater

N

Miles

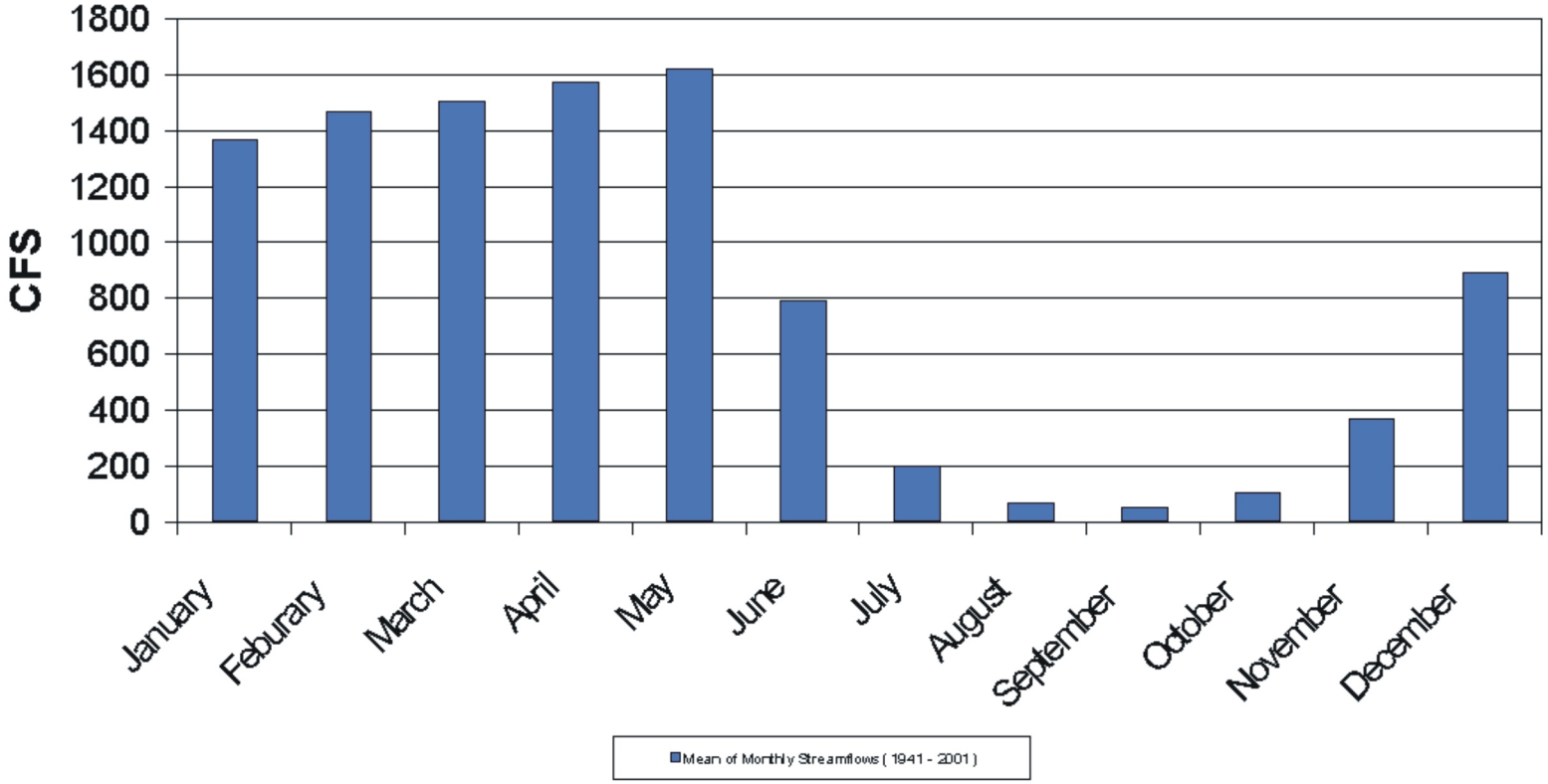
0 0.15 0.3 0.6 0.9 1.2

FOLSOM LAKE STATE RECREATION AREA RESOURCE INVENTORY

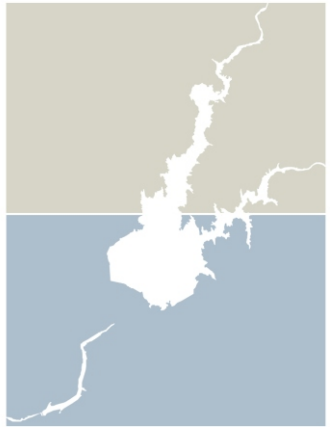
FIGURE H-1b

Unit Hydrology

Prepared by LSA Associates, Inc., Psomas
Source: Psomas, USGS



FOLSOM/LAKE/NATOMA



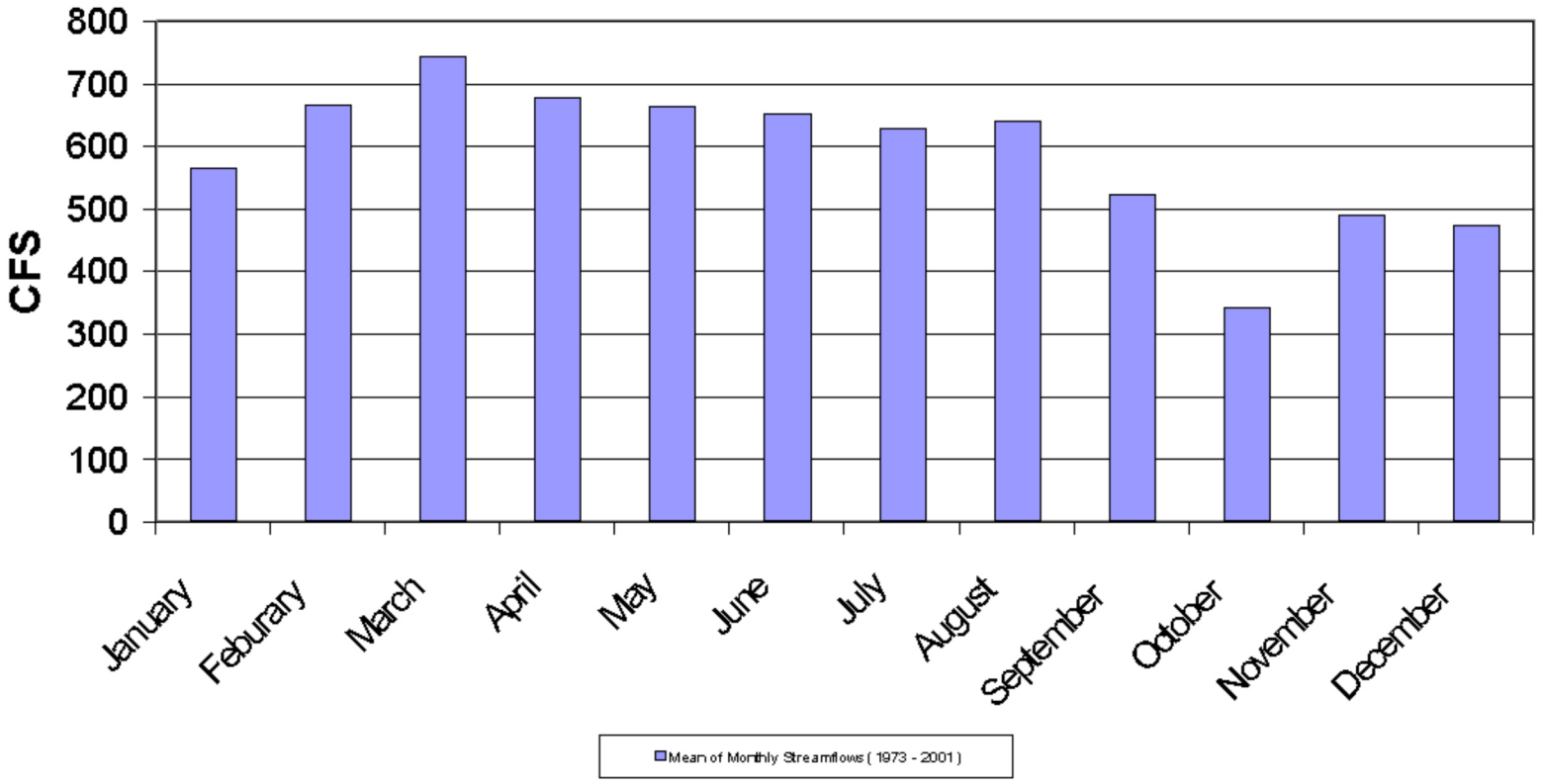
FIGURE

H-3

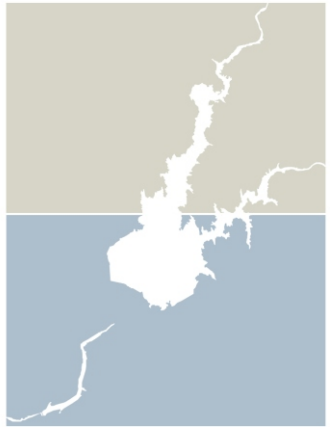
STREAMFLOW GRAPH
NORTH FORK

Prepared by PSOMAS

SOURCE: USGS



FOLSOM/LAKE/NATOMA



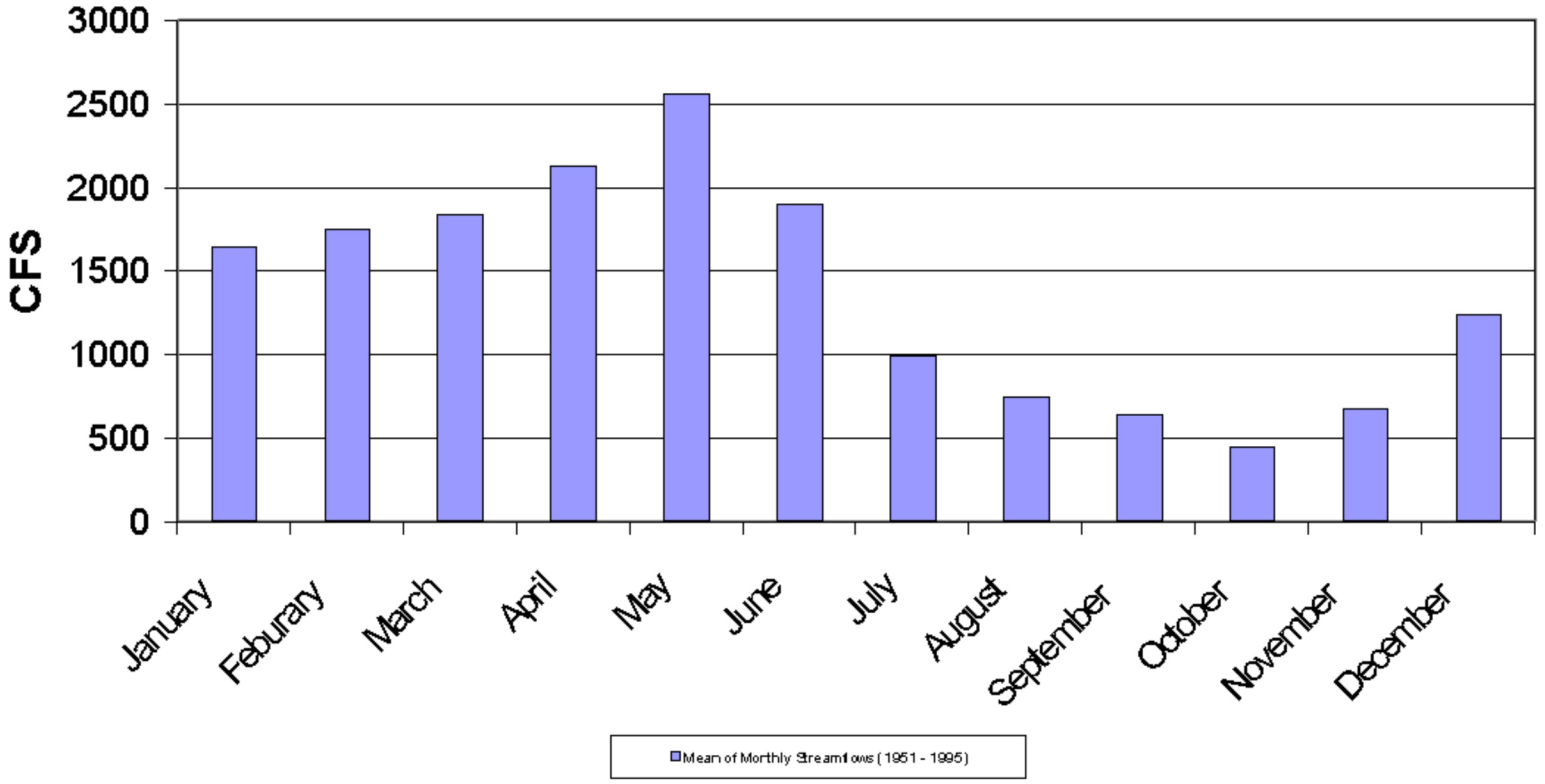
FIGURE

H-4

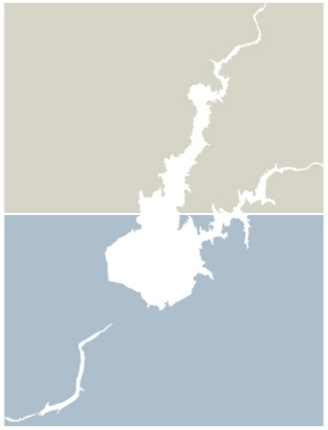
STREAMFLOW GRAPH
MIDDLE FORK

Prepared by PSOMAS

SOURCE: USGS



FOLSOM/LAKE/NATOMA



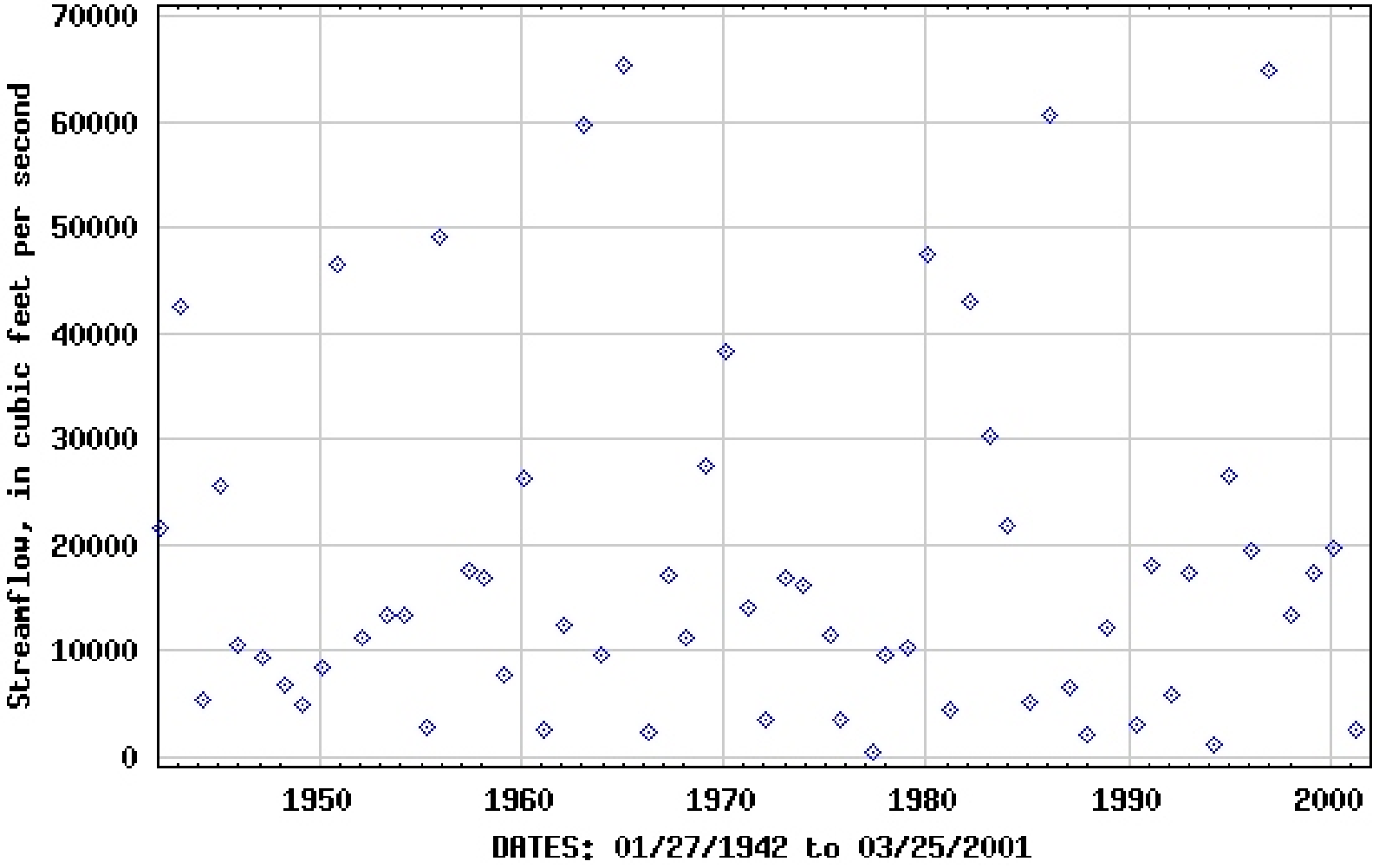
FIGURE

H-5

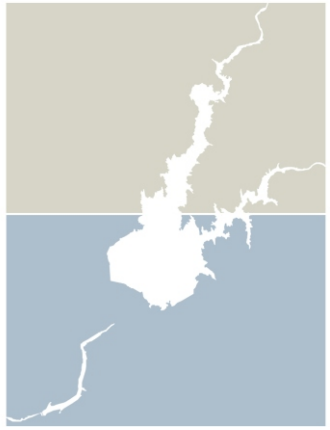
**STREAMFLOW GRAPH
SOUTH FORK**

Prepared by PSOMAS

SOURCE: USGS



FOLSOM/LAKE/NATOMA



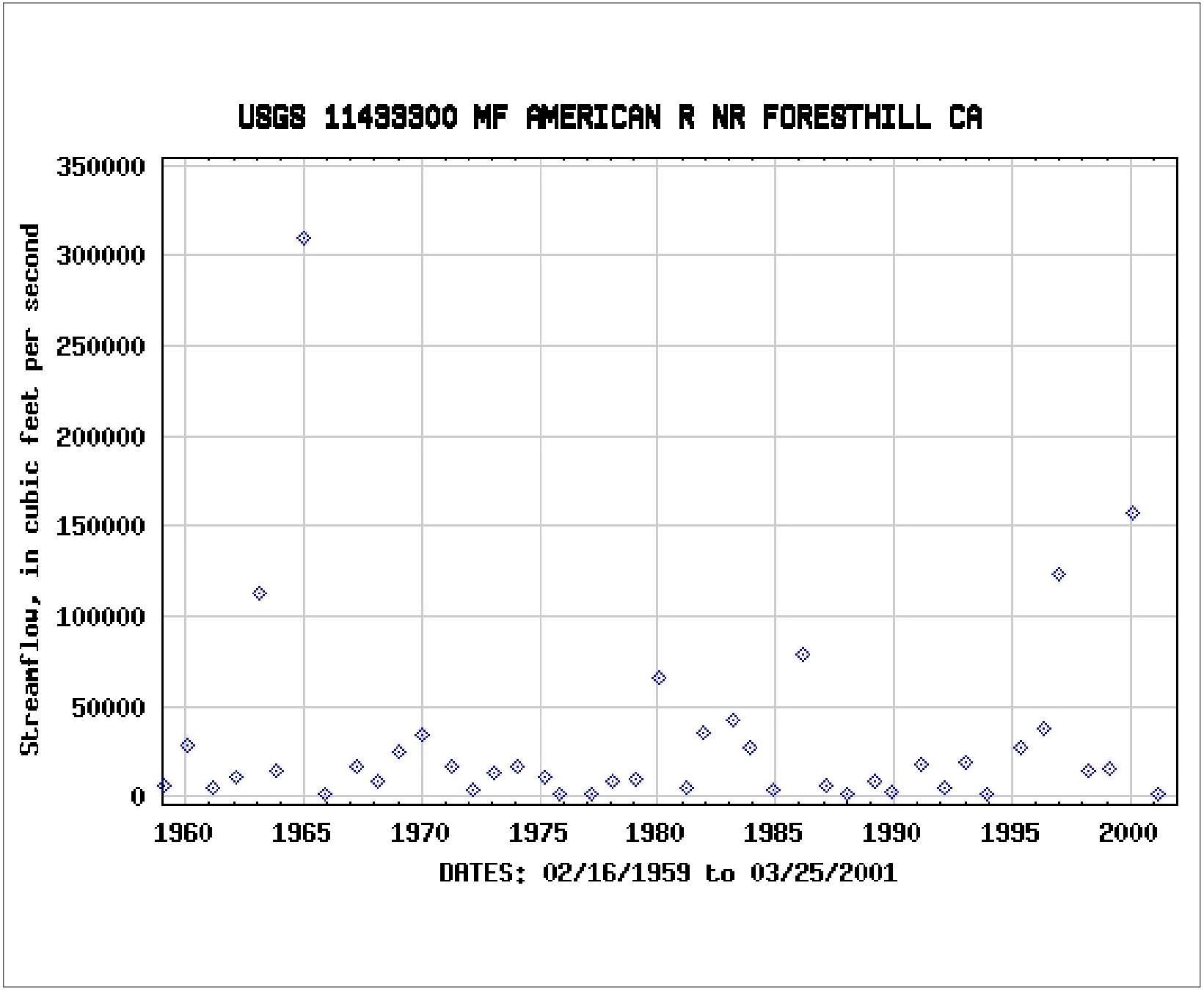
FIGURE

H-6

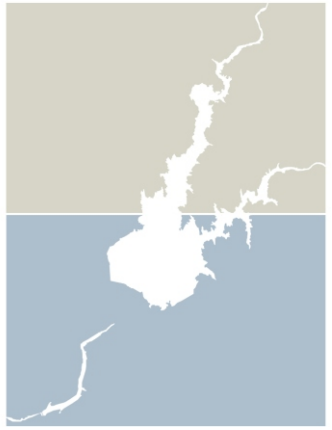
HYDROGRAPH
NORTH FORK

Prepared by PSOMAS

SOURCE: USGS



FOLSOM/LAKE/NATOMA



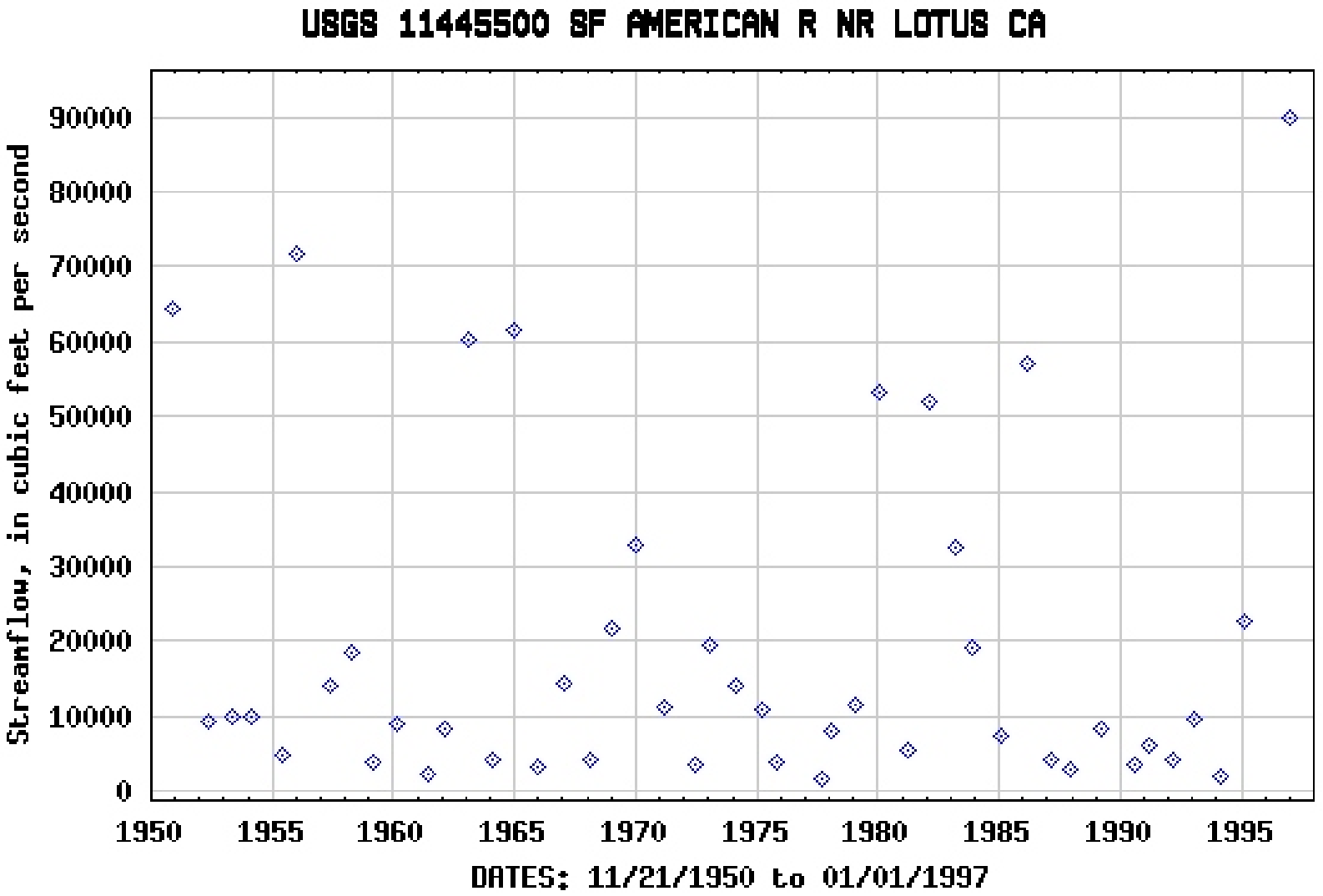
FIGURE

H-7

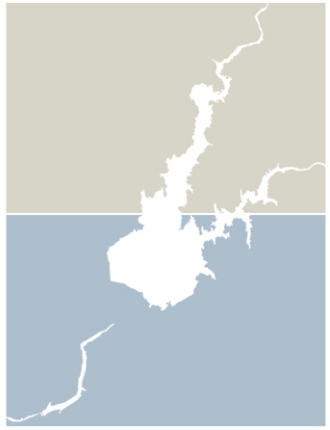
HYDROGRAPH
MIDDLE FORK

Prepared by PSOMAS

SOURCE: USGS



FOLSOM/LAKE/NATOMA



FIGURE

H-8

HYDROGRAPH
SOUTH FORK

Prepared by PSOMAS

SOURCE: USGS

Unfortunately, no USGS streamflow gauging stations are located on these major creeks; therefore, hydrographs are not available for these systems. Compared to the size of the American River Basin, these creeks are small and do not individually impact the hydrology of Folsom Lake. Creeks in the vicinity of the Unit are being impacted by the increasing amount of urban development in the area. Urban development creates impervious surfaces (rooftops, roadways, sidewalks) that prevent water (rainfall) from filtering into the ground. Added impervious surface increases stormwater runoff rates and volumes, which can instigate streambank erosion. Runoff associated with housing, roads and commercial development within nearby watersheds can negatively impact water quality by contributing sediment, petroleum residue, lead, zinc and other nutrients to the Unit's creeks and streams. During the summer months, landscape irrigation runoff from adjacent urban development can further increase stream flow rates and volumes and impact water quality by contributing nutrients from fertilized landscaping and bacteria from animal waste to the Unit's creeks and streams. A discussion of the water quality characteristics and concerns within the Unit is included in the Water Quality section of this Resource Inventory.

Hydrographs

The 100-year storm hydrograph for flow in the American River just downstream of Folsom Dam is shown in Figure H-2. The hydrograph was taken from the United States Army Corps American River Water, California Long-Term Study (ACOE. 2002.). The hydrograph also shows the impacts of the Folsom Dam Modification Project and the Folsom Dam Raise Project proposed by the ACOE.

As shown in the hydrograph, flows during a 100-year storm could exceed 350,000 cfs. During storm events, Folsom Dam would release 115,000 cfs. During a flood event (1 in 2 chance of occurring in any year), flows in the Lower American River could reach 40,000 cubic feet per second (cfs) if unregulated. Flood control storage within Folsom Dam would prevent flows from exceeding 25,000 cfs. During major flood events (between a 1-in-18 and 1-in-120 chance of occurring in any year), flows could reach between 160,000 cfs and 375,000 cfs if unregulated. Flood control storage within Folsom Dam would prevent flows from exceeding 115,000 cfs.

Figures H-3 through H-5 show mean monthly streamflows for the three major contributors to Folsom Lake, the North, Middle and South Forks of the American River. Hydrographs for these forks are shown in Figures H-6 through H-8.

Flood Maps

Storm events in 1986 and 1987, caused record flood flows and precipitation peaks in the American River Basin. Outflows from Folsom Lake combined with high flows on the Sacramento River resulted in water levels reaching the safety capacity of the levees that protect metropolitan Sacramento. These events raised significant concern over the adequacy of the existing flood control system and led to a series of investigations by the Sacramento Area Flood Control Agency (SAFCA), the ACOE, the State Reclamation Board and the Federal Emergency Management Agency (FEMA) into the need for improved flood protection for the Sacramento area (ACOE, 2002).

Early floodplain maps adopted by FEMA showed that the majority of flows generated by a 100-year storm could be contained within Folsom Lake with some flooding on the

northwestern side of the Lake where numerous CDPR recreational facilities exist. No major flooding would occur around Lake Natoma. Recent studies conducted by the ACOE have determined that earlier hydrologic studies of the American River are inaccurate and that existing FEMA floodplain maps are invalid. According to this new information (ACOE, 2002.), Folsom Dam can only provide flood protection for a 63-year storm event. A 100-year storm event would likely overtop the dam and cause extensive flooding around Folsom Lake, Lake Natoma and the Sacramento area. The ACOE and FEMA are currently in the process of updating floodplain maps based upon these new hydrological studies. Improvements related to the Folsom Dam Modification Project and the potential implementation of the Folsom Dam Raising Project will impact these maps. The FEMA Map is provided as Figures H-9a and H-9b.

Key to FEMA Map

Zone ANI	An area that is located within a community or county that is not mapped on any published FIRM (Area not included)
Zone A	An area inundated by 100-year flooding, for which no BFEs have been determined
Zone D	An area of undetermined but possible flood hazard
Zone X500	An area inundated by 500-year flooding; an area inundated by 100-year flooding with average depths of less than 1-foot or with drainage area less than 1 square mile; or an area protected by levees from 100-year flooding.
Zone X	An area that is determined to be outside the 100- and 500-year floodplains

Unit Boundary

ZONE

- A
- ANI
- D
- X
- X500

N

0 0.35 0.7 1.4 2.1 2.8 Miles

FOLSOM LAKE STATE RECREATION AREA RESOURCE INVENTORY

FIGURE H-9a

FEMA Zones

Prepared by LSA Associates, Inc., Psomas
Source: Psomas, FEMA

Unit Boundary

ZONE

- A
- ANI
- D
- X
- X500

N

0 0.150.3 0.6 0.9 1.2 Miles

FOLSOM LAKE STATE
RECREATION AREA
RESOURCE INVENTORY

FIGURE
H-9b

FEMA Zones

Prepared by LSA Associates, Inc., Psomas
Source: Psomas, FEMA

The Folsom Dam Modification Project, authorized by the United States Congress in 1999, is intended to reduce the probability of flooding in Sacramento in any year from 1 chance in 85 to 1 chance in 140 (ACOE, 2002). The first phase of the project will involve enlarging eight existing river outlets at Folsom Dam to permit increased capacity. Construction is expected to begin in early 2003 and be completed in about six years. In addition to the outlet modification, the ACOE will modify the use of surcharge storage in Folsom Lake – using both operational and physical means – to allow non-damaging releases to occur at Folsom Dam while allowing water levels in Folsom Lake to reach up to 474 feet (ACOE, 2002). Change to existing emergency release operation would reflect the new flood surcharge elevation of 474 feet for releases. Physical modifications to the dam itself would include replacement of three emergency spillway gates to allow an additional 3 feet of headroom above the new flood surcharge elevation of 474 feet (ACOE, 2002). In addition, an advance release strategy will be developed based on improved weather forecasts using the Advanced Hydrologic Prediction System of the National Weather Service. Under this strategy, the BOR would act on a five-day forecast of high flow to increase releases and accommodate incoming flood volumes.

Despite the improvements associated with the Folsom Dam Modification Project, the ACOE, BOR, and SAFCA have determined that Folsom Dam will not meet current federal dam safety standards without failure. As a result, these agencies have proposed to raise Folsom Dam by seven feet and increase the maximum flood pool water elevation from 474 feet to 482 feet (ACOE, 2002), effectively adding 95,000 acre-feet of storage capacity to Folsom Lake. This increased storage capacity would reduce the probability of flooding in Sacramento in any year to 1 chance in 213.

Dams within the Unit

There are two major dams within the Unit, Nimbus Dam on Lake Natoma and Folsom Dam on Folsom Lake. Both of these dams are operated by the BOR and were constructed as part of the Central Valley Project.

Nimbus Dam

Constructed in 1955, Nimbus Dam is almost 1,100 feet in length and 76 feet in height. Construction of the dam created Lake Natoma. Located immediately downstream of Folsom Lake, Lake Natoma serves as a regulating afterbay to stabilize flow releases to the Lower American River. Flows entering Lake Natoma from Folsom Lake can fluctuate widely as Folsom Dam responds to power generation needs. Daily water surface elevations in Lake Natoma typically fluctuate between four and seven feet. Lake Natoma is also the point of diversion for water in the Folsom South Canal. The completed portion of the Folsom South Canal extends from Nimbus Dam 27 miles south. In addition, Lake Natoma is used for water quality and temperature control that is essential to the preservation of spawning habitat for anadromous fish in the Lower American River and the success of the Nimbus Hatchery. The Nimbus Hatchery, located approximately 0.25 miles downstream of Lake Natoma, is operated and maintained by the California Department of Fish and Game and funded by the BOR. The hatchery spawns and rears chinook salmon and steelhead to compensate for the loss of 100 miles of upstream spawning and rearing habitat resulting from the construction of Folsom Dam.

Lake Natoma, with a storage capacity of 8,760 acre-feet, cannot provide significant flood storage and therefore has little effect on the flood hydrology of the American River. However, an adequate regime of flows and water temperatures from Folsom Lake and Lake Natoma are essential for creating favorable conditions for downstream populations of chinook salmon and steelhead. Carefully controlled water releases from Lake Natoma must balance fisheries needs with the demands for power generation, water supply deliveries, and Delta water quality standards. The Nimbus Dam Powerplant releases approximately 5,100 cfs. The Nimbus Dam Powerplant has two power generating units – each with a capacity of approximately 2500 cfs.

Folsom Dam

Folsom Dam, constructed in 1956, is located on the American River approximately 30 miles upstream of its confluence with the Sacramento River. Folsom Dam is 1,400 feet long and 340 feet high (CDPR website). The Folsom Lake reservoir provides flood protection for the Sacramento area; water supplies for irrigation, domestic, municipal, and industrial uses; power generation; and water-related recreational opportunities. In addition, Folsom Dam and Reservoir were designed to control water quality in the Sacramento Delta and are used to maintain flows that balance the needs of wildlife habitat, fish, and recreational use in and along the Lower American River (ACOE, 2002, Ch. 2).

Folsom Lake provides flood protection by storing extreme inflows and limiting outflows. The mean inflow to Folsom Lake is 2.4 million acre-feet per year. During normal operating conditions, Folsom Lake has a capacity to hold 975,000 acre-feet of water. At the elevation of the dam spillway, 475.4 feet, the lake has a maximum capacity of 1,120,200 acre-feet. Of the total capacity, up to 400,000 acre-feet is dedicated to flood control storage. Peak inflow during a 100-year storm event is approximately 353,537 cfs (ACOE, 2002). A flow of this magnitude would cause significant flooding and property damage in the American River basin downstream. During storm events, outflows are limited to 115,000 cfs to prevent such flooding and related property damage.

Due to the large volume of flood control storage available, Folsom Lake is a significant factor in flood control management for the Sacramento area. Due to its proximity to the Delta, the lake is also a key source of the Delta's water supply. Water released from Folsom Lake can quickly alleviate water supply and fish flow demands in the Delta.

Dams Upstream of the Unit

Multiple smaller dams and reservoirs are located in the American River upstream of the Unit. These dams were created for hydropower plants. The major reservoirs are summarized in Table H-1.

According to the ACOE, the 47,000 acre-feet of available flood control storage from these reservoirs is insufficient to capture the amount of runoff generated within the American River Basin (ACOE. 1992.). As such, these reservoirs do not provide a significant level of flood protection nor greatly impact the hydrology of the American River during large storm events. Furthermore, these reservoirs regulate only 14 percent of the drainage area and are disproportionately concentrated in the upstream area of the Middle Fork of the American River.

These reservoirs impact the hydrology of the American River by helping to mitigate the potential for reduced flows in the summer when rainfall is low and water supply and power generation demands are high. Water releases from these upstream reservoirs combined with

Table H-2: Major Reservoirs in the Upper American Drainage Area

Reservoir	Stream/American River Tributary	Owner[1]	Elev. Top of Dam (ft)	Capacity (ac-ft)
Lake Clementine	North Fork	COE	716	10,600
French Meadows	Middle Fork	PCWA	5271	133,700[2]
Hell Hole	Rubicon Riv/Middle Fork	PCWA	4650	208,400
Stumpy Meadows	Pilot Creek/Middle Fork	GDPUD	4272	20,000
Loon Lake	Gerle Creek/Middle Fork	SMUD	6418	76,500
Union Valley	Silver Creek/South Fork	SMUD	4578	271,000[2]
Ice House	South Fork Silver Creek/ South Fork	SMUD	5454	45,960[2]
Slab Creek	South Fork	SMUD	1870	16,600
Cables Lake	Caples Creek/ South Fork	PG&E	7960	21,581
Silver Lake	Silver Fork/South Fork	PG&E	7211	3,800
Ralston After Bay	Rubicon Riv/ Middle Fork	PCWA	1189	850
Chili Bar	South Fork	PG&E	1029	3,700
Gerle Div Dam	Gerle Creek/ South Fork	SMUD	5240	1,380
Junction Div Dam	Silver Creek/ South Fork	SMUD	4468	3,250
Camino Div Dam	Silver Creek/ South Fork	SMUD	2918	845[3]
Rubicon Sp.	Middle Fork	SMUD	6251	1,450
Oxbow	Middle Fork	PCWA	--	2,800
	TOTAL			822,416

[1] COE - Corps of Engineers
PCWA – Placer County Water Agency
GDPUD – Georgetown Divide Public Utility District
SMUD – Sacramento Municipal Utility Water District
PG&E – Pacific Gas and Electric Company

[2] Effective storage is reduced during winter months for dam safety.

those from Folsom Lake and Lake Natoma ensure adequate flows are available to meet fisheries needs as well as demands for power generation and water supply deliveries.

Hydropower Plants within the Unit

Three hydropower plants are located within the Unit, the Newcastle Powerhouse at Mormon Ravine, the Folsom Dam Powerhouse and the Nimbus Dam Powerhouse. PG&E operates the Newcastle Powerhouse. The BOR operates both the Folsom Dam and Nimbus Dam Powerplants, which were constructed as part of the Central Valley Project.

Numerous hydropower plants exist outside of Unit boundaries in the upper portions of the American River Basin. However, a detailed description of these facilities has not been included as part of this Resource Inventory.

Newcastle Powerhouse at Mormon Ravine

The Newcastle Powerhouse, operated by PG&E, is located off of Rattlesnake Road near Mormon Ravine. The powerhouse is on the north side of the North Fork of the American River, approximately 4 miles downstream of where the North Fork enters into Folsom Lake. The plant was constructed in 1986 and has a maximum operating capacity of 11.5 Megawatts (MW).

The hydroplant generates electricity using surplus raw water from Placer County Water Agency (PCWA) canals. Outflow from the single penstock (sluice or gate to control water flow) flows through the South Canal and into Folsom Lake. Since the water supply from PCWA is limited during times of the year, PG&E does not operate the plant at full capacity year round nor does PG&E have any plans to expand this plant. Compared to the releases from the Nimbus and Folsom Dam Powerhouses, water outflow from the plant is negligible.

The powerhouse transmission line connects to the PG&E owned Placer-Goldhill transmission line near the beginning of Rattlesnake Bar Road on the Peninsula. The Placer-Goldhill transmission line runs along the east side of Folsom Lake and is discussed in more detail in the Utilities Section of this Resource Inventory.

Folsom Dam Powerplant

The Folsom Dam Powerplant, operated by the BOR, was completed in 1956 with the construction of Folsom Dam. Three separate penstocks in the dam feed three generating units which produce up to 215,000 kW (WAPA 2000) of power. Power is distributed by the Western Area Power Administration (WAPA).

Water releases associated with powerplant operation are highly variable with a maximum outflow of 8,603 cfs (WAPA, 2000). The Folsom Dam Powerplant provides supplemental power supply during hours of peak demand. When electrical demands are low, powerplant operation is not necessary and therefore, no water releases occur (ACOE, 2002).

The Folsom Dam Powerplant is a significant source of electrical energy for Northern California. The plant was constructed as part of the Central Valley Project in which eight

hydropower plants and several water supply reservoirs were constructed to provide up to 2.044 million kW of electricity (ACOE. 2002). These hydropower plants account for 16% of the total energy generated within the State of California. The Folsom Dam Powerplant accounts for approximately 2% of California's total power generating capability.

The operation of the powerplant is critical to meeting California's energy needs. Despite this, no current plans to expand the power facility exist. However, the continued growth of California and the demand for power may increase pressure to expand this facility in the future.

Nimbus Dam Powerplant

The Nimbus Dam Powerplant, operated by the BOR, was completed in 1955 with the construction of Nimbus Dam and was part of the Central Valley Project Two penstocks in the dam feed two generating units which produce up to 17,000 kW (WAPA, 2000) of power. Power is distributed by the WAPA. According to the Western Area Power Administration (WAPA 2000), the maximum flow of water that the power plant can release is 5,100 cfs. Powerplant releases are not as variable as releases from the Folsom Dam Powerplant. This is due to the fact that the powerplant is operated continuously throughout the day (ACOE 2002).

Water releases associated with powerplant operation are not as variable as releases from Folsom Dam Powerplant because the Nimbus Dam Powerplant is operated continuously throughout the day (ACOE, 2002). Maximum flow of water release is 5,100 cfs (WAPA, 2000).

The Nimbus Dam Powerplant is not a significant source of electrical energy. It accounts for less than 1% of the 2.044 million kW of electricity generating capacity of the eight hydropower plants in the Central Valley Project. The powerhouse accounts for less than 0.14% of the total energy generated within the State of California.

No plans to expand the power facility currently exist. However, the continued growth of California and the demand for power may increase pressure to expand the facility in the future. Expansion of the facility is constrained by a lack of available land and restrictions on the outflow from Lake Natoma.

Major Water Diversions within the Unit

Several water agencies and entities hold entitlements to water from the American River. Major water users are listed in Table H-2. The contract amount represents the total water allotment each agency may obtain through its contract with the Central Valley Project. Most agencies are taking only a portion of the water to which they are entitled to (see the 1990 Deliveries amounts in the table). As California continues to grow, demand for water from the American River will also increase.

Table H-3: American River Central Valley Project Contracts and Deliveries[1]

Contracting Entity	Contract	1990
North Area Water Rights		
Natomas Diversions (Folsom and Southern California Water Co.)	32.0	18.0
North Fork Ditch (SJWD)	33.0	33.0
Folsom Prison	4.0	1.0
Subtotal	**69.0**	**52.0**
El Dorado Diversions		
El Dorado County CVP Water	25.8	25.0
El Dorado Water Rights	4.7	4.0
Subtotal	**30.5**	**29.0**
Others		
Placer County CVP Water	117.0	0.0
Placer County Water Rights	120.0	9.0
San Juan Water Dist. CVP Water	11.2	11.2
City of Roseville	32.0	11.0
FSC-Sacramento County Irrigation	0.0	10.0[3]
FSC-EBMUD	150.0	0.0
FSC-SMUD (60,000 ac-ft of CVP Water)	75.0	12.0
FSC-Losses	20.0	20.0
City of Sacramento	230.0	50.0
Carmicheal Irrigation Dist. & Riparian	56.0	0.0
Subtotal	**811.2**	**123.2**
Total	**910.7**	**204.2**

Note: FSC = Folsom South Canal

DMC = Delta-Mendota Canal

SLC = San Luis Canal

SJWD = San Juan Water District

SMUD = Sacramento Municipal Water District

CVP = Central Valley Project

[1] Source: USBR, Mid-Pacific Region

[2] Amounts are in 1,000 ac-ft.

[3] Interim Water Contracts

Of the water agencies mentioned above, only a portion of them take water directly out of Folsom Lake or Lake Natoma. Total water supply demands from Folsom Lake equal roughly 140,000 acre-feet per year (ACOE 2002). Total water supply demands from Lake Natoma equal approximately 20,000 acre-feet per year via the Folsom South canal (ACOE 2002). Water supply demands from the lower part of the American River, downstream from Lake Natoma, equal approximately 105,000 acre-feet.

Major diversions out of Folsom Lake and Lake Natoma are summarized in Table H-3. Water users not mentioned in the table obtain water from either the American River downstream from Lake Natoma or through the Sacramento Delta.

Existing water diversions do not significantly impact the hydrology of Folsom Lake or Lake Natoma on a regular basis. If all water agencies began to take their full allotment of water, the availability of water in the American River would be significantly impacted. To receive their full allotment of water, each agency would likely be required to undergo an environmental review and application process.

At times, existing water diversions from the American River do impact the hydrology of the American River, especially during the summer months when rainfall is low and irrigation demands are higher. These impacts are exacerbated when water from Folsom Lake is used to alleviate water fluctuation problems in the Delta (WAPA 2000).

Table H-4: Folsom Lake SRA Existing Diversion Points and Service Areas

Diversion Point	Service Area
Folsom Lake Dam	San Juan Water District (Citrus Heights Irrigation District) (Orangevale Mutual Water District) (Fairs Oaks Water District) (Placer County Water Agency) City of Folsom Folsom Prison City of Roseville
Folsom Lake at the South Fork Arm	El Dorado Irrigation District
Folsom South Canal out of Lake Natoma	Arden Cordova Water District Omochumne Hartnell Water District Galt Irrigation District Clay Water District Sacramento Municipal Utility District Sacramento County Water Agency, portions Mather Air Force Base EBMUD

Source: ACOE, 1992

Lake Levels

The monthly minimum and average lake levels for Folsom Lake and Lake Natoma are summarized in Table H-4 below. The data was analyzed using daily lake levels from October 1, 1975 through February 25, 2003. All elevations are given in feet above sea level. Lake level data was provided by the Central Valley Operations division of the BOR and was analyzed and compiled by Psomas.

Table H-5: Folsom Lake and Lake Natoma Lake Levels by Month (10/1/1975 through 2/25/2003)

Month	Folsom Lake			Lake Natoma		
	Minimum Lake Level	Maximum Lake Level	Average Lake Level	Minimum Lake Level	Maximum Lake Level	Average Lake Level
January	351.99	455.65	411.26	120.65	125.40	123.55
February	352.25	465.74	415.85	120.67	125.80	123.56
March	356.76	451.59	424.18	121.09	125.83	123.64
April	382.71	461.44	434.41	120.41	125.80	123.63
May	384.98	464.91	441.67	120.76	125.60	123.71
June	376.45	465.51	444.18	120.68	125.60	123.77
July	364.73	465.42	435.21	121.26	125.60	124.05
August	354.80	461.30	423.38	120.10	125.50	123.92
September	349.58	452.59	417.66	120.63	125.80	123.76
October	348.82	443.73	411.59	118.48	125.40	123.85
November	347.56	442.60	405.69	120.16	125.70	123.73
December	349.41	447.05	405.24	120.58	125.40	123.70

Although the primary function of Folsom Dam is flood control, the reservoir stores water for irrigation and domestic use and for electrical power generation. The dam also plays a role in the preservation of the American River fishery and the downstream control of salt-water intrusion in the Sacramento-San Joaquin Delta. Lake levels can fluctuate significantly depending on hydrological and meteorological conditions, water demands and flood control and hydropower needs, however water levels are largely dictated by water supply and flood

protection releases. Lake levels normally vary from about 466 feet in early summer to about 406 feet in early winter.

Lake Natoma is a regulating afterbay used to modulate flow fluctuations from the Folsom Powerplant into the American River and to generate electricity from water releases. The water levels in Lake Natoma can be controlled via releases from Folsom Lake. As a result, water levels in Lake Natoma do not vary significantly (between four and seven feet) and are not sensitive to variations in hydrological and meteorological conditions.

Future Projects

There are four major flood control or water supply projects that will impact the water resources and hydrology within the Unit, the El Dorado Irrigation District Raw Water Intake expansion, the San Juan Water District Peterson Water Treatment Plant expansion, the Folsom Dam Modification Project, and the Folsom Dam Raise Project.

El Dorado Irrigation District Raw Water Intake Expansion

The El Dorado Irrigation District plans to expand the existing water intake facility on the South Fork of the American River. The intake facility, located near the end of Planeta Way, includes water intake pipelines, a surge tank and a building that houses the pump station and electrical controls. The entire facility is located within the Unit on BOR property. The Irrigation District also has an easement for an existing 30" raw water line from the intake facility.

The Irrigation District plans to expand the intake facility by replacing five existing separate intake lines with one nine- foot diameter intake structure. In addition, the Irrigation District will expand the capacity of the intakes and pumps from 20 Million Gallons per Day (MGD) to 48 MGD. A new 42" transmission main will be added parallel to the existing 30" transmission main leaving the intake facility.

The total water demand required by this project is minor compared to the volume of water in Folsom Lake, therefore the expansion project will not significantly affect lake levels or the hydrology of the lake. The project will visually impact the Unit and impart some low-level noise impacts. Easement issues will constrain future development plans within the Unit. Impacts related to this project are discussed in greater detail in the Utilities Section of this Resource Inventory.

San Juan Water District Peterson Water Treatment Plant Expansion

The San Juan Water District plans to expand the Peterson Water Treatment Plant. The Water District has leased Parcel C from the Bureau to provide the required additional space. Impacts related to the Parcel lease acquisition are discussed in greater detail in the Utilities Section of this Resource Inventory. Expansion of the plant will provide a possible replacement water supply for American River groundwater pumping demands in the Sacramento area. The project would supplement winter water supply to help alleviate groundwater demands and allow for more groundwater recharge.

The San Juan Water District obtains water from Folsom Lake via an 84" diameter pipeline from Folsom Dam. The total water demand required by the San Juan Water District is minor compared to the volume of water in Folsom Lake, therefore, this expansion project will not significantly affect lake levels or the hydrology of the Lake.

Folsom Dam Modification Project

As mentioned earlier in this section, heavy storms in February 1986 resulted in a flood higher than any flood previously on record. Precipitation totals for the 1986 storm (which lasted 10 days) were more than half the normal annual rainfall. Significant flooding resulted along the Sacramento and American Rivers.

As a result, the ACOE, in conjunction with other agencies, re-evaluated the hydrology of the American River Basin and the existing flood control system. Using updated storm information and inflow data, the ACOE now believes that the Folsom Dam can only control storm flows for an event with a 63-year recurrence interval. The Folsom Dam Modification Project would increase Folsom Dam's storm flow control capability to handle a 140-year event.

The Folsom Dam Modification project includes improvements to the outlet structures as well as physical and operational modifications to the use of surcharge storage. The maximum flood control release is currently 115,000 cfs. Improvements to the spillway and release outlets would increase flood control release capacity to 160,000 cfs. According to the ACOE, the levees on the American River downstream of the Folsom Dam can now accommodate up to 160,000 cfs due to recent levee improvements (ACOE 2002).

New operation procedures would allow the BOR and the ACOE to control an additional 270,000 acre-feet of water within Folsom Lake and to provide up to 670,000 acre-feet of flood control storage. In addition, an advance release strategy based on improved weather forecasts would allow the BOR to increase releases and accommodate incoming flood volumes based on an accurate five-day flow forecast.

Folsom Dam Raise Project

Despite improvements related to the Folsom Dam Modification Project, the ACOE is proposing to raise Folsom Dam by 7 feet. The dam-raising project would allow for maximum lake levels to increase by up to 8 feet. The main purpose of the project would be to provide greater flood control protection for the Sacramento area.

The Folsom Dam Raise Project would raise the elevation of the top of the dam from 480.5 feet to 487.5 feet. The maximum flood elevation would be increased from 474 feet to 482 feet. The Folsom Dam Raise Project would provide an additional 96,000 acre-feet of flood control storage space. The ACOE currently reserves 400,000 acre-feet of space in the lake for flood control purposes.

Implementation of the Folsom Modification Project and the Folsom Dam Raise Project will cause greater fluctuation in lake levels than currently exists because the BOR would release more water during the winter to allow for increased flood control storage. In addition to greater lake level fluctuation, some of the long term impacts related to these two projects include flooding of several lots in the Mooney Ridge subdivisions, inundation of a majority

of existing CDPR facilities around Folsom Lake as well as the Newcastle Powerhouse and, damage to existing vegetation during periods of inundation.

According to Gold Fields District staff, the CDPR and the BOR constructed many of their recreation facilities based on information provided by the ACOE stating that the maximum water operational level would be 466 feet. Given that flood levels associated with a 63-year storm event can currently reach over 474 feet, many buildings and facilities within the Unit could be inundated in such an event. Unit facilities at risk are Beals Point, Observation Point, Browns Ravine, portions of the Peninsula, Granite Bay, Rattlesnake Bar, Old Salmon Falls lower parking lot, Salmon Falls, and part of Skunk Hollow.

The ACOE claims that the long-term operational effects of the dam-raising project would be less than significant (ACOE 2002) because the risk of flood occurrence is low and the inundation period would be brief (1 to 3 days), and would likely occur during the winter months when most vegetation is dormant. According to ACOE claims, the native vegetation is also naturally tolerant of inundation.

Temporary construction impacts would also result from implementation of these two projects. The ACOE has proposed to use excavated dredge tailing material in the construction of the dam raise project. Two potential borrow pits have been identified within the Unit, one at Mississippi Bar and one on the Folsom Peninsula. Vegetation and wildlife habitat located near the Folsom Dam and the proposed borrow pits would be significantly impacted by construction activities. Construction activities would also impact visual and recreation resources in the Unit and create additional noise, traffic, and air quality impacts.

Groundwater

Groundwater is not recognized as a major resource in the area due to the Unit's underlying geology composed of crystalline or nonporous metamorphic rocks. However, within Unit boundaries, minor groundwater resources may be found along fracture zones in the crystalline rocks. Currently, wells are being used to provide water at several locations within the Unit, including Rattlesnake Bar, the Peninsula campground and boat launch, the residences at Nimbus Flat, and the Shadow Glen stables. Fractured aquifers do not generally support high yield wells therefore surface sources will probably be the primary resource for drinking or irrigation water.

Regional aquifers occur west of the region of outcropping metamorphic and granitic rocks. The main resource is the unconfined Holocene alluvium aquifer that thickens to the west, towards the Central Valley. Only three nearby water wells are listed in the California Department of Water Resources database (http://wdl.water.ca.gov/gw/admin/main_menu_gw.asp).

Septic Systems

Soil is thin over most of the Unit area, with bedrock close to – or at the surface in many areas. Successful septic and leach field systems require several hundred square feet of space where fluids can percolate into the ground. As most of the bedrock is fairly non-porous and the soil is thin, there appear to be few areas where successful septic systems or leach fields

could be installed in the Unit. Individual assessment of a proposed site using percolation tests would be required to determine if it could support a septic system or leach field. More information regarding the capabilities and constraints of septic and sewer systems within the Unit is provided in the Utilities Section of this Resource Inventory.

High Water Table

The presence of a high water table can interfere with natural drainage, percolation in leach fields, and cause overflow in septic systems. As there is no continuous aquifer in the upper park area, most areas within the site do not experience a high water table. Rather, low areas may become water-logged due to the presence of impermeable material (bedrock) below the soil layer. New development planned for the Unit should consider the local groundwater conditions on a site-by-site basis.

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ENVIRONMENTAL CONDITIONS

WATER QUALITY

Folsom Lake State Recreation Area

April 2003

by

LSA Associates, Inc.

157 Park Place

Pt. Richmond, CA 94801

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WATER QUALITY

Introduction

This section discusses water quality characteristics of Folsom Lake, Lake Natoma and the American River in the vicinity of Folsom Lake State Recreation Area (the Unit). The information contained in this section is based on several sources, as follows: 1) a review of reports, documents and environmental plans for the Unit and other projects proposed for the area, including the Regional Water Quality Control Board - RWQCB (1998), Army Corps of Engineers - ACOE (2001a and b), Surface Water Resources Inc. - SWRI (2001), Placer County Water Agency - PCWWA (2002); U.S. Geological Survey - USGS (2002), National Water Information Systems (2003); 2) site visits conducted on July 10 and October 6, 2002 to inspect areas potentially prone to water quality problems such as public beaches and camping areas; and 3) interviews with resource agency personnel familiar with the area. Agency personnel interviewed include: Peter Vonich, Brian Deason and Sandi Richerson of the BOR; Jim Micheals and Shana Avalos of the CDPR; Ken Christiansen of the Folsom Lake Marina; and Mary Taylor of the Sacramento County Department of Environmental Management. The El Dorado County Department of Environmental Management and the Placer County Department of Environmental Health were contacted but they had no pertinent water quality data. RWQCB personnel interviewed include: Rick Humphreys, Steve Rosenbaum, George Day, Pat Leary, and Richard McHenry. Charles Alpers of the USGS was interviewed regarding recent mercury studies in Lake Natoma.

Existing Water Quality

The vast majority of water entering Folsom Lake and Lake Natoma is well oxygenated, cold water of high quality. As water flows through the two lakes, it is impacted by various sources of water quality degradation that cause water quality problems. Primary water quality problems include excessive sediment inflow from development in local runoff, nutrient inflow to Alder Pond, mercury bioaccumulation in fish from abandoned mining tailings, bacterial contamination of waters heavily frequented by waterfowl, and occasional sewage spills in the watershed from wastewater treatment plants. Despite these problems, water leaving Lake Natoma remains of high enough quality to generally meet State water quality standards.

Seasonal temperature stratification processes play an important role in lake water quality conditions. Folsom Lake becomes thermally stratified each spring and maintains a separation between the warmer waters of the top layer (epilimnion) and the cold water pool comprising the bottom layer (hypolimnion). Thermal stratification begins in April, continues through the summer and holds into November when winds and inflow begin to mix the top and bottom layers. During the summer, the epilimnion temperature is typically 78 to 72 degrees F (25.5 to 22 degrees C) from the surface down to a depth of 35 feet.

A relatively broad zone of temperature change called the metalimnion or thermocline lies beneath the epilimnion. A depth of 65 feet is needed before the water temperature drops to

60 degrees F (15.5 degrees C). Near the bottom of the reservoir the summer water temperature lowers to 48 degrees F (9 degrees C). Dissolved oxygen levels in the upper warm layer were 8 mg/L in late July of 2002 and 6 mg/L at a depth of 195 feet in the hypolimnion (Brian Deason, BOR *pers. com.*).

Lake Natoma does not thermally stratify because water released into it from Folsom Lake flows through quickly to Nimbus Dam. The upper one third of Lake Natoma has a "plunge zone" defined by the cold water from Folsom Dam release moving along the bottom of the regulating reservoir. As the waters spread out over the wider portions of Lake Natoma they become warmer. Typical summer water temperatures in Lake Natoma are in the range of 58 to 70 degrees F (14.5 to 21 degrees C) (Brian Deason, BOR *pers. com.*). As in Folsom Lake, the waters of Lake Natoma are well oxygenated throughout the year.

Water releases from Folsom Lake to Lake Natoma are managed to maintain cold water temperatures in the Lower American River throughout the year. These water releases help maintain water temperatures suitable for anadromous steelhead and chinook salmon in the Lower American River below Nimbus Dam.

Several sources of water quality data were used in the following water quality discussion. These are summarized below:[1]

- ***Bureau of Reclamation Sampling Stations*** - The BOR has three water quality sampling stations in or near the Unit. These are located on the American River below Folsom Dam [Station # BS-MN-10]; on the American River at the headwaters of the South Canal, on Lake Natoma [Station # BS-MN-16]; and behind Folsom Dam at the outlet to the American River [Station # BS-MN-17]. Parameters analyzed for the quarterly water samples from these stations include fecal coliform, heavy metals, nutrients, organic priority pollutants, and a wide variety of pesticides.

  Sampling results currently available for review cover the period from February 1999 to November 2000 for the American River below Folsom Dam, and February 2001 to February 2002 for the other two stations. More recent sampling results exist, but are not yet available for public review (Peter Vonich, BOR pers. com.). Because of the extensive analyses for pesticides and Polycyclic Aromatic Hydrocarbon (PAH) compounds, the available data for 1999 through 2002 comprises 64 pages and are too lengthy to include in this document. However, results for these parameters are summarized. Analysis results for fecal coliform, nutrients, mercury, and MTBE are presented in Tables WQ-1 and WQ-2.

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[1] The ***National Water Information Systems*** (NWIS 2003) has monitoring stations located along the rivers and lakes above Folsom Lake, at the Folsom Dam, and at Nimbus Dam. However, most of the NWIS stations above Folsom Lake do not appear to be presently active and the data available from this site are 12 to 20 years out of date. For this reason, these data are not included in this section as more current water quality information has been used whenever possible.

- ***Sacramento County Department of Environmental Management Sampling Data*** - The Sacramento County Deptartment of Environmental Management conducts occasional bacteriological tests of swimming beaches in the two lakes. These data are included in Table WQ-3.

- ***Sacramento Coordinated Monitoring Program (CMP) -*** Managed by Steve Nebozuk of the Sacramento Regional Central Sanitation District, this program maintains a water quality monitoring station on the American River below Nimbus Dam. This program has monthly sample data from 1992 to the present with a large number of pesticides and PAHs included in the analyses. As with the BOR data noted above, the CMP data includes analyses for the pesticides Malathion, Chlordane, Carbofuran, Diazinon, Lindane and many others. A review of these data found no detectable levels of pesticides. The CMP data are too extensive to include in this document, but monthly readings (June 2001 through June 2002) of dissolved oxygen, water temperature, and pH are graphed in Figure WQ-1.

Ambient water quality conditions in the Lower American River below Nimbus Dam generally meet applicable regulatory standards as set forth in the Water Quality Control Plan ("Basin Plan") for the Central Valley Region (RWQCB 1998). Concentrations of contaminants typically increase downstream from Nimbus Dam to the Sacramento River as the river receives runoff from more urbanized drainages (SWRI 2001). Folsom Lake, Lake Natoma and the American River, down to the Sacramento River, are recognized in the RWQCB Basin Plan as water bodies that provide a series of "beneficial uses" to the public. These beneficial uses must be taken into consideration when establishing water quality objectives and evaluating impacts of any proposed activity on water quality. The beneficial uses specifically provided by Folsom Lake and Lake Natoma are the following:

- municipal and domestic water supply;
- irrigation water for agriculture;
- hydropower;
- water contact recreation;
- non-contact water recreation;
- warm water freshwater habitat;
- cold water freshwater habitat;
- fish spawning; and
- wildlife habitat.

Under the Basin Plan, the State of California defines specific water quality objectives that should be attained in order to protect and maintain the beneficial uses of Folsom Lake, Lake Natoma and the American River downstream. Discussed below are the key water quality objectives for these systems and what is currently known about existing conditions relating to each of these objectives.

Table WQ-1: Selected Water Quality Parameters from BOR Sampling Stations between Folsom Lake and Nimbus Dam

American River below Folsom Dam		Date of Sampling							
(Station # BS-MN-10)	Units	2/16/99	5/18/99	8/24/99	11/8/99	3/6/00	5/15/00	8/16/00	11/7/00
Fecal Coliform	MPN/100mL	80	7	50	1600	270	>1600	50	6
Nitrate & Nitrite as N	mg/L	0.180	0.056	<0.100	0.220	0.120	0.230	<0.050	<0.050
Total Phosphorus as P	mg/L	<0.050	<0.050	<0.100	<0.100	0.013	0.070	0.029	0.011
Tot. Dissolved Solids	mg/L	46	49	20	50	53	91	31	40
Mercury (dissolved)	ug/mL	0.006	<0.01	<0.01	<0.01	0.011	0.013	<0.005	<0.005
MTBE	ug/mL	ND	<0.5	---	<0.5	<0.5	<0.5	<0.5	<0.5
Headwaters of South Canal at		**Date of Sampling**							
Lake Natoma (Station # BS-MN-16)	**Units**	**2/27/01**	**5/17/01**	**8/6/01**	**11/5/01**	**2/13/02**			
Fecal Coliform	MPN/100mL	27	300	30	4	14			
Nitrate & Nitrite as N	mg/L	0.060	<0.050	<0.050	<0.050	0.080			
Total Phosphorus as P	mg/L	0.025	0.029	<0.010	<0.010	0.180			
Tot. Dissolved Solids	mg/L	36	36	34	39	38			
Mercury (dissolved)	ug/mL	<0.005	<0.005	<0.005	<0.005	<0.005			
MTBE	ug/mL	<3	<3	<3	<3	<3			
Behind Folsom Dam at Outlet		**Date of Sampling**							
(Station # BS-MN-17)	**Units**	**2/27/01**	**5/17/01**	**8/6/01**	**11/5/01**	**2/13/02**			
Fecal Coliform	MPN/100mL	30	4	2	8	17			
Nitrate & Nitrite as N	mg/L	<0.050	<0.050	<0.050	<0.050	0.110			
Total Phosphorus as P	mg/L	<0.010	<0.010	0.014	0.022	<0.050			
Tot. Dissolved Solids	mg/L	39	41	43	42	44			
Mercury (dissolved)	ug/mL	<0.005	<0.005	<0.005	0.0074	<0.005			
MTBE	ug/mL	---	---	---	---	---			

Source: Peter Vonich, BOR at Folsom Dam

Table WQ-2: Fecal Coliform Bacteria Levels in Lake Natoma and Folsom Lake, 2002 BOR Sampling

Table WQ-2. Fecal Coliform Bacteria Levels in Lake Natoma and Folsom Lake, 2002 BOR Sampling																
	Fecal Coliform Concentrations in MPN/100 mL															
	Lake Natoma														Folsom Lake	
Sampling Date	Aquatic Center	Aquatic Center Dock	Willow Creek	Willow Creek Channel	Negro Bar	Negro Bar Boat Ramp	Nimbus Flat	Nimbus Flat Boat	Alder Creek	Parkshore	Folsom South Canal	Peninsula	Nimbus Buoy Line	Mississippi Bar	Granite Bay	Beals Point
7/24/02	>1600		23												8	280
7/29/02	240		130												22	300
8/5/02	300		110												13.37	<2
8/12/02	300		220												22	11
8/19/02	300		30												11	4
9/3/02	240		50												7.4	130
9/9/02	240			23	23							2				
9/16/02	11			14	30		7		4	2						
9/23/02	500	80					50				30		23	130		
9/24/02					13											
9/25/02				30		70		23								
9/26/02	2			170		30										
9/30/02	13	17					23	11								
10/7/02	27		30		17		50									
10/15/02	50															
10/21/02	30		30													
10/28/02	4		50													
11/8/02	130		>1600	>1600	>1600		80		220							

Note: The September 24 - 26, 2002 samplings were in response to a sewage spill at Folsom Prison.
The high values (>1600) on November 8, 2002 were associated with a storm event following 167 days of no rain.

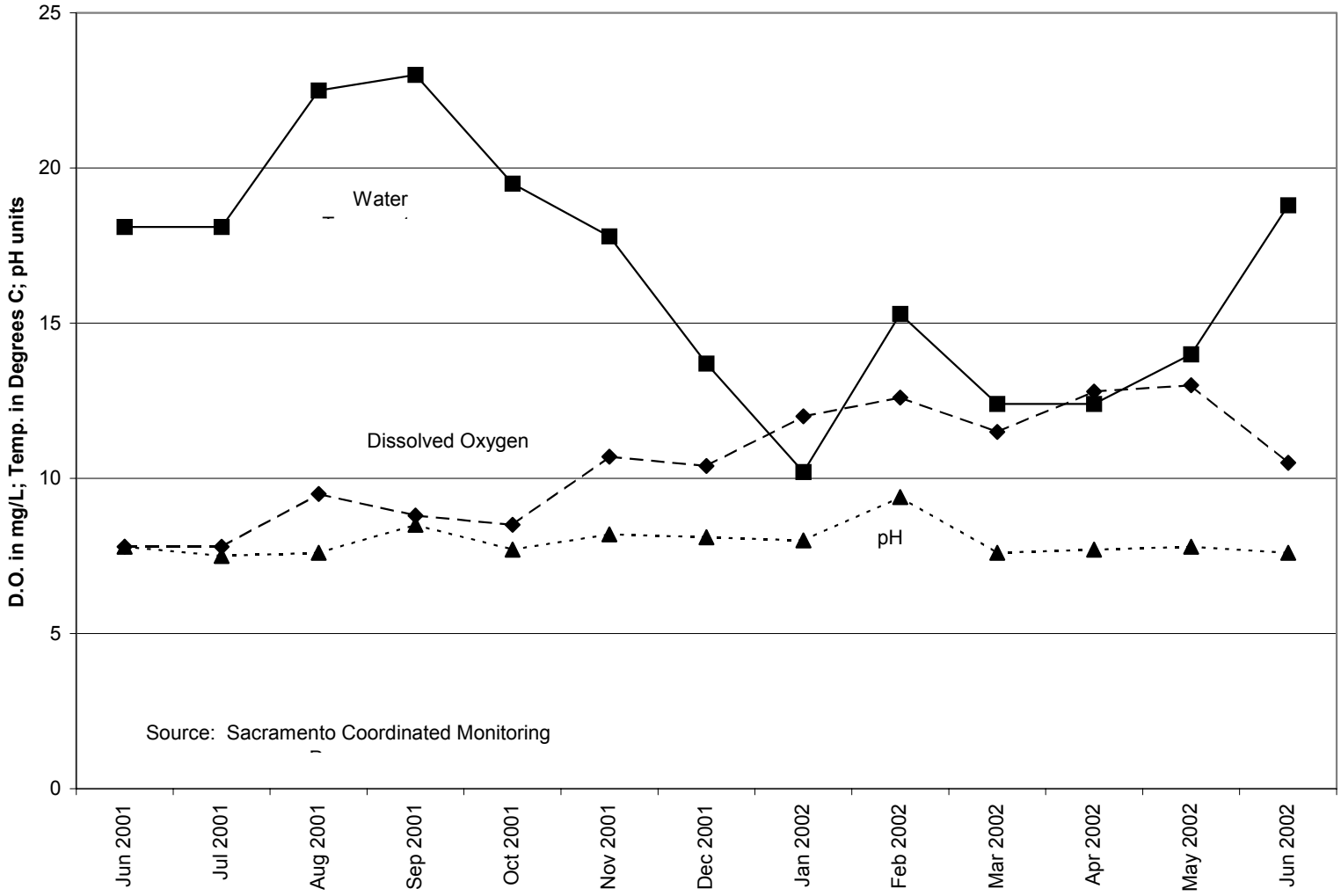
Source: Brian Deason at the U.S. Bureau of Reclamation, Folsom Dam

Table WQ-3: Bacteria Levels at Swim Beaches Folsom Lake SRA Sacramento County Sampling Data

Sampling Location	Sample Date	Fecal Coliform (MPN/100 mL)	Total Coliform (MPN/100 mL)	Enterococcus (MPN/100 mL)
		Alert Level: 400 MPN/100 mL	Alert Level: 10,000 MPN/100 mL	Alert Level: 61 MPN/100 mL
Folsom Lake at Folsom Point (Dike 8)	6/28/02	14	300	1
Lake Natoma (upper) at Folsom Landing	7/12/02	50	80	2
Lake Natoma (upper) at Folsom Landing	9/25/02	23	300	Not Taken
Lake Natoma (upper) at Folsom Landing	9/25/02	70	280	Not Taken
Lake Natoma (lower) at Aquatic Center	7/12/02	170	300	17
Lake Natoma (lower) at Aquatic Center	9/25/02	23	300	Not Taken
Lake Natoma (lower) at Aquatic Center	9/25/02	70	280	Not Taken

Source: Sacramento County Department of Environmental Management

Figure WQ-1: Dissolved Oxygen, Temperature, and pH, Lower American River below Nimbus Dam, June 2001 to June 2002



Temperature

The Basin Plan states that the natural receiving water temperature of waters shall not be altered in a manner that adversely affects beneficial uses. Releases from Folsom Lake Dam and Nimbus Dam are managed so that water temperatures in Nimbus Lake and the American River downstream favor the specific beneficial uses of maintaining cold water freshwater habitat and fish spawning habitat. Recommendations regarding the operation of these dams are made through the American River Operation Group (AROG), a collaborative group of stakeholders. The primary goal of AROG is to make recommendations on how to balance the operation of the dams while considering the cold water needs of the anadromous salmonid fisheries in the Lower American River below Nimbus Dam (Jim Micheaels, Gold Fields District DPR *pers. com.*).

As noted above, water temperatures in Folsom Lake are largely a consequence of seasonal water stratification. The temperature of water releases from Folsom Dam depends on whether the water released is from the cold hypolimnion, the moderate thermocline layer, or the warm epilimnion. Water releases from Folsom Lake's hypolimnion are in the temperature range of 48 – 60 degrees F (9.0 – 15.5 degrees C).

Water releases from Folsom Lake pass too quickly through Lake Natoma to allow this afterbay to thermally stratify. The cold water gradually warms as it spreads over the wider portions of the Lake Natoma. Figure WQ-1 shows monthly temperatures for the water discharged from Nimbus Dam into the Lower American River in 2001 and 2002. To allow dissolved oxygen and pH to be plotted on the same graph as water temperature, the temperature is shown in degrees C. The lowest temperatures are in March and April with 12.4 degrees C (54.5 degrees F). June and July temperatures are a little over 18.0 degrees C (64 degrees F), and the warmest temperatures occur in August and September where it tops out at 23 degrees C (73 degrees F). The August and September temperatures likely reflect the period when most of the hypolimnion waters had been expended.

Nimbus hatchery, which raises steelhead and chinook salmon, draws its water from Lake Natoma. During late summer, Lake Natoma's water to the hatchery sometimes fails to meet the hatchery's requirement of water not exceeding 60 degrees F (15.5 degrees C). By prolonging the release of cold water from the hypolimnion of Folsom Lake throughout the summer and early fall, Lake Natoma water are more likely to meet the hatchery requirements. Cold water releases from Nimbus Dam to the Lower American River must also remain sufficiently cool to avoid stressing the juvenile steelhead rearing in the river and the adult Chinook salmon migrating up the river to spawn.

Bacteria

Regarding bacteria objectives, the Basin Plan specifically assigns Folsom Lake fecal coliform bacteria standards that are twice as stringent as other waters in the region that are designated for water contact recreation. The Basin Plan states:

> For Folsom Lake, the fecal coliform concentration based on a minimum of not less than five samples for any 30-day period, shall not exceed a geometric mean of 100

Most Probable Number (MPN)/100 ml, or shall more than 10 percent of the total number of samples taken during any 30-day period exceed 200/100 ml.

Table WQ-1 presents fecal coliform bacteria levels for a variety of months in 1999 through early 2002 for three sampling stations. None of the samples from Folsom Lake at the dam had fecal coliform levels in excess of the above water quality objective. However, the American River below Folsom Dam exceeded the management goal of 100 MPN/100 mL in November 1999, March 2000, and May 2000. The headwaters of the South Canal at Lake Natoma exceeded the fecal coliform bacteria objective in May 2001. Additional fecal coliform bacteria data associated with swim beaches and areas of heavy waterfowl use is provided later in this section.

Dissolved Oxygen

The Basin Plan states that the monthly median of mean daily dissolved oxygen concentration shall not fall below 85 percent of saturation in the main water mass, and the 95 percentile concentration shall not fall below 75 percent of saturation. The dissolved oxygen concentrations shall not be reduced below 7.0 mg/L at any time in waters with cold water fishery and fish spawning beneficial uses.

Although, only limited dissolved oxygen data is available for the two lakes, it would appear that both lakes are well oxygenated throughout the year, and that these standards are probably met. For example, dissolved oxygen levels in the upper warm layer were 8 mg/L in late July of 2002 and 6 mg/L at a depth of 195 feet in the hypolimnion (Brian Deason, BOR pers. com.). Table WQ-1 displays the dissolved oxygen levels for the Lower American River directly below Nimbus Dam. All readings are greater than 7.0 mg/L with the lowest readings occurring in June and July 2001. The highest reading was 13 mg/L and the median reading was 10.5 mg/L.

pH

The Basin Plan states that pH shall not be depressed below 6.5 nor raised above 8.5. Changes in normal ambient pH levels shall not exceed .05 in fresh waters designated for cold water fisheries beneficial uses.

Table WQ-1 presents monthly pH values for the discharge from Nimbus Dam for 13 months in 2001 and 2002. The pH values range from 7.5 to 9.4. The value of 9.4 is an outlyer and may be an error, as the second highest pH value is 8.5. The median pH value for the 13-month period was 7.7.

Oil and Grease

The Basin Plan states that waters shall not contain oils, greases, waxes, or other materials in concentrations that cause nuisance, result in a visible film or coating on the surface of the water or on objects in the water, or otherwise adversely affect beneficial uses.

There are three primary sources of oil and grease entering the waters of Folsom Lake and Lake Natoma. Urban runoff from the developed watershed around portions of the two lakes are a primary source of petroleum residue that enters the storm drain system and discharge into local drainages to the lakes. A second source of petroleum products is the storm drains

for the marina and day use facility parking lots and adjacent roads. Petroleum residues build up on these surfaces during the dry season. The first substantial storm event of the fall/winter season typically carries the highest load of oil and grease residue into the storm drains and ultimately into the two lakes (Varanasi 1989). The third source is related to motor boat activities on the lake. Spilled gasoline associated with filling fuel tanks while on or adjacent to the lake, plus the pumping of bilge water while boating on the lake, can be a significant source of petroleum on waters with heavy boating use.

Petroleum-based oil and grease are hydrophobic (repel water) and leave a film on the surface of the water. Also known as "Polycyclic Aromatic Hydrocarbons" or PAHs, their hydrophobic nature cause them to rapidly attach to suspended sediments and ultimately be deposited on the lake bottom (Varanasi 1989). Examples of PAH compounds often included in water testing are: Naphthalene, Fluorene, Dibenzothiophene, Phenanthrene, Fluoranthene, Pyrene, and Chrysene. Both the BOR and Sacramento CMP water analyses for the stations previously described include a large number of PAH compounds. Although this data set is too large to include in this document, a review of these data sets rarely shows a PAH compound at detectable levels.

Total Dissolved Solids

The Basin Plan states that total dissolved solids in Folsom Lake shall not exceed 100 mg/L (90 percentile).

Table WQ-1 presents total dissolved solids (TDS) data for three locations between Folsom Lake and Nimbus Dam. The highest TDS value recorded for this data set is 91 mg/L and the lowest is 20 mg/L. The majority of the TDS readings are between 36 and 50 mg/L.

Turbidity

The Basin Plan requires that turbidity shall be less than or equal to 10 Nephelometric Turbidity Units (NTUs) in Folsom Lake and the American River (Folsom Dam to Sacramento River), except for periods of storm runoff,

The Sacramento CMP data for the Lower American River immediately below Nimbus Dam includes turbidity readings. A review of the monthly data set from January 2001 through June 2002 for this site shows turbidity readings ranging from 0.5 NTU to 5.0 NTU with most of the readings between 1.0 NTU and 4.0 NTU, well within the Basin Plan objectives.

Sources of Water Quality Problems

This section discusses known or potential sources of water quality problems in the Unit.

Storm Water Runoff

In the past, water quality impacts from storm water runoff have not been a major concern for Folsom Lake and Lake Natoma. The primary water sources for the two lakes (the South and North Forks of the American River) contribute huge volumes of water from undeveloped watersheds. At one time, the relatively small volume of local runoff originated from

watershed lands with only a modest level of urbanization. However, over the past two decades, the local watershed for both lakes has become increasingly urbanized and the urbanization process is continuing apace. As a consequence, the water quality of local runoff has almost certainly decreased while the volume and rate has increased with increased amounts of impervious surface.

Storm water runoff associated with housing, roads, and commercial development within the nearby watershed are sources of sediment and petroleum residue. Other contaminants commonly associated with street and parking lot storm water runoff are lead, zinc, nutrients from adjacent fertilized landscaping, and bacteria from dog waste (Wanielista and Yousef 1992). Storm water runoff from lawns at day-use areas within the Unit can be a source of bacteria from the waste materials of dogs and waterfowl, particularly geese.

The Georgetown Divide Resource Conservation District (GDRCD) recently completed a watershed assessment for the South Fork of the American River Watershed in which sedimentation and fuels management were identified as the primary resource concerns within the watershed. Sub-basins located in the foothill zone of the watershed (nearest the Unit) were identified as having the greatest potential to experience adverse water quality effects associated with sedimentation, including the New York, Kelley, Big Sailor and Webber Creek sub-basins (GDRCD, 2003). Furthermore, the RWQCB believes that a reduction in sediment loads from local runoff to Folsom Lake and Lake Natoma would help reduce concentrations of other urban runoff pollutants of concern. Therefore, sediment management in the local watershed is a primary concern to the RWQCB (George Day, RWQCB Storm Water Unit *pers. com.*).

The most visible example of sediment problems associated with local runoff occurs at the Folsom Lake Marina at the mouth of Brown's Ravine. Development in the Brown's Ravine watershed and adjacent watersheds that are drained by several ephemeral streams into the Folsom Lake Marina area has resulted in sediment problems during most storm events (Ken Christiansen, Folsom Lake Marina Manager pers. com.). The recent widening of Green Valley Road has resulted in the replacement of the older 12-inch culverts with 3-foot and 4-foot culverts to accommodate increased stormflow resulting from impervious surface associated with development in the watershed. Unfortunately, drainpipes near the Marina are still 12-inches in diameter and are too small to accommodate this increased storm water runoff. During most storm events, much of the runoff in an ephemeral drainage overflows its culvert and flows across the Marina parking lot. Following storm events, this parking lot is covered with sediment and debris that must be removed by CDPR staff. There are also four ephemeral streams that overflow culverts and cross the main entrance road to the Marina. One of these sites of overflow exhibits severe erosion near the culvert.

The primary drainage into the Folsom Lake Marina is through Brown's Ravine. The high sediment load now carried by Brown's Ravine because of upstream development has added approximately 1.5 feet of sediment to the Marina basin in the vicinity of the docks. It has also resulted in the waters of the Marina basin being especially turbid (Ken Christiansen, Folsom Lake Marina Manager pers. com.). There appears to be no water quality data that quantifies the pollutant load of storm drain contaminants entering Folsom Lake and Lake Natoma (George Day, RWQCB Storm Water Unit *pers. com.*) through Brown's Ravine.

The City of Folsom uses the Sacramento County standards for erosion and sediment control and has a number of sediment and storm water retention basins in place (Daron Wilson, City of Folsom Planning Dept. Engineer *pers. com*.). Development and road widening projects in the Brown's Ravine area are located in El Dorado County. El Dorado County employs Best Management Practices (BMPs) to minimize sediment and erosion associated with construction activities.

Interviews with various BOR, RWQCB, and County (Placer, El Dorado, and Sacramento counties) water quality and public health specialists revealed that almost no monitoring of storm water from local drainages is conducted. However, some testing for nutrients in Alder Creek waters at Alder Pond adjacent to Lake Natoma have been performed (Sandi Richerson, BOR *pers. com*.). The testing of Alder Pond waters resulted from concern regarding nutrient input to Alder Pond from the nearby auto mall car washing operations that may affect the growth of aquatic weeds and algae.

Alder Creek Pond is an isolated component of the Lake Natoma drainage located on the south side of Hwy 50. Culverts under Hwy 50 connect this still-water portion of Alder Creek with Lake Natoma. Alder Creek Pond has a history of water quality problems manifested as excessive growths of water hyacinth or algae, accompanied by high levels of biochemical oxygen demand and depressed levels of dissolved oxygen. Nutrient enrichment from the local watershed is suspected as a contributor to this problem (Charles Alpers, USGS *pers. com.*).

Nutrient testing of two Alder Pond water samples collected in January 2002 found total phosphorus levels of 0.036 mg/L and 0.053 mg/L. The BOR considers "fair" protection from nuisance aquatic plant growth to range from 0.030 mg/L to 0.049 mg/L, and "poor" protection to range from 0.050 mg/L to 0.149 mg/L. These sample samples had total nitrogen levels of 0.71 mg/l and 1.01 mg/L, which are also sufficiently high to encourage nuisance plant growth. These Alder Pond testing results are reported in a letter from BOR Area Manager, Thomas Aiken to Peter Piccardo of the City of Folsom (Aiken, 2002). The letter states that the large population of water hyacinth in Alder Pond is not a natural occurrence but is induced by high nutrient loading.

Alder Pond is scheduled for restoration under the U.S. Army Corps of Engineers' Aquatic Restoration Program if a non-Federal sponsor can be found (Sandi Richerson, BOR *pers. com.*). Restoration would manage the pond for its wildlife values and would install a gate system to provide greater flexibility in managing water levels in Alder Pond. Currently the water levels rise and fall with the water level in Lake Natoma.

Water Quality Impacts from Boating Activities

The Unit is served by the Folsom Lake Marina and five other boat launch facilities around the lake. Motor boats and two-stroke engines are allowed on Folsom Lake. Lake Natoma allows motor boats upstream of Willow Creek (max. speed of 5 mph) but not downstream toward Nimbus Dam. There is a paved boat launch ramp for boats without gasoline engines at the Aquatic Center near Nimbus Dam. A gravel launch ramp is provided for power boats at the mouth of Willow Creek.

Bilge Program - At Folsom Lake, boating facilities as well as camping and day use facilities adjacent to the Lake include parking lots from which storm water runoff drains into the Lake. Petroleum residue (oil and grease) builds up in these parking lots during the dry season and is

flushed into the lake with the first substantial rain of the fall/winter. The Folsom Lake Marina and boat launch areas are also potential sources for spilled petroleum products. However, for the past three years the Unit has implemented a Bilge Program to minimize spilled petroleum products (Shana Avalos, Gold Fields District DPR Interpreter *pers. com.*). Boaters at the Folsom Lake Marina are encouraged to maintain a kit consisting of absorbent pads for small spills, a funnel to facilitate gasoline transfer to outboard and inboard motors, a sponge to be placed in the bilge, and a bucket in which to transport the soiled rags and sponge. The soiled rags and sponge can be disposed of at the Marina. Brochures on the program are distributed at the Marina and other park facilities to educate the public to the problem and the availability of the kit. Petroleum spills have not been a problem at the Marina in recent years (Ken Christiansen, Folsom Lake Marina Manager *pers. com.*).

Pump-it-Out Program - Another program aimed at boaters is the "Pump-it-Out" program (Shana Avalos, Gold Fields District DPR Interpreter *pers. com.*). Brochures are distributed to boaters alerting them to boat holding tanks pump-out facilities at the Folsom Lake Marina. As part of this program designed to eliminate Unit users' wastewater from entering the lakes, public restrooms are distributed along the shoreline of Folsom Lake and Lake Natoma. Folsom Lake also has two floating restrooms located at New York Cove and Anderson Island.

A 2002 season survey by the City of Sacramento Dept. of Public Utilities interviewed 53 individuals at Folsom Lake to determine awareness of the Pump-Out and restrooms program (Jason Lee, City Dept. of Public Works *pers. com.*). Of the 53 people interviewed, 47 percent had received information on the program, but only 11 percent were knowledgeable about the program. Forty one of the people interviewed owned boats and of this number, seven boat owners had holding tanks. Four of the seven boat owners with holding tanks used pump-out stations. Thirty five of the 41 boat owners used the restrooms facilities around Folsom Lake, and 11 of the 12 individuals without boats used the restrooms.

MTBE

Based on water quality studies in Shasta Lake, it is likely that the extensive use of two-stroke engines have resulted in measurable quantities of the gasoline additive, MTBE, in Folsom Lake (George Day, RWQCB Storm water Unit *pers. com*.). However, the BOR's analyses for MTBE (five to seven occasions for two sites in the vicinity of the Unit) found no detectable levels of MTBE (see Table WQ-1). While MTBE in lakes is a general concern, there is currently no plan to prohibit the use of two-stroke engines on Folsom Lake.

Water Quality Impacts at Swimming Beaches

Based on interviews with the Environmental Health Departments of Sacramento, Placer and El Dorado Counties, and with Pat Leary of the RWQCB, there has been only minimal bacteriological testing of swimming beaches in the Unit. The Sacramento County Department of Environmental Management occasionally conducts bacterial testing of Folsom Lake and Lake Natoma in response to complaints (Mary Taylor, *pers. com.*) and in 2002 collected samples for bacterial testing at two Lake Natoma sites and one site on Folsom Lake (Table WQ-3). In 2002, the BOR also conducted bacterial testing of several Lake Natoma sites and two Folsom Lake swimming beaches (Sandi Richerson, BOR *pers. com.*). The BOR data are provided in Table WQ-2.

Data in Table WQ-3 show no exceedence of the Sacramento County alert level (400 MPN/100 mL) for fecal coliform bacteria. However BOR sampling data (Table WQ-2) indicate that the alert level was exceeded several times in 2002. At the Lake Natoma Aquatic Center a level of >1,600 MPN/100mL was detected on July 24, 2002, and a level of 500 MPN/100mL was detected on September 23, 2002. A similar exceedence (> 1600 MPN/100 mL) was found on November 8 at Willow Creek, Willow Creek channel, and Negro Bar. These high levels of fecal coliform bacteria occurred during the first significant storm event of the rainy season (Table WQ-2).

The Basin Plan objective for Folsom Lake coliform bacterial levels is that the geometric mean of 5 samples collected over a 30-day period should not exceed 100MPN/100mL. BOR sampling data in Table WQ-2 indicate that fecal coliform levels may have exceeded this Basin Plan objective at the Lake Natoma Aquatics Center where 8 of 9 samples collected over a 2-month period exceeded 100MPN/100mL (from July 24-September 23, 2002 –Table WQ-2).

Occasionally, the messy diapers of small children wading in the shallows contributes to bacterial contamination at swimming beaches. Storm water runoff from parking lots and nearby camping facilities may also carry pet and animal waste into the lake near swim beaches, particularly with the first rains of the fall season. However, more commonly the source of most fecal coliform input to swimming areas is waterfowl, both domesticated and wild that frequent the beaches looking for handouts. At present, the numbers of geese and other waterfowl appear not to be a problem at the beaches on Folsom Lake. However, large numbers of geese are present on Lake Natoma (Jim Micheaels, Gold Fields District DPR, *pers. com.*). Geese may be a major contributor to the fecal coliform levels at Nimbus Flat, Negro Bar, and the confluence of Willow Creek

Sewage Spills

Approximately three years ago, Lake Natoma was the recipient of a sewage spill from the City of Folsom via Hinkle Creek. The spill was not reported until 48 hours after the event. Testing at that time revealed bacteria concentrations to be within acceptable levels (Peter Vonich, BOR *pers. com.*). Recently Folsom Prison had a sewage spill that failed to enter Lake Natoma. Sewage spills such as these can temporarily raise fecal coliform bacteria to levels hazardous to human health. Fish kills can occur if the spill includes a large volume of organic materials that can quickly lower dissolved oxygen levels. High levels of unionized ammonia used for sewage treatment may be sufficient to cause a fish kill.

In recent years, wastewater facilities operated by the El Dorado Irrigation District (EID) in El Dorado County have greatly reduced the number of spills that enter waterways draining into Folsom Lake (Richard McHenry, SWRCB NPDES Section *pers. com.*). The EID wastewater treatment plant with drainages closest to Folsom Lake is the El Dorado Hills facility. Placer County has a wastewater treatment facility just above Granite Bay, and the City of Auburn has treatment facilities whose spills may eventually drain into the North Fork American River. When wastewater treatment plant spills occur, follow-up testing of the waters of Folsom Lake is rare. Unit personnel are often not notified of the occurrence of some of these spills (Richard McHenry, SWRCB NPDES Section *pers. com.*). In most cases, the volume of water in Folsom Lake and Lake Natoma will quickly dilute the spill to safe bacterial levels. However, Unit personnel should be notified of every sewage spill through either the

Office of Emergency Service or the county environmental health department with jurisdiction over the wastewater treatment facility.

Water Quality Problems from Abandoned Mine Waste

A history of gold mining in the area, and the use of mercury to process gold-bearing ore appears to be the cause of relatively high levels of mercury in Lake Natoma fishes. Researchers recently found that more than half of the 22 sampled fish contained mercury in concentrations above the federal EPA's "screening level" (0.3 ppm), warranting further testing. Bass more than one-foot long contained mercury at levels that trigger state advisories (Bowman 2002). The sampled fish were captured at the mouths of the once heavily mined Willow and Alder Creeks and a small inlet on the east side of the lake (Bowman 2002). The Folsom area had one of the largest gold-dredging operations in California. Operators of the giant floating dredgers coated the sluices with mercury to amalgamate the gold particles, occasionally spilling the mercury into the surrounding environment.

Mercury can exist in many forms, most of which are stable and unavailable for biological uptake. However, inorganic mercury can be methylated by microbes and fungi into an organic form known as methyl-mercury (Baudo et al 1990; Domagalski et al 2000). Fish take in some methyl-mercury through their gills, but most of their intake is through their food. Once consumed by fish, methyl-mercury is retained in the fatty tissue and bioaccumulates so that older and larger fish contain a higher concentration of methyl-mercury than younger or smaller fish. Fish that predate on other fish tend to have higher concentrations of methyl-mercury than fish feeding at lower levels of the food chain. Humans who consume these fish are vulnerable to bioaccumulating methyl-mercury at levels potentially harmful to health. Methyl-mercury mainly attacks the nervous system causing loss of sensation in the extremities, tiredness, and blurred vision (OEHHA 2002). The California Department of Health Services (undated brochure) recommends that pregnant and breast-feeding women eat no more than 0.5 pounds (uncooked weight) of fish per week from freshwater sources in California. Children less than 6 years old are recommended to eat no more than 3 ounces of freshwater fish per week.

Funded by the BOR, the U.S. Geological Survey collected additional fish in September and October 2002 from the mouth of Alder and Willow creeks, plus Mississippi Bar and Negro Bar. The fillets from the fish, mostly bass and bluegill, will be tested for mercury and methyl-mercury content. With the approval of further funding from state or federal agencies, an investigation of mercury levels in water, sediment, and biota will be conducted by the U.S. Geological Survey and the University of California, Davis. The sampling program will begin in the spring of 2003 and will include sampling in the fall of 2003 (Charles Alpers, USGS, pers. com.). The objective of the investigation is to evaluate mercury and methyl-mercury concentration and loads in the Willow Creek and Alder Creek watershed. Humbug Creek, a tributary to Willow Creek, will also be included in the sampling program. Small fishes and aquatic macroinvertebrates will be used as bioindicators of mercury exposure because they have a limited range of movement and are indicative of localized exposure conditions (USGS 2002).

Testing of fish tissue for mercury content in Folsom Lake in the late 1980s indicated that fish occurring in association with known mining tailings throughout the lake are likely to have some degree of elevated mercury levels (Rick Humphreys, SWRCB, Abandoned Mines

Geologist, pers. comm..). Old mine tailings occur at Morman Island, Rattlesnake Crossing, and Pilot Creek, and the sediments below the Salmon Falls Bridge are known to have elevated mercury levels. Because not all fish in Folsom Lake inhabit areas of old mine tailings, elevated mercury in sport fish appears not to be widespread throughout the lake. At present, there has been insufficient testing to determine if mercury contamination in Folsom Lake fishes warrants concern.

There are abandoned chromate mines on the Peninsular between the North and South Fork arms of Folsom Lake. No active mines exist there. Chromium in several chemical states may occur in the environment, however, most of these chemical states are relatively non-toxic. The most toxic forms of chromium to aquatic life are trivalent and hexavalent chromium (EPA 1973). However, there is a great range of sensitivity to chromium between aquatic species and waters of different hardness. Chromium toxicity is less of a concern than methyl-mercury because chromium does not bioaccumulate in fish tissue as does mercury, and thereby is not likely to be a public health hazard (Rick Humphreys, SWRCB, Abandoned Mines Geologist, *pers. comm.*). There appears to be no data for chromium levels in sediment, water, or fish from the vicinity of Folsom Lake drainages.

Recommendations

Water Quality Database Coordination

There are presently identified two sources of scheduled water quality sampling and analyses data pertinent to the Unit: the BOR and the Sacramento Coordinated Water Quality Monitoring Program (CMP). It appears that the water quality data developed by these two sampling programs are not automatically shared between them. The data from these two sampling programs, plus the periodic bacteria sampling conducted by the Sacramento County Department of Environmental Management, are valuable for anyone managing or monitoring the quality of water in the Unit. Development of a program for storing these data in a central database is recommended. At a minimum, a program manager for the Gold Fields District of CDPR should be notified of sampling events and analyses and methods for accessing the resulting data.

Because nearly all the water in the Unit is held within reservoirs, other water quality factors should be considered that are not reported in regular hydrologic sources. Factors such as temperature stratification, possible occurrence of anoxic events in backwater areas, and contamination from adjacent land uses and waterfowl are relevant to understanding the water quality characteristics of Folsom Lake and Lake Natoma.

Bacteriological Monitoring

The Basin Plan standards for fecal coliform bacteria levels in Folsom Lake and the waters downstream of Folsom Dam are twice as stringent as for most other waters with water contact recreation. It is assumed that this is due to the heavy use of these waters by swimmers and water skiers. Sources of potential contamination and human exposure include: diapered children at swimming beaches, illegal flushing of boat holding tanks, concentrations of waterfowl near swim areas, dog droppings at picnic areas that can be washed into the lake during storm events, and sewage spills from the treatment plants for the City of Folsom and the Folsom State Prison. At present no regular monitoring of fecal coliform levels by any state or county public health agencies occurs. Currently, Unit staff are not routinely notified when when sewage spills occur in the Folsom Lake and Lake Natoma watersheds.

Coordination between the Gold Fields District of the CDPR, the BOR and state and county public health agencies is recommended to develop the following programs for monitoring fecal coliform bacteria levels in the Unit.

Monitoring Fecal Coliform Levels at Swim Beaches

To ensure that swim beaches meet Basin Plan standards for bacteria, several of the most heavily used swim beaches in Folsom Lake and Lake Natoma should be selected for twice-monthly testing of fecal coliform levels between Memorial Day weekend and Labor Day weekend. The July sampling should be scheduled to include the 4th of July holiday weekend. Sampling would probably have to occur on the last day of major holidays and on Sundays of regular weekends due to the eight-hour holding time required for fecal coliform tests. Suggested sites include Granite Bay, Beals Point, Peninsula, and Negro Bar. For those sites where waterfowl are typically present, sampling should be accompanied by a rough count of the number of geese and ducks present. Consideration should be given to the value and

feasibility of using random throws of a 1-meter quadrat to count waterfowl droppings on the lawn areas as a means of estimating the extent of waterfowl use in an area.

Quarterly Monitoring on Lake Natoma near Sewage Treatment Plants

Sewage treatment plants for the City of Folsom and the Folsom State Prison have the potential for spilling sewage into Lake Natoma. Quarterly monitoring of fecal coliform levels at points of potential discharge into the lake will establish baseline conditions and determine if low level leakage is occurring.

Memorandum of Agreement

The CDPR should develop a Memorandum of Understanding with either the Office of Emergency Service or the three counties' environmental health departments to ensure that Unit personnel are notified of every sewage spill within Unit watersheds.

Establish a Rapid Response Team for Spill Events

There should be coordination with the Sacramento County Dept. of Environmental Management, the City of Folsom Sewage Treatment Facility, and the Folsom State Prison Sewage Treatment Facility to establish a rapid response team in the event of a sewage spill. Procedures for spill notification and sampling protocols and responsibilities need to be developed so that fecal coliform and E.c*oli* testing can be conducted at specified locations in a timely manner should a spill occur.

Methylmercury Monitoring

In addition to public health concerns regarding bacteria levels, a second concern is the levels of methyl-mercury in the fish of Lake Natoma. It has not yet been determined if the levels of mercury in fish tissue warrant a public threat sufficient to warn anglers to limit their consumption of fish from Lake Natoma. Continued coordination with the USGS in its current study of mercury levels in Lake Natoma fish is recommended.

State Park and Recreation Participation in Alder Creek Pond Restoration

The future of Alder Creek Pond, a persistent trouble spot for water hyacinth, algae, and water quality, is now being evaluated by the Alder Creek Coalition, the U.S. Army Corps of Engineers, and other agencies. CDPR staff should assign a representative to participate in the U.S. Army Corps of Engineers process for planning the restoration of Alder Pond.

Upgrading of Storm Drain System – Folsom Lake Marina

The storm drain and culvert system along the main entry road to the Folsom Lake Marina and at the Marina parking lot are substantially undersized for handling the present storm water volume. Upgrade of this stormdrain system should be a top priority. An assessment of possible BMPs both in the upstream watershed and on Unit lands to reduce the amount of sediment entering the Marina basin should be implemented.

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ENVIRONMENTAL CONDITIONS

NOISE

Folsom Lake State Recreation Area

April 2003

by

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NOISE

Introduction

LSA Associates has prepared this summary to document the current noise environment at the Folsom Lake State Recreation Area (the Unit). The purpose of this summary is to:

- Discuss the fundamentals of noise
- Characterize the current noise environment
- Provide background information for dealing with issues related to traffic noise, and boat noise
- Identify the noise regulations in affected local jurisdictions in the vicinity of the Unit

Literature reviewed included published scientific articles, files, and previous studies pertaining to the Unit. Fieldwork consisted of ambient noise level testing at several locations throughout the Unit. The primary sources for the background research were planning documents from the municipalities in which the Unit resides, including El Dorado, Placer and Sacramento Counties, the City of Folsom, and the community of Granite Bay. Although the Unit is a part of the California State Park system and owned by the Bureau of Reclamation, it is subject to the noise ordinances of these municipalities. A list of source documents is included in the reference subsection.

Fundamentals of Noise

Sound is a pressure wave transmitted through the air. It is described in terms of loudness or amplitude (measured in decibels), frequency or pitch (measured in Hertz [Hz] or cycles per second), and duration (measured in minutes or hours). The standard unit of measurement of the intensity of sound is the decibel (dB), with 0 dB corresponding roughly to the threshold of hearing.

Typical human hearing can detect changes in sound levels of approximately three dB under normal conditions. However, the human ear is not equally sensitive to all frequencies. Sound waves below 16 Hz are not heard at all and are felt more as a vibration. Similarly, while people with extremely sensitive hearing can hear sounds as high as 20,000 Hz, most people cannot hear above 15,000 Hz. In all cases, hearing acuity falls off rapidly above approximately 10,000 Hz and below approximately 200 Hz. Since the human ear is not equally sensitive to sound at all frequencies, a special frequency dependent rating scale is used to relate noise to human sensitivity. The A-weighted decibel scale, dBA, performs this compensation by discriminating against frequencies in a manner approximating the sensitivity of the human ear.

Noise is defined as unwanted sound and is known to have several adverse effects on people, including hearing loss, speech and sleep interference, physiological responses, and

annoyance. Based on these known adverse effects of noise, the federal government, the State of California, and many local governments have established criteria to protect public health and safety and to prevent disruption of certain activities.

Various noise measurements are used to assess the level and the annoyance potential of community noise such as that generated by aircraft activity and arterial traffic. They include:

- A-Weighted Sound Level, dBA
- Continuous Equivalent (Average) Noise Level, L_{eq}
- Community Noise Equivalent Level, CNEL, or Day-Night Sound Level, L_{dn}

These measures are used in assessing noise and are discussed in this analysis. The standards that are considered important include the Noise Elements of the General Plan of the Cities of Folsom and Granite Bay and the Counties of Sacramento, El Dorado, and Placer, as well as the Municipal Code Noise Ordinance of these Cities and Counties. The measures are summarized as follows:

- *A-Weighted Sound Level*. The A-weighted sound pressure level, commonly called dBA. The dB refers to a measurement in decibels. The A identifies a particular setting of the measurement instrument, the sound level meter. It provides a scale that is consistent with the range and characteristics of peoples' hearing ability. It is measured over a period of time, typically one hour, to identify the minimum and maximum levels and the statistical variation of fluctuating sounds.

- *Continuous Equivalent (Average) Noise Level (L_{eq})*. An energy equivalent level of the fluctuating noise for the time period being measured. Such data are applied to the 24 hour measurement of noise, CNEL or L_{dn} (see below).

- *Community Noise Equivalent Level (CNEL) or Day-Night Sound Level (L_{dn})*. A given level of noise may be more or less tolerable depending on the duration of exposure experienced by an individual. The U.S. Department of Housing and Urban Development (HUD) and the Environmental Protection Agency (EPA) have adopted the L_{dn} as their standard. This measure weights the average noise level (L_{eq}) for late evening and early morning hours (10:00 p.m. to 7:00 a.m.), increasing them by 10 dBA. The daytime noise levels are then combined with these weighted levels and are averaged to obtain a 24-hour average noise level. In the State of California, CNEL is widely used, which also weights events occurring between the evening hours of 7 p.m. and 10 p.m., increasing them by 5 dBA.

Noise levels that are less than 40 dB CNEL/L_{dn} are not considered significant. This finding is identified as part of the noise assessment guidelines for environmental impact statements (National Academy of Science 1977). In addition, generally established regulatory standards throughout California do not typically address noise levels that are less than 40 dBA. However, even low levels of noise can be annoying to people when the background ambient noise is very low.

Regulatory Setting

A project would normally have a significant effect on the environment if it: conflicts with the adopted environmental plans and goals of the community in which it is located, substantially increases the ambient noise levels for adjoining areas, or exposes people to severe noise levels. The following discusses the noise standards of affected counties and cities.

Sacramento County

Sacramento County General Plan Noise Element.

The Noise Element of the Sacramento County General Plan, originally adopted December 15, 1993, and last amended June 24, 1998, contains policies designed to accomplish the following goals: 1) to protect the citizens of the County from the harmful and annoying effects of excessive noise exposure, and 2) to protect the economic base of the County by preventing incompatible land uses from encroaching upon existing or planned noise producing uses. The Noise Element provides the following relevant policies:

NO-1 Noise created by new transportation noise sources should be mitigated so as not to exceed 60 dBA L_{dn}/CNEL at the outdoor activity areas of any affected residential lands or land use situated in the unincorporated areas. When a practical application of the best available noise reduction technology cannot achieve the 60 dBA L_{dn}/CNEL standard, then an exterior level of 65 dBA L_{dn}/CNEL may be allowed in outdoor activity areas. (The Noise Element defines "transportation noise sources" as traffic on public roadways and railroad line operations.)

NO-2 Noise created by new non-transportation noise sources shall be mitigated so as not to exceed any of the noise level standards of Table II-1, as measured immediately within the property line of any affected residential land use situated in the unincorporated areas. (Table II-1 of the Noise Element provides daytime (7 a.m. to 10 p.m.) exterior noise standards of 50 dBA L_{50} and 70 dBA L_{max} and nighttime (10 p.m. to 7 a.m.) standards of 45 dBA L_{50} and 65 L_{max}.)

NO-3 Where proposed non-transportation noise sources are likely to produce noise levels exceeding the performance standards of Table II-1 at existing or planned residential uses, an acoustical analysis shall be required as part of the environmental review process so that noise mitigation may be included in the project design.

NO-6 The compatibility of proposed residential projects with existing and future noise levels due to transportation noise sources shall be evaluated through a comparison to Figure II-1, Land Use Compatibility for Community Noise Environments (in which parks, water recreation, and riding stables are acceptable in areas up to 75 dBA L_{dn}/CNEL, conditionally acceptable in areas between 75 and 80 dBA L_{dn}/CNEL, and unacceptable in areas above 80 dBA L_{dn}/CNEL) to Table II-3, "Acceptable Noise Levels in Unoccupied Rooms," and to Figure II-4 for projects affected by aircraft noise.

Sacramento County Noise Ordinance

Chapter 6.68 (Noise Control) of the Sacramento County Code (SCC) contains noise standards designed to assess noise complaints. Specifically, SCC §6.68.070 provides exterior noise standards of 55 dBA from 7 a.m. to 10 p.m. and 50 dBA from 10 p.m. to 7 a.m. for all residential land uses. Noise levels are not allowed to exceed 20 dBA above the exterior noise level standard at any time, 15 dBA above the standard for a cumulative period of 1 minute per hour, 10 dBA above the standard for a cumulative period of 5 minutes per hour, 5 dBA above the standard for 15 minutes per hour, and the standard for a cumulative period of 30 minutes per hour.

El Dorado County

El Dorado County Public Health and Safety Plan

The El Dorado County General Plan Public Health and Safety Element (December 1993), includes noise as one of the issues. The goal of the noise sub-element is to ensure that County residents are not subjected to noise beyond acceptable levels.

One of the objectives of the noise sub-element is to protect existing noise sensitive development (e.g., hospitals, schools, churches, and residential) from new uses that would generate noise levels incompatible with those uses and, conversely, discourage noise sensitive uses from locating near sources of high noise levels. In its Noise Element, El Dorado County lists maximum allowable noise exposure for transportation noise sources (see Table N-1). The Noise Element also lists the noise performance standards for noise sensitive land uses (i.e., residences, schools, hospitals) affected by non-transportation sources (see Table N-2). Applicable policies for noise regulation of the Unit include:

Policy 6.5.1.2: Where proposed nonresidential land uses are likely to produce noise levels exceeding the performance standards of Table N-2 at existing or planned noise sensitive uses, an acoustical analysis shall be required as part of the environmental review process so that noise mitigation may be included in the project design.

Policy 6.5.1.3: Where noise mitigation measures are required to achieve the standards of Tables A and B, the emphasis of such measures shall be placed upon site planning and project design. The use of noise barriers shall be considered a means of achieving the noise standards only after all other practical design related noise mitigation measures have been integrated into the project and the noise barriers are not incompatible with surroundings.

Policy 6.5.1.7: Noise created by new proposed non-transportation noise sources shall be mitigated so as not to exceed the noise level standards of Table N-2 for noise sensitive uses.

Policy 6.5.1.8: New development of noise sensitive land uses will not be permitted in areas exposed to existing or projected levels of noise from transportation noise sources, which exceed the levels specified in Table A, unless the project design includes effective mitigation measures to reduce exterior noise and noise levels in interior spaces to the levels specified in Table N-1.

Policy 6.5.1.10: To provide a comprehensive approach to noise control, the County shall:

A. Develop and employ procedures to ensure that noise mitigation measures required pursuant to an acoustical analysis are implemented in the project review process and, as may be determined necessary, through the building permit process.

B. Develop and employ procedures to monitor compliance with the standards of the Noise Element after completion of projects where noise mitigation measures were required.

C. The zoning ordinance shall be amended to provide that noise standards will be applied to ministerial projects with the exception of single family residential building permits.

TABLE N-1
MAXIMUM ALLOWABLE NOISE EXPOSURE FOR TRANSPORTATION NOISE SOURCES

LAND USE	OUTDOOR ACTIVITY AREAS [1]	INTERIOR SPACES	
	L_{dn}/CNEL, dBA	L_{dn}/CNEL	L_{eq}, dBA [2]
Residential	60 [3]	45	--
Transient Lodging	60 [3]	45	--
Hospitals, Nursing Homes	60 [3]	45	--
Theaters, Auditoriums, Music Halls	--	--	35
Churches, Meeting Halls, Schools	60 [3]	--	40
Office Buildings	--	--	45
Libraries, Museums	--	--	45
Playgrounds, Neighborhood Parks	70	--	--

[1] In Communities and Rural Centers, where the location of outdoor activity areas is not clearly defined, the exterior noise level standard shall be applied to the property line of the receiving land use. For residential uses with front yards facing the identical noise source, an exterior noise level criterion of 65 dB L_{dn}/CNEL shall be applied at the building facade, in addition to a 60 dB L_{dn}/CNEL criterion at the outdoor activity area. In rural regions, an exterior noise level criterion of 60 dB L_{dn}/CNEL shall be applied at a 100 foot radius from the residence.

[2] As determined for a typical worst-case hour during periods of use.

[3] Where it is not possible to reduce noise in outdoor activity areas to 60 dB L_{dn}/CNEL or less using a practical application of the best available noise reduction measures, an exterior noise level of up to 65 dB L_{dn}/CNEL may be allowed provided that available exterior noise level reduction measures have been implemented and interior noise levels are in compliance with this table.

Source: El Dorado County General Plan 1993

TABLE N-2
NOISE LEVEL PERFORMANCE PROTECTION STANDARDS FOR NOISE SENSITIVE LAND USES AFFECTED BY NON-TRANSPORTATION [1] SOURCES

NOISE LEVEL	DAYTIME 7 AMB7 PM		EVENING 7 PMB10 PM		NIGHT 10 PMB7 AM	
DESCRIPTOR	COMMUNITY	RURAL	COMMUNITY	RURAL	COMMUNITY	RURAL
Hourly L_{eq},dB	55	50	50	45	45	40
Maximum level, dB	70	60	60	55	55	50

Each of the above noise levels shall be lowered by 5 dB for simple tone noises, noises consisting primarily of speech or music, or for recurring impulsive noises. These noise level standards do not apply to residential units established in conjunction with industrial or commercial uses (e.g., caretaker dwellings).

The County can impose noise level standards, which are up to 5 dB less than those specified above, based upon determination of existing low ambient noise levels in the vicinity of the project site.

In Community Areas, the exterior noise level standard shall be applied to the property line of the receiving property. In Rural Areas, the exterior noise level standard shall be applied at a point 100 feet away from the residence. The above standards shall be measured only on property containing a noise sensitive land use. This measurement standard may be amended to provide for measurement at the boundary of a recorded noise easement between all effected property owners and approved by the County.

[1] For the purposes of the Noise Element, transportation noise sources are defined as traffic on public roadways, railroad line operations, and aircraft in flight. Control of noise from these sources is preempted by federal and State regulations. Control of noise from facilities of regulated public facilities is preempted by California Public Utilities Commission (CPUC) regulations. All other noise sources are subject to local regulations. Nontransportation noise sources may include industrial operations, outdoor recreation facilities, HVAC units, schools, hospitals, commercial land uses, other outdoor land use, etc.

Source: El Dorado County General Plan 1993

Placer County

Placer County General Plan Noise Element

Placer County has adopted a Noise Element as part of its General Plan (1994). Goal 9.A of the Noise Element states "To protect County residents from the harmful and annoying effects of exposure to excessive noise." Applicable policies for noise regulation of the Unit include:

Policy 9.A.1: The County shall not allow development of new noise sensitive uses where the noise level due to nontransportation noise sources will exceed the noise level standards of Table N-3 as measured immediately within the property line of the new development, unless effective noise mitigation measures have been incorporated into the development design to achieve the standard specified in Table N-3.

Policy 9.A.2: The County shall require that noise created by new nontransportation noise sources be mitigated so as not to exceed the noise standards of Table N-3 as measured immediately within the property line of lands designated for noise sensitive uses.

Policy 9.A.3: The County shall continue to enforce the State Noise Insulation Standards (California Code of Regulations, Title 24) and Chapter 35 of the Uniform Building Code (UBC).

Policy 9.A.5: Where proposed nonresidential land uses are likely to produce noise levels exceeding the performance standards of Table N-3 at existing or planned noise sensitive uses, the County shall require submission of an acoustical analysis as part of the environmental review process so that noise mitigation may be included in the project design.

Policy 9.A.6: The feasibility of proposed projects with respect to existing and future transportation noise levels shall be evaluated by comparison to Table N-3.

Policy 9.A.8: New development of noise sensitive land uses shall not be permitted in areas exposed to existing or projected levels of noise from transportation noise sources, including airports, which exceed the levels specified in Table N-4, unless the project design includes effective mitigation measures to reduce noise in outdoor activity areas and interior spaces to the levels specified in Table N-4.

Policy 9.A.9: Noise created by new transportation noise sources, including roadway improvement projects, shall be mitigated so as not to exceed the levels specified in Table N-4 at outdoor activity areas or interior spaces of existing noise sensitive land uses.

TABLE N-3
ALLOWABLE NOISE LEVELS WITHIN SPECIFIED ZONE DISTRICTS
Applicable to New Projects by or Including
Non-transportation Noise Sources

Zone District of Receptor	Property Line of Receiving Use	Interior Spaces
Residential Adjacent to Industrial	60	45
Other Residential	50	45
Office/Professional	70	45
Transient Lodging	65	45
Neighborhood Commercial	70	45
General Commercial	70	45
Heavy Commercial	75	45
Limited Industrial	75	45
Highway Services	75	45
Shopping Center	70	45
Industrial	--	45
Industrial Park	75	45
Industrial Reserve	--	--
Airport	--	45
Unclassified	--	--
Farm	(see footnote)[1]	--
Agriculture Exclusive	(see footnote)	--
Forestry	--	--
Timberland Preserve	--	--
Recreation and Forestry	70	--
Open Space	--	--
Mineral Reserve	--	--

[1] Normally, agricultural uses are noise insensitive and will be treated this way. However, conflicts with agricultural noise emissions can occur where single family residences exist within agricultural zone districts. Therefore, where effects of agricultural noise upon residences located in these agricultural zones are a concern, an L_{dn} of 70 dBA will be considered acceptable outdoor exposure at a residence.

Notes:

- Except where noted otherwise, noise exposures will be those which occur at the property line of the receiving use.
- Where existing transportation noise levels exceed the standards of this table, the allowable L_{dn} shall be raised to the same level as that of the ambient level.
- If the noise source generated by, or affecting the uses shown above consists primarily of speech or music, or if the noise source is impulsive in nature, the noise standards shown above shall be decreased by 5 dB.
- Where a use permit has established noise level standards for an existing use, those standards shall supersede the levels specified in this table. Similarly, where an existing use, which is not subject to a use permit causes noise in excess of allowable levels, said excess noise shall be considered the allowable level. If a new development is proposed which will be affected by noise from such an existing use, it will ordinarily be assumed that the noise levels already existing or those levels allowed by the existing use permit, whichever are greater, are those levels actually produced by the existing use.
- Existing industry located in industrial zones will be given the benefit of the doubt in being allowed to emit increased noise consistent with the state of the art at the time of expansion. In no case will expansion of an existing industrial operation be cause to decrease allowable noise emission limits. Increased emissions above those normally allowable should be limited to a one-time 5 dB increase at the discretion of the decision making body.
- The noise level standards applicable to land uses containing incidental residential uses, such as caretaker dwellings at industrial facilities and homes on agriculturally zoned land, shall be the standards applicable to the zone district, not those applicable to residential uses.
- Where no noise level standards have been provided for a specific zone district, it is assumed that the interior and/or exterior spaces of these uses are effectively insensitive to noise.

Source: Placer County General Plan 1994

TABLE N-4

MAXIMUM ALLOWABLE NOISE EXPOSURE
TRANSPORTATION NOISE SOURCES

LAND USE	OUTDOOR ACTIVITY AREAS [1]	INTERIOR SPACES	
	L_{dn}/CNEL, dB	L_{dn}/CNEL, dB	L_{eq}, dB [2]
Residential	60 [3]	45	--
Transient Lodging	60 [3]	45	--
Hospitals, Nursing Homes	60 [3]	45	--
Theaters, Auditoriums, Music Halls	--	--	35
Churches, Meeting Halls	60 [3]	--	40
Office Buildings	--	--	45
Schools, Libraries, Museums	--	--	45
Playgrounds, Neighborhood Parks	70	--	--

[1] In Communities and Rural Centers, where the location of outdoor activity areas is not clearly defined, the exterior noise level standard shall be applied to the property line of the receiving land use.

[2] As determined for a typical worst-case hour during periods of use.

[3] Where it is not possible to reduce noise in outdoor activity areas to 60 dB L_{dn}/CNEL or less using a practical application of the best available noise reduction measures, an exterior noise level of up to 65 dB L_{dn}/CNEL may be allowed provided that available exterior noise level reduction measures have been implemented and interior noise levels are in compliance with this table.

Source: Placer County General Plan 1994

City of Folsom

Folsom General Plan Noise Element

The Noise Element of the Folsom General Plan (Folsom Community Development Department, 1988) was developed to mitigate noise conflicts and to minimize future noise conflicts adopting policies and implementation measures designed to achieve land use compatibility for proposed development. The contents of the Noise Element were determined by the requirements of Section 65302(f) of the California Government Code and by the "Guidelines for the Preparation and Content of Noise Elements of the General Plan," which were adopted and published by the California Office of Noise Control (ONC) in 1976. For the purpose of the General Plan, noise sensitive land uses include residential land uses, schools, hospitals, and nursing homes.

The Noise Element of the Folsom General Plan contains several policies that are considered relevant to the Unit:

Policy 30.2: Develop and implement effective strategies to abate and avoid excess noise exposures in the City by requiring that effective noise mitigation measures be incorporated into the design of new noise generating and new noise sensitive land uses.

Policy 30.3: Protect areas within the City where the present noise environment is within acceptable limits.

Policy 30.4: Areas within the City of Folsom shall be designed as noise impacted if exposed to existing or projected exterior noise levels exceeding 60 dBA L_{dn}/CNEL, or the performance standards relate to nontransportation related noise sources. (These standards are summarized in Table N-5 below.) Each noise level standards shall be reduced by 5 dBA for simple tone noises, noises consisting primarily of speech or music, or recurring impulsive noises. Noise from single occurrences, such as the passage of locomotives, heavy trucks, or aircraft, should also be evaluated in terms of single event noise levels. The maximum noise created by such an event may result in activity interference, even though the cumulative noise exposure in terms of L_{dn}/CNEL is within acceptable limits. The potential for sleep disturbance is usually of primary concern in such cases and should be evaluated on a case-by-case basis.

Policy 30.5: New development of residential or other noise sensitive land uses will not be permitted in noise impacted areas unless effective measures are incorporated into the project design to reduce these noise levels as follows:

1. For noise attributable to traffic on public roadways, railroad line operations, and aircraft: 60 dBA L_{dn}/CNEL or less is acceptable in outdoor activity areas, and 45 dBA L_{dn}/CNEL or less is acceptable at the interior level. Where it is not possible to reduce exterior noise, because of 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 dBA L_{dn}/CNEL with windows and doors closed.

2. For nontransportation related noise sources: achieve compliance with the performance standards contained within Table N-5.

   If compliance with the adopted standards and policies of the Noise Element will not be achieved, a statement of overriding considerations for the project must be provided.

TABLE N-5
CITY OF FOLSOM NOISE LEVEL PERFORMANCE STANDARDS FOR NEW PROJECTS AND DEVELOPMENTS

Exterior Noise Level Standards, dBA		
Cumulative Number of Minutes in any One Hour Time Period	**Daytime 7:00 a.m. to 10:00 p.m.**	**Nighttime 10 p.m. to 7:00 a.m.**
30	50	45
15	55	50
5	60	55
1	65	60
0	70	65

Source: City of Folsom General Plan 1988.

Policy 30.6: When industrial, commercial land uses or other uses including nontransportation related noise sources are proposed, which would affect areas containing noise sensitive land uses, noise levels generated by the proposed use shall not exceed the performance standards contained within Table N-6.

Policy 30.7: Prior to approval of proposed development of residential or other noise sensitive land uses in a noise impacted area, an Acoustical Analysis may be required. The acoustical analysis shall:

1. Be the responsibility of the applicant.

2. Be prepared by a qualified person experienced in the field of environmental noise assessment and architectural acoustics.

3. Include representative noise level measurements with sufficient sampling periods and locations to adequately describe local conditions.

4. Include estimated noise levels in terms of L_{dn}/CNEL and/or the standards of Table E for existing and projected future (20 years hence) conditions, with a comparison made to the adopted policies of the Noise Element.

5. Include recommendations for appropriate mitigation to achieve compliance with the adopted policies and standards of the Noise Element. Where the noise source in question consists of intermittent single events, the report must address the effects of maximum noise levels in sleeping rooms in terms of possible sleep disturbance.

6. Include estimates of noise exposure after the prescribed mitigation measures have been implemented

Policy 30.8: The City of Folsom shall endeavor to develop and employ procedures to ensure that the requirement imposed pursuant to the findings of an acoustical analysis are implemented as part of the project review and building permit processes. The appropriate time to require an acoustical analysis would be as early in the project review process as possible so that noise mitigation may be an integral part of the project design.

Policy 30.9: Noise level criteria applied to land uses other than residential or other noise sensitive uses shall be consistent with the standards in the land use compatibility for community noise environments established in Guidelines for the Preparation and Content of Noise Elements of the General Plan (California Department of Health, 1976).

Policy 30.10: The City of Folsom shall enforce the State Noise Insulation Standards (California Code of Regulations, Title 24) and Chapter 35 of the Uniform Building Code (UBC). Title 24 requires that an acoustical analysis be prepared for all new developments of multifamily dwellings, condominiums, hotels, and motels proposed for areas within 60 dBA L_{dn}/CNEL contour of a major noise source for the purpose of documenting that an acceptable interior noise level of 45 dBA L_{dn}/CNEL or below will be achieved.

Policy 30.11: The City of Folsom shall adopt a community noise control ordinance to address noise complaints and to provide local industry with performance standards for future developments and equipment modifications. The ordinance should be consistent with the model noise control ordinance contained in the database of the General Plan.

Policy 30.15: If noise barriers are required to achieve the noise level standards contained within the Noise Element, the following construction practices are recommended:

1. Noise barriers exceeding six feet in height relative to the roadway should incorporate an earth berm so that the total height of the solid portion of the barrier (such as masonry or concrete) does not exceed six feet.

2. The total height of a noise barrier above roadway elevation should normally be limited to 12 feet.

3. The noise barriers should be designed so that their appearance is consistent with other noise barriers in the project vicinity.

The General Plan provides noise standards for new projects and developments. Noise created by a nontransportation related noise sources shall be controlled so as not to exceed the noise level standards set forth in Table N-5 as measured at any affected residentially designated lands.

Granite Bay Community

The Placer County Board of Supervisors established the Granite Bay Municipal Advisory Council (MAC) in 1980. The primary purpose of the MAC is to advise the Board of Supervisors regarding issues affecting the Community. The Granite Bay Community follows the noise standards established in the Placer County Noise Element.

Ambient Noise Degradation. In addition to the standards stated above, the significance of noise impacts may be described by the expected change in ambient noise levels that would occur as a result of a project.

Expected reactions to changes in ambient noise levels for persons who are exposed to noise have been reported, quantified by metrics that define short-term exposure (e.g., hourly L_{eq}, L_{max}, and L_n). These metrics are usually used to describe noise impacts due to industrial operations, machinery, and other sources that are not associated with transportation. According to Egan and others, as shown in Table N-6, an increase of at least 3 dBA is usually required before the change will be clearly noticeable. This analysis assumes that a minimally perceptible increase of 3 dBA represents a significant increase in ambient noise levels.

TABLE N-6
SUBJECTIVE REACTION TO CHANGES IN
NOISE LEVELS OF SIMILAR SOURCES

Change in Level, dBA	Subjective Reaction	Factor Change in Acoustical Energy
1	Imperceptible (Except Tones)	1.3
3	Barely Perceptible	2.0
6	Clearly Perceptible	4.0
10	About Twice (or Half) as Loud	10.0

Source: Egan 1988

Existing Noise Measurement Results

Ambient noise monitoring was conducted by LSA staff in the Unit vicinity between 9:00 a.m. and 6:00 p.m. on September 19, 2002, to document the existing noise environment. A total of ten locations around Folsom Lake were selected for the ambient noise monitoring. Ambient noise measurements were taken for 20 minutes at each site. Table N-7 lists the noise monitoring results at these ten locations. The measured noise data show that noise in the Unit is generally low to moderate, typical of rural areas. The average noise level measured ranged from 37.2 dBA L_{eq} to 65.3 dBA L_{eq}. Locations that are near roads with higher traffic volumes show higher noise levels than locations away from the traffic.

Table N-7: Ambient Noise Levels, dBA

Site	L_{eq}	L_{max}	L_{min}	Noise Sources
1. Nimbus Dam Overlook; hillside above Lake Natoma	51.2	55.7	31.9	Traffic on Hazel Avenue and Highway 50; autos entering and existing overlook@ lot; birds
2. Willow Creek State Park; approximately 50 feet from edge of water	42.9	54.2	37.9	Traffic on Folsom Boulevard; autos within the park; pedestrian traffic; birds
3. Approximately 80 feet east of Riley Street and Rainbow Bridge; south side of American River	54.6	62.4	44.9	Traffic on Riley Street and Rainbow Bridge; birds
4. Top of levee near Dam Road and Natoma Street intersection	52.7	65.7	39.1	Traffic along Dam Road and Riley Street; boats on the lake; airplane overflight; birds
5. Lake Hills Drive at Shoreline Pointe Road; a residential area with view of lake	65.3	85.8	32.5	Lawn mower; autos; birds; one cement truck drove up and turned around that contributed the loud noise
6. Salmon Falls parking lot	38.6	55.0	31.5	Autos on Salmon Falls Road; construction equipment on hillside above parking lot; birds
7. Peninsula Campground; boat launch area	44.4	59.8	32.7	Boats on the lake; waves hitting shoreline; birds
8. Rattlesnake Bar recreation area	42.5	55.9	32.5	Boats on the lake; birds
9. Granite Beach	37.2	57.3	31.8	Boats on the lake; pedestrians; birds
10. Douglas Boulevard at Auburn Folsom Road	60.1	70.9	52.2	Traffic on Douglas Boulevard and Auburn Folsom Road

Source: LSA Associates, Inc., September 2002.

Recommendations

In consideration of high use periods or seasons, the ambient noise monitoring included in this inventory was conducted during a relatively quiet period of time in the Unit. Additional noise monitoring is recommended to assess noise levels during heavy use periods when boating and traffic activities are highest.

Pre-test Boat Noise Measurement

The pre-test noise measurement is used to clearly identify the (source) noise level of each individual boat/ski. To measure each individual source noise level, the noise level should be taken at a set distance, for example, at 25 feet or 50 feet, with minimal interference from other noise sources. This set of noise levels can be used to determine if ambient noise level observed at a specified location is from such noise source(s). The source noise level testing should be conducted for as many expected noise sources as possible, including jet skis, ski boats, and slower boats. The more completely the pre-test source noise levels are documented, the easier it will be at a later time to identify potential noise effect from a specific noise source.

Ambient Noise Measurement

Ambient noise measurement around the Folsom Lake State Recreation Area should be conducted at the locations of concern near sensitive receptors such as residences or camp sites, based on CDPR staff recommendations. It is not expected that boating activities in the lake would occur over the nighttime period. Therefore, noise levels or standards in terms of the 24-hour weighted average, such as community noise equivalent level (CNEL) or day-night average noise level (Ldn) are not adequate for impact determination for boat noise. Noise measurements should be conducted for a 1-hour period at each monitoring site, recording the maximum noise level (Lmax), the percentile exceedance levels (Ln), and the continuous equivalent noise level (Leq). Observation of the correlation between the noise sources and the recorded noise levels should be documented to identify the potential sources of noise impacts at each monitoring site. This set of noise data can be used later to determine if mitigation measures, such as the restriction of certain types of activities in specified areas, will be required to meet applicable noise standards. CDPR staff will determine the number of noise monitoring sites.

Traffic Noise Measurement

Traffic noise modeling is also recommended to be conducted after the traffic counts and projections in the Unit are available. Traffic noise levels on area roadway links will be tabulated for the baseline “no project” and the “with project” scenarios to determine the project’s contribution to the cumulative noise levels.

References

City of Folsom, City of Folsom General Plan Noise Element. 1988.

El Dorado County, El Dorado County General Plan Public Health, Safety, and Noise Element, July 17, 2000.

Placer County, Granite Bay Community Plan Noise Element, 1989 (accessed via the Granite Bay Municipal Advisory Council website, www.granitebay.com)

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Sacramento County, Sacramento County General Plan Noise Element, Amended 1998.

Sacramento County, Sacramento County Noise Ordinance

NATURAL RESOURCES

PLANT LIFE

Folsom Lake State Recreation Area

April 2003

by

LSA Associates

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PLANT LIFE

Introduction

This section describes and maps vegetation resources within the Folsom Lake State Recreation (the Unit). Preparation of this section entailed four major tasks: (1) initial information gathering, (2) aerial photographic interpretation, (3) field mapping for ground-truthing of vegetation communities, and (4) data analysis and recommendations. All work was conducted between July and October 2002.

For the first task, the study team reviewed a wide range of information sources, as follows: California Department of Parks and Recreation (CDPR) 1978a, 1978b, 1978c, 1979, 1988, 1996; El Dorado County 2000; Jones and Stokes 1994a, 1994b, 1994c, 1995, 1996, 2001a, 2001b, 2001c; Place County Water Agency 2002; Quinn et al. 1991; Rhodes and Bowcutt 1994; and U.S. Army Corps of Engineers (ACOE) 1991a, 199b, 1996a, 1996b, 2001a, 2001b; Bureau of Reclamation (BOR) 1988a, 1988b. The team also consulted with the following persons having knowledge and expertise on the Unit: Ken Davis, Consultant; Sandi Richerson, Ecologist, BOR; Peter Warner, CDPR Mendocino District; Sally Walters, CDPR Gold Field District; Gary Fregien, CDPR; Jim Barry, CDPR; Brian Deason, BOR; Mike Healy, California Department of Fish and Game (CDFG); and Todd Keeler-Wolf, CDFG.

The project team also became familiar with special status plant species that might occur in or around the Unit. The study team consulted both the *California Natural Diversity Data Base* (CNDDB 2003) and the California Native Plant Society *Inventory of Rare and Endangered Plants* (CNPS 2001), and visited the Pine Hill Preserve, which is adjacent to the Unit, to become familiar with special status species occurring within the preserve. The unique soils that characterize the Pine Hill Preserve also occur in small portions of the Unit, increasing the possibility that similar special status species might also occur in the Unit.

The second task (*aerial photographic interpretation*) entailed analysis of aerial photographs (preliminary base map: Year 2000, scale: 1: 700) and preliminary mapping of vegetation communities. Plant community boundaries were delineated on aerial photographic field maps, based on previous vegetation maps for the areas and on an initial ground-truthing site visit to preliminarily identify aerial photographic vegetation signatures.

For the third task (*field mapping*), biologists from the study team surveyed the Unit to authenticate and modify the preliminary vegetation maps as needed. The entire extent of the Unit adjacent to Folsom Lake and both forks of the American River were surveyed from the water. Walking surveys were conducted in representative areas of the Unit not accessible by water (including Lake Natoma).

Field surveys were performed on July 16, 17, 18, 19, August 20, 21, September 9, and October 17, 2002, and January 22, 2003. During the field surveys, biologists made observations and collected data on each plant community, as follows:

1. A list of all observed plant species was compiled for each community.

2. Community boundary adjustments were made on the preliminary vegetation maps where needed.

3. Significant vegetation stands were noted on the maps and their locations recorded using a Global Positioning System (GPS) receiver. Significant vegetation stands included native grassland stands, vernal pools, seasonal wetlands and invasive exotic plant infestations.

4. General (non-quantitative) observations were made for each plant community including vegetation dominance, structure (*e.g.*, stand layers, approximate canopy height, canopy and shrub layer density, ground cover), and evidence of past disturbances (*e.g.*, fire, clearing, erosion, invasive exotic plant presence).

5. Although focused surveys for special status species were not conducted, biologists visited specific plant communities likely to support special status species.

The data collected during the vegetation field surveys resulted in a final vegetation community map that constitutes one of the data layers in the project's GIS. The vegetation layer consists of a complex mosaic of vegetation community type polygons for the entire Unit. When these polygons are combined with the other data layers in the GIS (*e.g.*, soils, topography, slope), vegetation data can be viewed in a manner consistent with the California Native Plant Society *Vegetation Rapid Assessment Protocol* (CNPS 2001).

Investigation of aquatic plants in the Unit relied upon interviews with experts currently involved in aquatic weed eradication efforts in the area, as well as limited field surveys of areas known or likely to be support aquatic vegetation. Consultant, Ken Davis, and Bureau of Reclamation (BOR) ecologist, Sandi Richerson, were the primary sources of information on this topic. Additional agency personnel interviewed on this topic included: Peter Warner of the Mendocino District, Sally Walters of the Gold Field District, Folsom Lake State Recreation Area; Brian Deason of the BOR; and Mike Healy of CDFG.

The fourth task (*data analysis and recommendations*) entailed preparation of detailed vegetation community descriptions, species lists and the final vegetation maps which are layered upon an aerial photographic base map, dated 1992, scale 1:700). The task also entailed description of observed and potential vegetation management needs based on field observations by the project team and consultations with Unit staff. Extensive input was also received from fire ecologist Maria Morales, who is preparing a "Unit Burn Plan" for Folsom Lake State Recreation Area. Ms. Morales' plan is based on fuels data and assessment collected from throughout the Unit.

Terrestrial Vegetation

Overview

The Unit is dominated by aquatic habitat within Folsom Lake and Lake Natoma. Nevertheless, the boundaries of the Unit also encompass significant stands of terrestrial vegetation that surround the lakes. The Unit supports many fine examples of native plant communities that provide suitable habitat for a large number of native fauna, and also provide excellent interpretive opportunities for visitors from nearby urban areas.

The Unit supports nine major terrestrial vegetation communities that are typical of the lower foothills of California's Central Valley (Barbour and Major 1977, Sawyer/Keeler-Wolf 1995). These are chamise chaparral, interior live oak woodland, blue oak woodland and savanna, annual grassland, cottonwood/willow riparian, freshwater marsh, seasonal wetland and northern claypan/hardpan vernal pool.

The Unit's plant communities occur in a distinctive pattern that reflects topography, soils and aspect (topographic position). The boundaries between some plant communities are distinct, such that a person can literally step from one type into another (*e.g.*, riparian/grassland boundaries). For other plant communities, the boundaries are gradual transitional zones that are defined only by a gradual decrease in the density of tree canopy (*e.g.*, oak savanna/grassland boundaries).

The Unit's mix of vegetation communities is a product of complex interactions of natural and human influences that have shaped the region. These influences include climate, soil type and depth, elevation, slope, aspect (topographic position), grazing and browsing, fire, physical disturbances by humans, reservoir fluctuations and invasive exotic vegetation. Successful long-term protection and management of the Unit's vegetation must take into account the relationship of the vegetation to physical, environmental and human influences, and how the vegetation responds to changes in these influences.

All of the Unit's plant communities have been significantly influenced by human activities, to varying degrees. For example, most of the Unit's annual grasslands are highly disturbed and bear little resemblance to the native perennial grasslands that they replaced. Grassland disturbance occurred in two major waves. The first wave occurred approximately two-hundred years ago when Europeans introduced livestock grazing to the region. The introduction of cattle, and the associated introduction of European annual grasses as forage, forever altered the grassland landscape. Prior to the introduction of cattle, the Unit would have contained substantial zones of native perennial grassland ecosystems, adapted to brief but intensive periods of grazing by tule elk and pronghorn. These native ecosystems have been replaced by Mediterranean annual grasslands, more suited to extended grazing by cattle.

The second wave of grassland disturbance occurred during the past century with the introduction of aggressive exotic pest plants, such as yellow starthistle (*Centaurea solstitialis*), medusa head (*Taeniatherum caput-medusae*), mustard (*Brassica nigra*) and wild radish (*Raphanus sativus*). Improper grassland management and/or lack of management have almost certainly contributed to the continued spread of these weeds in many locations in California. These noxious weeds are now the dominant species in many grasslands in the Unit.

Woodland and chaparral communities throughout the Unit are adapted to natural cycles of fire and grazing/browsing. Human disturbances, such as fire suppression and cattle grazing activities (prior to Unit establishment) have affected the location, density and composition of these vegetation communities. The hydrology of wetland and riparian areas has been changed by various land alteration activities as well as changes in groundwater regimes caused by the creation of Folsom Lake and Lake Natoma. New wetland and riparian plant communities have developed along the shorelines of the lakes and in former upland areas that became subject to annual water level fluctuations.

Vegetation Classification

The Unit is located within the California Floristic Province (Hickman 1993). This Province extends west from the crests of the Sierra Nevada and Cascade Mountains to the Pacific Ocean and excludes the California deserts (Barbour and Major 1977; Hickman 1993). Because of its great plant and habitat diversity, the California Floristic Province is divided into six regions and 17 subregions (Hickman 1993). The Unit occurs in the transition zone between 2 vegetative subregions. Lake Natoma is located entirely within the Sacramento Valley subregion in the wetter, northern portion of the Great Central Valley region. Folsom Lake is located in the northern Sierra Nevada Foothills subregion.

Elevations in Folsom Lake SRA range from approximately 100 feet to 1,500 feet (see Geology Section). Table PL-1 summarizes the elevation ranges of the Unit's plant communities.

Plant communities in the Unit are described primarily in accordance with the Sawyer and Keeler-Wolf (1995) terrestrial vegetation classification system. The Holland (1986) vegetation classification system is also referenced. The Holland system was used by the California Natural Diversity Data Base (CNDDB) until October 2000 when it was replaced by the Sawyer/Keeler-Wolf system, which is also integrated into the CNPS *Vegetation Rapid Assessment Protocol* (CNPS 2001).

The Holland system is based on a classification approach developed by Cheatham and Haller (1975) which divided the California landscape into 375 natural communities. Each community is easily distinguished from the others because several species are more or less restricted to it, including at least a few dominant species or characteristic indicator species.

Under the Sawyer/Keeler-Wolf system, major vegetation types constitute one hierarchical level based on broad characterizations of dominance (*e.g.*, shrublands, woodlands). Natural plant alliances or "series," constitute the next level in the classification scheme. Series are identified by the dominant plant species that occur in the overstory or dominant height stratum (*e.g.*, chamise series, blue oak series). Series can be further divided into plant associations, which are determined by the characteristic sub-dominant species or by the species that are dominant in the understory (*e.g.*, chamise-white sage association, blue oak/grass association).

The Sawyer/Keeler-Wolf system divides California vegetation into 241 herb, shrub or tree dominated series. Additionally, unique vegetation that cannot be classified into series are identified in several non-series categories of habitats, stands, and vernal pool types.

Wherever possible, this report provides the most appropriate Sawyer/Keeler-Wolf series or non-series name in describing each vegetation community in the Unit. However, the specific names used to identify each vegetation community are not necessarily identical to the Sawyer/Keeler-Wolf series names. This was done for two reasons. First, many of the Sawyer/Keeler-Wolf series names do not always convey to the non-technical reader a clear picture of the appearance of a vegetation community. For example, the term "blue oak woodland and savanna" used in this report provides a better understanding of this particular community than does the term "blue oak series" used under the Sawyer/Keeler-Wolf system.

Second, the Unit contains some vegetation communities (*e.g.*, seasonal wetlands, lake shoreline fluctuation zone) that do not have analogs in the Sawyer/Keeler-Wolf system. In these instances, assigning a Sawyer/Keeler-Wolf series or non-series name would be misleading.

Table PL-1 summarizes the Unit's plant communities with respect to classification, dominant species, elevation range and approximate acreage. Each community is described in more detail in the following sections.

Chamise Chaparral

General Description. The chamise chaparral community found in the Unit is classified as "chamise series" under the Sawyer/Keeler-Wolf classification system. Chamise chaparral is one of over 40 chaparral series designations under the Sawyer/Keeler-Wolf system, approximately 15 of which recognize chamise as a dominant species and corresponds to the "chamise chaparral" and "gabbroic northern mixed chaparral" community types of Holland (1986). Chamise chaparral is dominated by chamise (*Adenostema fasciculatum*), an evergreen shrub that accounts for greater than 60 percent of the vegetative cover. In most instances, associated species contribute less than 10 percent of the canopy cover (Hanes 1990).

Chamise chaparral is the most common type of chaparral in California. In turn, chaparral is the most common vegetative type in California, occurring on dry slopes on the islands, near the coast, and in mountains. Chamise chaparral requires a Mediterranean climate with limited winter rainfall (30-60 cm) and hot dry summers (Hanes 1990). It flourishes on thin, nutrient poor, rocky soils and, in northern California, is sometimes found on serpentine soils. Chamise chaparral occurs between 300 and 3,000 meters elevation on xeric south and west-facing slopes.

Appearance. Chamise is 1-3 meters tall at maturity and forms dense interwoven thickets that are difficult to walk through. Chamise looks gray from a distance, both because of the color of the small leaves, and because of the many dead branches and shredding bark of the bushes (Figure PL-1). Chamise chaparral has little understory and litter relative to other types of chaparral due in large part to allelopathic substances (toxins) produced by the chamise leaves (Hanes 1990).

Characteristic Plant Species. In the Unit, chamise constitutes approximately 90 percent of the vegetative cover in the almost continuous shrub canopy. Foothill pine (*Pinus sabiniana*) and manzanita (*Arctostaphylos viscida*) are occasionally observed in small numbers above the chamise. Sage (*Salvia sonomensis*) is the dominant ground cover with foxtail chess (*Bromus madritensis*) and foothill needlegrass (*Nassella lepida*) occurring as subdominants. Table PL-2 provides a list of all plant species known or expected to occur in each vegetation community type in the Unit.

Occurrence within the Unit. Chamise chaparral is distributed across approximately 450 acres of the Unit and occurs primarily along the steep south- and southwestern-facing rock outcrops bordering the upper reaches of the American River's South Fork (Figure PL-2). These stands are an extension of a large mantle of chamise that continues almost unbroken for miles to the southeast of the South Fork. Another large stand of chamise occurs on the

Peninsula along the crest and southwestern slope of Flagstaff Hill. Finger-like extensions of this shrubland cover steep east- and south-facing slopes of the Unit portions of the Peninsula. Small (<10 acre) stands of chamise also occur at the extreme southern tips of the Peninsula on moderate slopes. Additional small (<5 acres) stands of chamise occur immediately north of Beek's Bight at the base of the North Fork of the American River.

In the Unit, chamise chaparral occurs on two basic soil types (see Figure 5-1 in the *Soils* Section). The first soil type, that occurs primarily along the upper reaches of the South Fork of the American River, is part of the Rescue soil series, that consists of well-drained soils derived from underlying gabbrodiorite rock formations (SCS 1974). This soil series typically occurs at elevations ranging from 1,000 to 2,500 feet. The specific soil type common to the chamise stands described above is Rescue, extremely stony sandy loam, that occurs on 3 to 50% slopes. The soil is only 3 to 8 inches deep and is easily eroded. The second soil type, that occurs on north and south sides of the South Fork in the vicinity of Iron Mountain and Flagstaff Hill, is a serpentine soil. Stone outcrops constitute 50 to 90 percent of the ground between areas of very thin infertile red soil. Serpentine soils have high levels of magnesium, nickel and chromium (toxic to most plants) and are low in calcium, nitrogen and phosphorous (Pavlik *et al.* 1991).

Probably the best example of this mix of gabbroic and serpentine soil types in the vicinity of the Unit occurs in the Pine Hill Ecological Preserve, located approximately 4 miles southeast of the South Fork of the American River. The preserve supports extensive stands of chamise chaparral containing several federally-listed endangered plant species that are adapted to these unique soil conditions (see discussion below).

Associated Special Status Plant Species. Eleven special status species have the potential to occur in the Unit in chaparral habitats on gabbroic or serpentine soils, as follows:

Plant species listed under the Federal and/or State Endangered Species Acts:[1]

- Stebbin's morning glory (*Calystegia stebbinsii*) – FE, SE[2]
- Pine Hill ceanothus (*Ceanothus roderickii*) – FE, SR[3]
- Pine Hill flannelbush (*Fremontodendron decumbens*) – FE, SR
- Eldorado bedstraw (*Galium californicum ssp. sierrae*) – FE, SR
- Layne's ragwort (*Senecio layneae*) – FT,[4] SR

Other special status plant species listed by the State of California or California Native Plant Society are the following:[5]

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[1] The section entitled, Special Status Plants, (page PL-25) and Table PL-2 provide details on the where each special status plant species is known to occur in the Folsom Lake unit vicinity, as well as the habitat requirements and exact listing status of each species.

[2] FE = listed as Endangered under the federal Endangered Species Act; SE = listed as Endangered under the State Endangered Species Act.

[3] SR = listed as Rare by the State of California

[4] FT = listed as Threatened under the federal Endangered Species Act.

- Bisbee Peak rush rose (*Helianthemum suffrutescens*) - 3
- Brandegee's clarkia (*Clarkia biloba* ssp. *brandegeae*) - 1B
- Butte County fritillary (*Fritillaria eastwoodiae*) - 3
- El Dorado County mule ears (*Wyetheia reticulata*) -1B
- Red Bluff dwarf rush (*Juncus leiospermus* var. *leiospermus*) - 1B
- Red Hills soaproot (*Chlorogalum grandiflorum*) - 1B

Although these species tend to occur in mixed chaparral communities, the chamise chaparral found in the Unit occurs on similar soil in the upper reaches of the South Fork of the American River as does mixed chaparral. Table PL-3 provides information on special status plant species known or with the potential to occur in the Unit.

Management Considerations. Fire is the primary influence in sustaining chaparral communities. Chaparral is prone to frequent fires, and the species that evolved in this community did so under the influence of fire. In areas where fire is not suppressed, chaparral burns on a 10 to 40 year cycle (Muller *et al*. 1968). After a burn, chamise chaparral is slow to regrow relative to other chaparral types, due mainly to the poor soils on which it occurs (Hanes 1990). After a fire, pioneering forbs establish quickly from an extensive seedbank, only to be suppressed by grasses after 4 to 5 years. After 7 to 9 years, the shrubby component has regrown from seed or resprouting (Hanes 1990). Chamise chaparral cannot perpetuate itself in the absence of fire, as fire appears necessary to rid the soil of toxins produced by the chamise (Hanes 1971). If fire is suppressed for many years, openings created by dead chamise will be filled with grasses.

For thousands of years prior to the arrival of Europeans, chaparral burns were regularly set by Native Americans. Spaniards and the settlers that followed also routinely burned chaparral (Hanes 1990). This burning most likely had the long-term effect of perpetuating and expanding chaparral communities, although the short-term goal was to open the shrubland. The suppression of fire in chaparral communities has created senescent stands of chamise that, if unburned, give way to grasslands. Additionally, the lack of fire for long periods of time allows for the accumulation of fuel that, when ignited, results in fires hot enough to sterilize seeds in the seedbank and kill the root-crown burl from which shrubs re-grow. In this scenario, the thin soils are exposed to erosion forces that can quickly strip away the soil. In either case, long-term fire suppression results in the eventual loss of the chaparral community.

Grazing and browsing have not played a significant role in the chamise community. Chamise is woody, occurs on steep slopes and grows in dense thickets, making it both an unpalatable food source for cattle and difficult to access.

Chaparral is a highly valued watershed cover, preventing surface erosion on thin soils where little else will grow (Barbour and Major 1977). Chamise chaparral is of particular value in

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[5] CNPS special status plant categories are described on Page PL-25.

the Unit because the steep slopes on which it occurs are exceedingly predisposed to erosion (SCS 1974).

The potential for chaparral to support the federally-listed endangered plant species discussed above is directly related to the unique gabbroic and serpentine soil types that occur there. Disruption of these soils by ground disturbing activities could create soil conditions unfavorable to these species (BOR 2002).

Interior Live Oak Woodland

General Description. This plant community is classified as "interior live oak series" under the Sawyer/Keeler-Wolf classification system. Holland (1986) also identifies a similarly described community as "interior live oak woodland." Interior live oak (*Quercus wislizenii*) is the sole or dominant tree in the canopy. However, based on the sub-dominance by foothill pine and blue oak in many locations in the Unit, the community may also be described under the Sawyer/Keeler-Wolf system as "interior live oak-blue oak-foothill pine association."

Interior live oak woodland is unique to California because the dominant and subdominant woody species are all California natives. It extends through the North Coast range and the western slopes of the Sierra foothills, occurring as savanna or woodlands on slopes and in valleys on shallow well-drained soils (Sawyer & Keeler-Wolf 1995). At higher elevations (typically below 5,000 feet) on north aspects, canopy cover tends to increase (Griffin 1990, Pavlik *et al*. 1991). Interior live oak is not restricted to a particular type of soil, although it does not occur on serpentine (Pavlik *et al*. 1991).

Appearance. The interior live oak canopy varies substantially. In most locations, the canopy is near-continuous, while in some areas it may have a more open woodland appearance (Figure PL-3). Scattered foothill pines extend above the oak canopy in both closed and open woodlands. Where the upper canopy is dense, shrubs are common in the understory but the groundcover is sparse. Where the upper canopy is more open, shrubs are less common and grasses dominate the groundcover. The interior live oak series intergrades with blue oak series.

Characteristic Plant Species. In addition to the evergreen interior live oak, the canopy includes sub-dominants foothill pine, black oak (*Quercus kellogii*) and blue oak (*Quercus douglasii*). The shrub layer in the Unit is dominated by poison oak (*Toxicodendron diversilobum*) and California buckeye (*Aesculus californica*), while the understory is dominated by blue wild rye (*Elymus glaucus*), hedgehog dogtail (*Cynosurus echinatus*) and ripgut brome (*Bromus diandrus*). Table PL-2 provides a list of all plant species known or expected to occur in each vegetation community type in the Unit.

Occurrence within the Unit. Interior live oak woodland is distributed across approximately 3,890 acres of the Unit and is the most common community type (by relative cover) in the Unit (Figures PL-4a and PL-4b). A good example of this community type is found north of Granite Bay, where it occurs in an elevation range of 500 to 700 feet in hilly terrain with multiple slope aspects. The soil series on which it occurs is the Andregg-Rock outcrop complex, a moderately deep, well-drained soil type that developed from granitic parent material on 5 to 30 percent slopes (SCS 1980). Here interior live oak is clearly the most dominant tree in the overstory.

On the western and eastern margins of the Peninsula, the blue oak component of the canopy increases such that it becomes co-dominant with interior live oak before transitioning to a separate blue oak community (described below). In the center of the Peninsula and along the length of the South Fork of the American River, foothill pine cover is notably greater than in interior live oak stands elsewhere in the Unit.

The variation in abundance of the three most common canopy species appears to correspond roughly with soil descriptions for the area. Where blue oak is a significant component of the canopy, the soil is described as an Ahwahnee course sandy loam on 9-15% slopes and Auburn very rocky silt loam on 30-50% slopes (SCS 1974, 1980). These soils are very well drained, favoring the more drought tolerant blue oaks. Where the foothill pine becomes co-dominant, the most common soil type is Auburn very rocky silt loam on 2-30% slopes.

Associated Special Status Plant Species. Fourteen special status species have the potential to occur in the Unit in interior live oak woodlands, as listed below. Most of these species are primarily associated with chaparral communities, but nevertheless may also occur within oak woodlands where inclusions of gabbroic or serpentine soils are found. Some species may also occur where red clay soils of the Pine Hill formation are found (see Figures 5-1 in *Soils* Section). Big-scale balsamroot, Tuolumne button-celery, and dubious pea are limited to oak woodland sites where deeper, more mesic soils are found.

Plant species listed under the Federal and/or State Endangered Species Acts:

- Eldorado bedstraw (*Galium californicum ssp. sierrae*) – FE, SR
- Stebbin's morning glory (*Calystegia stebbinsii*) – FE, SE
- Pine Hill ceanothus (*Ceanothus roderickii*) – FE, SR
- Pine Hill flannelbush (*Fremontodendron decumbens*) – FE, SR
- Layne's ragwort (*Senecio layneae*) – FT, SR

Other special status plant species listed by the State of California or California Native Plant Society are the following:

- Bisbee Peak rush rose (*Helianthemum suffrutescens*) - 3
- Brandegee's clarkia (*Clarkia biloba* ssp. *brandegeae*) - 1B
- Butte County fritillary (*Fritillaria eastwoodiae*) - 3
- El Dorado County mule ears (*Wyetheia reticulata*) - 1B
- Red Bluff dwarf rush (*Juncus leiospermus* var. *leiospermus*) - 1B
- Red Hills soaproot (*Chlorogalum grandiflorum*) - 1B
- Big-scale balsamroot (*Balsamorhiza macrolepis* var. *macrolepis*) - 1B
- Tuolumne button-celery (*Eryngium pinnatisectum*) - 1B

- Dubious pea (*Lathyrus sulphureus* var. *argillaceus*) - 3

Table PL-3 provides information on special status plant species expected to occur in the Unit.

Management Considerations. In general, fire thins the understory of interior live oak woodlands, and regular fires will create a more savanna-like structure. Range improvement efforts to reduce woody vegetation and human-set fires have opened oak woodlands. Grazing has limited re-growth in oak woodlands throughout California.

Where fire and grazing are infrequent, the live oak and shrub component of interior live oak woodlands will increase (Griffin 1990). Regular low-intensity fires will favor blue oaks over interior live oaks as the blue oak component of the community is more fire adapted than interior live oak. Mature blue oaks will survive fires that kill the above-ground portions of interior live oak, although interior live oak can resprout from the base. Foothill pine saplings are very sensitive to fire (Griffin 1990). This suggests that regular fires would have the effect of reducing the regeneration of foothill pine in the interior live oak woodlands.

Blue Oak Woodland and Savanna

General Description. The blue oak woodland and savanna community is classified as "blue oak series" under the Sawyer/Keeler-Wolf classification system and "blue oak woodland" under the Holland system. It encompasses a continuum of cover types in which the dominant species is blue oak, ranging from dense canopy woodland to open canopy savanna. Where savanna predominates, this community may be classified under the Sawyer/Keeler-Wolf system as "blue oak/annual grass association."

Blue oaks occur only in California and commonly below 3,500 feet in the foothills surrounding the Central Valley, as well as the inner Coastal Ranges. Blue oaks are extremely drought tolerant and can thrive in regions with as little as 15 inches of annual rainfall (Pavlik *et al*. 1991). In such areas they tend to grow as scattered trees in oak savannas. Where soil moisture increases or on cooler north facing slopes, oak savannas transition into denser woodlands that support more species. The predominance of oak woodland in comparison to oak savanna at the Unit probably reflects such higher moisture conditions.

Appearance. Blue oak woodland and savanna communities can be readily identified due to the distinctive appearance of their dominant species. The deciduous leaves of blue oaks have a blue-green color that gives the blue oak its name. Canopy cover varies from closed woodland (greater than 30 percent cover) to open savanna. An open shrub layer will establish under closed canopy blue oak woodlands. Mature trees can grow to 60 feet with diameters of up to two feet (Pavlik 1991). Blue oak savannas are typically composed solely of blue oaks in the open canopy with little or no shrubby understory. In blue oak woodlands, the canopy includes blue oak as the dominant tree with interior live oak and foothill pine as occasional subdominants. Like the savanna, blue oak woodlands have very little understory. The majority of small trees that occur under the canopy are blue oak saplings giving blue oak woodlands, as well as blue oak savannas, an open park-like appearance (Figures PL-5 and PL-6).

Characteristic Plant Species. Blue oaks tend to be the dominant or sole canopy species. The dominant plants in the grassy understory tend to vary with canopy density. Hedgehog dogtail grass usually dominates in the shadiest spots and is associated with the invasive

exotic species, Italian thistle (*Carduus pycnocephalus*). In less shady locations, wild oats (*Avena fatua*) or ripgut brome dominate in association with soft chess (*Bromus hordeaceus*) or rose clover (*Trifolium hirtum*).

The understory contains some notable native plant species in the Unit. Individual clones (tussocks comprised of a single plant) of deergrass (*Muhlenbergia rigens*) and purple needlegrass (*Nassella pulchra*) occur occasionally under open blue oak woodland. Where the canopy is more dense, creating deep shade, or in open savanna where non-native annual grasses predominate, the native grasses drop out. A 75 foot by 200 foot stand of native deergrass occurs on the Peninsula at the base of the South Fork of the American River (see vegetation maps). It extends along a moist drainage at the edge of blue oak woodland and open grassland. The stand is currently monitored for the purpose of documenting stand persistence and clone regeneration after fire (Jim Barry, CDPR, *pers. com.*). Table PL-2 provides a list of all plant species known or expected to occur in each vegetation community type in the Unit.

Occurrence within the Unit. Blue oak woodland and savanna community is distributed across approximately 1,930 acres of the Unit and is second only to interior live oak woodland in the amount of acreage covered within the Unit (Figures PL-7a and PL-7b). The largest unbroken stands are found on the Peninsula on well-drained, sandy or rocky soil. Additional blue oak woodlands and savannas occur along the lower portion of the South Fork of the American River and in scattered patches around the body of the reservoir.

Associated Special Status Plant Species. Special status species that have the potential to occur in blue oak woodland are the same as those discussed for the interior live oak community series, above. Few, if any, of the listed species are likely to occur in blue oak savanna. Table PL-3 provides information on special status plant species expected to occur in the Unit.

Management Considerations. Maintenance of blue oak woodland and savanna is dependent on disturbance regimes associated with grazing and/or fire. Under heavy grazing or browsing, blue oak savannas will usually transition to grasslands, particularly after a high intensity fire that damages mature oaks. However, regular moderate fire and/or moderate grazing will tend to maintain the savanna community. Where soil moisture is moderate to high or where fire does not regularly occur, a denser blue oak woodland will develop, which is generally the case in the Unit.

Blue oak savannas on shallow soils with a south aspect are likely to persist without developing an understory, regardless of disturbance regime, since such physical conditions do not promote the development of woodland characteristics (Griffin 1990).

Depending on environmental conditions such as fire frequency, grazing intensity, and the nature of human impacts, successional changes can occur at different rates. In dry areas, like California's foothills, succession will proceed more slowly. Human-set fires prior to the 1900s and historic range improvement efforts were large-scale disturbances that opened oak woodlands throughout California (Griffin 1990). Despite fire suppression policies in the last half-century, several studies (Griffin 1971, Muick and Amme 1990) indicate that regeneration rates for deciduous oaks, including the blue oak, have been particularly low in the last 70 years in California. The low levels of reproduction have been attributed to acorn damage caused by cattle grazing, deer browsing, and insect and rodent herbivory.

California Annual Grassland

General Description. This community type is identified by Sawyer/Keeler-Wolf as the "California annual grassland series." Holland identifies the community as "valley and foothill grassland" or "non-native grassland."

Originally, grassland probably covered well-drained areas in California from sea level to approximately 3,600 feet in elevation (Barbour and Major 1990). Grasslands ringed the Central Valley and were dotted along the coast. Purple needlegrass is thought to have been the dominant grass of pristine valley grasslands (Barbour and Major 1990). Since then, non-native annual grasses and forbs have come to dominate the region's grasslands as they have elsewhere in California. Human introduction of non-native plants into California began with the European settlements in the 18th century and continues today.

With a few notable exceptions (see below), all of the grassland areas in the Unit can be classified as non-native because they have an insignificant amount of native grass cover, and are overwhelmingly dominated by non-native annual grass species. Because exotic annual grasses are so abundant and native grasses so rare throughout the state, the California Department of Fish and Game has defined "native grassland" as having a minimum of 10 percent cover of native grass species (Todd Keeler-Wolf, *pers. com.*). Very few grassland areas in the Unit meet even this minimal definition.

Appearance. Annual grassland is typically composed of a dense cover of annual grasses and broadleaved plants (forbs) adapted to colonizing and persisting in disturbed areas (Figure PL-8 and PL-9). The height of the vegetation is approximately three feet. An occasional blue oak intrudes into the grasslands of the Unit, which are defined as having less than 10 percent tree canopy cover (Barbour and Major 1990).[6]

Characteristic Plant Species. The dominant grasses in this community are brachypodium (*Brachypodium distachyon*), ripgut brome, soft chess brome and wild oats (*Avena fatua*). Although this community is dominated by non-native species, native grasses and wildflowers are present in varying degrees. Invasive exotic pest plants, primarily yellow starthistle (*Centaurea solstitialis*), medusa head (*Taeniatherum caput-medusae*) and mustard (*Brassica nigra*) are common associates. Table PL-2 provides a list of all plant species known or expected to occur in each vegetation community type in the Unit.

Occurrence in Folsom Lake Unit. Annual grassland is distributed across approximately 1,120 acres of the Unit and is the third most abundant cover type in the Unit after interior live oak and blue oak woodlands (Figures PL-10a and PL-10b). It is found in low areas around the margins of the reservoir, along drainages, and on some arid ridgetops. Additionally, patches of grassland occur in the Peninsula where clearing (presumably for grazing) has opened the interior live oak woodland canopy.

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[6] Grasslands are defined as having less than 10 percent tree canopy cover; savanna has 10-30 percent tree canopy cover; and woodland has over 30 percent tree canopy cover (Barbour and Major 1990). Holland's community classification system is also noted parenthetically for comparison (Holland 1986). Specific vegetation series are described below.

Many grassland areas of the park are notable for their high proportion of the invasive non-native weed, yellow starthistle. The primary exceptions to this are grasslands on the Peninsula where starthistle invasion is still at relatively low levels. Yellow starthistle is more commonly found in disturbed areas. The highest levels of starthistle invasion are found in the grasslands along roads, trails, around picnic areas and camp sites, and near mine shaft openings. With the exception of two fairly large grasslands in the Peninsula where low to no starthistle was detected, all of the remaining grasslands within the Unit contain medium to high levels of starthistle. In general, starthistle coverage is higher on the western side of Folsom Lake than elsewhere within the Unit.

Few grassland areas in the Unit support more than a sprinkling of natives. One exception is the 75 foot by 200 foot stand of native deergrass that occurs on the Peninsula at the base of the South Fork of the American River (Figure PL-10a). It extends along a moist drainage at the edge of blue oak woodland and open grassland. The stand is currently monitored by Jim Berry (CDPR) with the purpose of documenting stand persistence and clone regeneration after fire. Purple needle grass makes an occasional appearance in the Unit's grasslands, but contributes less than 1 percent overall cover.

Associated Special Status Plant Species. No special status species are endemic to grasslands listed for the region surrounding the Unit. Several species that occur in vernal pools (described more fully in the vernal pool section below) are listed as occurring in grasslands by virtue of the fact that vernal pools are most often found in a grassland matrix. None of these vernal pool species are found outside of the pools in the grassy upland. Table PL-3 provides information on special status plant species expected to occur in the Unit.

Management Considerations. Management efforts for grasslands in the Unit should take into account two key concerns, as follows:

1. The lack of grasslands that have even a small component of native grass species contribute to an overall low grassland habitat quality and deprives visitors of the opportunity to view an important component of the region's natural history of the region.
2. The on-going colonization and spread of invasive exotic pest plants, primarily yellow starthistle, is rapidly diminishing the habitat quality of grasslands and associated woodland and savanna areas. Starthistle is also degrading the quality of the visitor's experience because its dense, spiny flower heads render many grasslands hostile and impenetrable for walking. Horseback riding is also difficult where narrow trails pass through dense starthistle stands. Finally, it contributes to the overall fire hazard of grassland areas.

Prior to the introduction of non-native grasses, the grasslands of the Unit were likely characterized by a relatively diverse mix of annual native forbs and grasses. These grasslands were well adapted to the presence of brief but intensive periods of grazing by native ungulates such as tule elk and pronghorn, as well as periodic light fires. The native forb and grass species were well-adapted to initial colonization after fire and grazing, however they eventually gave way to native perennial bunchgrasses, that are slow growing, but better competitors over the long term. The stable self-perpetuating late successional grasslands were probably dominated by purple needlegrass.

This historic relationship of grazing and fire to grasslands is no longer applicable to the Unit. Existing grasslands are a consequence of long-term grazing by livestock and the corresponding introduction of non-native annual species, that were better adapted to heavy livestock grazing than native bunchgrasses (Painter 1995). Livestock grazing patterns differ from the behavior of the native ungulates, and consequently the timing, intensity, and uniformity of herbivory and trampling differs, all conditions that favor the non-native annual grass species.

In the Unit, annual grasslands will gradually undergo transition to blue oak woodlands in the absence of fire. However the nature of the fire regime is very important. Occasional fires will help maintain grasslands, particularly in areas with deeper soils, by preventing young oaks from getting their start. However, light fires may promote the growth of oak savanna and woodland by promoting rapid crown sprouting from seedlings and saplings, by releasing nutrients to the soil and by reducing competition from other plants (Pavlik *et al*. 1991). On the other hand, the lack of regular, low-intensity fires, as a result of fire suppression, can result in excessive fuel accumulation, resulting in severe and damaging wildfires that kill mature oaks.

Prior to establishment of the Unit, cattle grazing probably played a role in helping to prevent transition of annual grasslands to blue oak woodlands through annual consumption of acorns and seedlings as well as browsing of saplings. Deer browsing may continue to play such a role. Deer will consume both grasses and forbs in their early green stages, but concentrate on woody vegetation (oak leaves, acorns) for most of the year (Wagner 1989). Therefore, their role in shaping the vegetation communities at the Unit may help control the invasion of grasslands by oaks through acorn and seedling/sapling consumption. However, whether such browsing by deer at the Unit is significant enough to actually prevent encroachment of blue oak woodland into grasslands is unknown.

Other non-native species occur within the grasslands of the Unit. A large stand of intergrade needlegrass (*Nassella pulchra* x *Nassella formicara* – an Argentinian species) occurs in a grassy area at the end of Rattlesnake Bar Road, approximately ½ mile past the entrance kiosk for the Peninsula Campground. The stand has been monitored by CDPR to mark its spread. Another stand of the intergrade *Nassella* species is found along the bluff between Willow Creek and Alder Creek on Lake Natoma (Gary Fregien, CDPR *pers. com*). It is unclear how much of a threat this intergrade species represents at this time.

Cottonwood/Willow Riparian

General Description. The Unit supports two types of riparian communities: "Fremont cottonwood series" and "mixed willow series," as identified by Sawer and Keeler-Wolf (1995). The occurrence of these riparian types depends largely upon the permanence of the water source and the level of stream disturbance that has occurred. Holland (1986) refers to these community types as the "Great Valley mixed riparian forest" and the "Great Valley cottonwood riparian forest," respectively.

Riparian communities occur along river, stream, and creek courses where the presence of water keeps soils moist and therefore supports a vegetational makeup different from the surrounding drier upland areas. Riparian trees and shrubs are tolerant of long periods of surface waters and/or saturated soil conditions along a stream corridor, and also have the ability to tap into deeper zones of soil moisture during the dry season via extended root

systems. Riparian systems occur where steep slopes channel water from spring rains into shallow channels or folds in the topography. Although often dry except for late winter and early spring, the drainages are often more densely vegetated than the surrounding slopes as plants take advantage of seasonal pulses of moisture. Both the Fremont cottonwood series and mixed willow series tend to occur on relatively fine-textured alluvium deposited by seasonal flooding.

Appearance. The general appearance of riparian vegetation in the Unit depends on the type of stand and whether it occurs along a perennial or an intermittent seasonal drainage. The canopy of Fremont cottonwood dominated riparian stands in the Unit is typically less than 25 meters in height and may be continuous or open (Sawyer and Keeler-Wolf 1995). Mixed willow riparian stands typically have a canopy that is less than 10 meters in height and the understory is typically sparse (Figure PL-11).

Characteristic Plant Species. The vegetation in the Fremont cottonwood series is dominated by Fremont cottonwood (*Populus fremontii*), black willow (*Salix gooddingii*), Northern California black walnut var. hindsii (*Juglans californica*), and California ash (*Fraxinus dipetala*). Buttonbush (*Cephalanthus occidentalis*), white alder (*Alnus rhombofolia*), California buckeye (*Aesculus californica*), arroyo willow (*Salix lasiolepis*), and California grape (*Vitis californica*) are common understory species. In contrast, the mixed willow series is dominated by willows including black willow, arroyo willow, and narrowleaf willow (*Salix exigua*). Table PL-2 provides a list of all plant species known or expected to occur in each vegetation community type in the Unit.

Occurrence in the Unit. Cottonwood/willow riparian communities are distributed across approximately 390 acres of the Unit. These communities occur along eight perennial creeks and 22 intermittent streams that empty into Folsom Lake, and along three perennial creeks that enter Lake Natoma (Figures PL-12a and PL-12b). Perennial creeks flow throughout the year. Intermittent streams are small drainages that flow seasonally for extended periods and may receive inflows from both surface run-off and groundwater. The Unit also contains numerous ephemeral streams, that are small drainages that flow for only brief periods following storm events and do not receive groundwater inflows. Ephemeral streams generally do not support riparian vegetation.

Two of the existing perennial creeks feeding into Folsom Lake, New York Creek and Miner's Ravine, were historically intermittent stream systems that now perennially carry irrigation run-off water from developments within their watersheds. Willow Creek, flowing into Lake Natoma also carries a significant amount of irrigation run-off.

Fremont cottonwood stands occur in relatively undisturbed sections of creeks in the Unit. These areas tend to be along the upper reaches of creeks, further away from the lake itself. The three best examples occur along the South Fork of the American River: Sweetwater Creek, Hancock Creek, and Pilot Creek. More disturbed creeks, such as New York Creek, Deep Ravine Creek, Anderson Creek, and Willow Creek, contain similar canopy species, although cottonwood trees are more dominant in the canopy. The understory along these disturbed creeks is choked with the non-native Himalayan blackberry (*Rubus discolor*), and California grape blankets the shrub layer. In several cases, these creeks appear to have once been seasonal streams that have become perennial as a result of run-off from surrounding upstream development.

Mixed willow stands are most commonly observed near the mouth of creeks and drainages adjacent to Folsom Lake and Lake Natoma, and in occasional patches along the shorelines of both lakes. These areas are subject to high seasonal water tables and seasonal flooding during periods of high lake water levels. Willow stands also occur in permanent small ponds, such as those created by mining and dredger tailings on Mississippi Bar.

Associated Special Status Plant Species. The single special status plant species occurring in the riparian forests is Northern California black walnut (*Juglans californica var. hindsii*), a CNPS List 1B species. However, several creeks and their associated riparian zones occur as narrow strips within larger habitat types such as interior live oak, that could contain the special status plants associated with these habitat types. Additionally, vernal pools sometimes occur in close proximity to riparian areas. Either of these nearby habitats could harbor special status species. Table PL-3 provides information on special status plant species expected to occur in the Unit.

Management Considerations. Many of the riparian habitats in the Unit have been disturbed and/or fragmented by inundation from the reservoir, upstream inputs from run-off, stream perennialization, and road crossings. This fragmentation has probably facilitated infestation by invasive exotic plant species, such as Himalayan berry (mentioned above) that grows in dense thickets. Such infestations reduce the diversity of native vegetation along the stream corridors and reduce habitat value accordingly

Freshwater Marsh

General Description. Freshwater marsh community in the Unit is classified as "cattail series" in Sawyer and Keeler-Wolf. Holland labels this community type as the "coastal and valley freshwater marsh." The cattail series occurs from sea level to approximately 6,500 feet (2,000 meters) in elevation.

Appearance. This community type typically occurs in shallow freshwater depressions and backwater areas along streams where water is slow moving and seldom exceeds three feet in depth (Figure PL-13). It is characterized by dense stands of perennial, emergent marsh vegetation (14.5 to 16 feet /4.5 to 5 meter), such as bulrush (*Scirpus* sp.). Along its edges, dense stands of shorter-statured marsh plants are found, while the interiors may be broken by open patches of water, that often are choked with smartweed (*Polygonum* sp.) and floating pond weeds. The cattail series can tolerate saline waters and will occur in permanently flooded as well as irregularly flooded environments. Peaty organic-rich soils have accumulated under perennially saturated soils.

Characteristic Plant Species. In the Unit, marsh vegetation is often dominated by cattails and bulrush, but shorter stature sedges (*e.g.*, *Carex aquatilis*), spikerush (*Eleocharis macrostachya*), and spreading rush (*Juncus patens*) are often found in close association in shallower water. Table PL-2 provides a list of all plant species known or expected to occur in each vegetation community type in the Unit.

Occurrence in the Unit. Freshwater marsh is distributed across approximately 10 acres of the Unit. Freshwater marsh was less likely to occur in the Unit prior to European settlement when water in the area traveled through creeks and the American River. Marsh conditions can now be found along the edges of the artificial ponds and slow moving creek sections where they enter the lakes as a result of dam construction (Figures PL-14a, Pl-14b). Cattail

marsh is found in patches along the dredge tail ponds of Mississippi Bar, in relatively protected coves along Lake Natoma, along the banks of the larger perennial creeks such as New York Creek and Willow Creek, in ephemeral and seasonal creeks such as Indian Springs and Hancock Creek. Freshwater marsh, dominated by the introduced species, yellow iris (*Iris pseudacorus*), is found along the edges of Avery's Pond. In most cases, freshwater marsh communities along riparian drainages occur in patches too small to show on the base map. Another example of freshwater marsh is found in the Mormon Island Wetland Preserve below the Folsom Dam.

Associated Special Status Plant Species. None of the special status species that might occur in the Unit occur in this community type. Table PL-3 provides information on special status plant species expected to occur in the Unit.

Management Considerations. A number of exotic non-native species are known to occur or were observed during field surveys in the freshwater marsh habitats of the Unit. Pampas grass (*Cortaderia selloana*) is a tall (6 – 13 feet) tussock grass that germinates and grows on moist, usually sandy, soils. In the Unit, pampas grass has been observed along the banks of Lake Natoma and bordering many of the dredge tailing ponds along Mississippi Bar. Pampas grass is also known to occur along the lower American River (Bossard, *et al*. 2000).

Yellow iris, an introduced species, occurs in dense stands around the shore of Avery's Pond and at Negro Bar near Natoma Crossing. Like pampas grass, it has escaped from gardens. Scarlet wisteria (*Sesbania punicea*) has recently been reported along the American River Parkway although it was not observed in recent field visits. This shrubby legume is a weed of great concern in the eastern portion of the United States and in other countries where it has invaded. Giant reed grass (*Arundo donax)* is an aggressive invader along riverine systems, and has been observed very close to the Unit (Sandi Richerson, CDPR *pers. com.*). It is expected to soon invade both marsh and stream systems of the Unit.

As with other wetland systems, the successional cycle of a freshwater marsh community is based upon the (usually) cyclical nature of water level increases and draw-downs. Under most circumstances, freshwater marshes do not transition to a different community type. Because the cattail series occurs most often in areas of perennial water in the Unit, the successional cycle may not be yearly as with seasonal wetlands and vernal pools, but may occur over a multi-year period. Typically, existing stands of cattail and bulrush will persist through short seasonal drawdowns. During drawdowns, the moist exposed soil provides germination sites for cattail and bulrush seeds as well as a large number of annual forbs, such as dotted smartweed (*Polygonum punctatum*).

If drawdown conditions persist for more than one growing season, cattail and bulrush clones will die back. Cattails can resprout from dehydrated rhizomes after several years without water. More typically, the return of moist conditions promotes the germination of these species from the seedbank. Deep-water inundation can sometimes result in floating rafts of cattails breaking free and dispersing across lakes or downstream. Deep water also promotes herbivory from muskrats that can remove large stands of cattails and bulrush for their nests. Heavy herbivory and deep water alone can result in the death of cattail and bulrush stands that will return from the seedbank during the next drawdown.

Fire does not play a role in the succession or development of freshwater marsh communities, except in areas where the non-native pampas grass has established dense stands. The thatch

from these large plants is a fire hazard that might serve as an ignition source for nearby upland vegetation communities.

Freshwater marsh community is usually subject to U.S. Army Corps of Engineers jurisdiction under Section 404 of the Clean Water Act, and Regional Water Quality Control Board jurisdiction under Section 410 of the Clean Water Act. The limits of jurisdictional area are defined by the Corps' "three parameter test" which requires that there be (1) a predominance of hydrophytic plant species (*i.e.*, plants that are tolerant of or require extended periods of inundation or soil saturation); (2) evidence of hydric soils (soils with characteristic typical of saturated or ponded conditions for extended periods); and (3) hydrological conditions suggesting extended periods of ponding or soil saturation (Environmental Laboratory 1987).

Seasonal Wetlands

General Description. Seasonal wetlands are wetland habitats that are typically wet in the winter months and dry in the summer. Vernal pools, discussed in the section that follows, are a type of seasonal wetland with unique hydrology and flora. Seasonal wetlands that are not vernal pools are typically distinguished from vernal pools by seasonal inundation that is greater in depth and longer in duration. This difference in hydrology promotes a different suite of moisture-adapted vegetation than vernal pools, although there is some overlap. The vegetation in seasonal wetlands varies greatly by geographic location and hydrology. One result of this diversity is that seasonal wetlands have not been classified by Sawyer and Keeler-Wolf (1995) or Holland (1986). Despite its lack of formal recognition as a unique vegetation community, it provides important habitat for many animals (amphibians and invertebrates in particular – refer to the Animal Life section).

Appearance. The vegetation in seasonal wetlands is usually less than three feet in height and is dominated by a wide mix of grasses and forbs (Figure PL-15). The plants in this community are adapted to saturated soils in the winter and can tolerate drought in the summer. Seasonal wetland vegetation is found in isolated basins and along creeks and ephemeral drainages. Consequently, hydrology may be determined by winter rainfall, overbank flooding from adjacent water bodies, and dry season upstream run-off from human activities.

Characteristic Plant Species. Seasonal wetlands that experience long periods of flooding or contain deeper water (1-2 feet) develop a plant community dominated by sedges (*Carex* sp. and *Cyperus* sp.), rushes (*Juncus* sp.), and spikerush (*Eleocharis* sp.). Seasonal wetlands with a shorter hydroperiod or shallower water tend to be dominated by moisture-tolerant grasses such as Italian ryegrass (*Lolium multiflorum*) and rabbits-foot grass (*Polypogon monspeliensis*). Table PL-2 provides a list of all plant species known or expected to occur in each vegetation community type in the Unit.

Occurrence in the Unit. Seasonal wetlands are distributed across approximately 3-5 acres of the Unit, occurring primarily along streams (PL-14a and Pl-14b). Seasonal wetlands also occur in relatively level or low areas below the high water line of the reservoir where water has ponded briefly following lake level draw-downs and at the mouth of most major drainages feeding into Folsom Lake. By virtue of their small size and patchy distribution, only a few areas are large enough to be shown on the base map.

Larger stands of seasonal wetlands are found in the Mormon Island Wetland Preserve, the Snipes Pershing Park, adjacent to the intergrade purple needlegrass stand near the Peninsula Campground, at the Nimbus Overlook, and in a grassland area west of Folsom Boulevard and south of Willow Creek (southeast side of Lake Natoma). In three of the four sites, the seasonal wetlands occur in close proximity to vernal pool wetland communities. In addition, two significant seasonal wetlands containing a few vernal pool plants are located on Doton's Point along a walking path. These seasonal wetlands are (erroneously) labeled vernal pools on the interpretive signs, but differ from classic vernal pools in the type of vegetation that dominates the basins. The dominant plants in these seasonal wetlands are sedges, rushes, and spikerushes, which are indicative of longer hydroperiods and/or deeper water during the wet season.

Associated Special Status Plant Species. Although unlikely because of differences in hydrology, all of the special status species that may occur in vernal pools (discussed below) may also occur in seasonal wetlands. Some overlap in non-special status species occurs in both seasonal wetlands and vernal pools. Seeds or other propagules from special status species could be dispersed from vernal pools into other seasonal wetlands and may persist in small numbers. These species are the following:

Plant species listed under the Federal and/or State Endangered Species Acts:

- Boggs Lake hedge-hyssop (*Gratiola heterosepala*) – SE
- Slender Orcutt grass (*Orcuttia tenuis*) – FE, SE
- Sacramento Orcutt grass (*Orcuttia viscida*) – FE, SE

Other special status plant species listed by the State of California or California Native Plant Society are the following:

- Dwarf downingia (*Downingia pusilla*) - 2
- Ahart's dwarf rush (*Juncus leiospermus* var. *ahartii*) - 1B
- Legenere (*Legenere limosa*) - 1B
- Pincushion navarretia (*Navarretia myersii* ssp. *myersii*) - 1B

Table PL-3 provides information on special status plant species expected to occur in the Unit.

Management Considerations. Seasonal wetlands in the Unit potentially support a number of introduced plant plants, including pennyroyal (*Mentha pulegium*) and purple loosestrife (*Lythrum hyssopifolium*). Perennial pepperweed, (*Lepidium latifolium*) is an invasive exotic pest plant typically associated with disturbed seasonal wetlands. This prolific seeder can spread quickly if not eradicated and can form dense monocultures to the exclusion of nearly all other species. Pepperweed was not observed in any of the seasonal wetlands visited during field surveys of the Unit, however its occurrence is a strong possibility.

As with other wetland and riparian-associated vegetation communities, seasonal wetlands are subject to a cyclical pattern of succession. Winter inundation and summer drawdowns

maintain a vegetation community tolerant of flooding and saturated soils as well as dry conditions. Seasonal wetlands do not tend to become vernal pools or visa versa as a consequence of hydrology, which is controlled by the permeability of the soil (usually greater in seasonal wetlands) and the topography of the basin, and the length of inundation. Likewise, seasonal wetland communities do not tend to develop into freshwater marsh because the hydrology of freshwater marshes is so much deeper. The exception to this occurs where formerly seasonal or ephemeral creeks become perennial (from upstream augmentation) and former seasonal wetland vegetation along the banks becomes permanently inundated. Here, freshwater marsh species such as cattail begin to displace typical seasonal wetland vegetation.

Seasonal wetlands are subject to the influence of fire by virtue of the fire patterns of surrounding upland communities. Seasonal wetlands are typically small in size and are dry during the fire season, therefore subject to burning. Nonetheless, the amount of fuel seasonal wetlands contribute to a burn is small. Fire is not likely to have an important successional role in the development of seasonal wetland vegetation, although its effects on seasonal wetlands in general have not been investigated.

Seasonal wetlands are usually subject to U.S. Army Corps of Engineers jurisdiction under Section 404 of the Clean Water Act, and Regional Water Quality Control Board jurisdiction under Section 401 of the Clean Water Act. The parameters by which the limits of jurisdictional area can be determined are described above under "Freshwater Marsh."

Northern Claypan and Northern Hardpan Vernal Pools

General Description. Vernal pools in the Unit are identified by their low herbaceous vegetation of annual hydrophytic species and their soil characteristics that include a shallow impermeable clay layer that forms a water-tight basin. Vernal pools are classified as the "northern claypan vernal pool" and "northern hardpan vernal pool" habitats under the Sawyer/Keeler-Wolf classification system. The Holland classification system identifies these vernal pools based upon the same criteria, and gives them the same name, "northern claypan and hardpan vernal pools."

Vernal pools are shallow wetlands that receive water from winter rain, and occasionally, overland sheet flow. A type of seasonal wetland, vernal pools dry up during the late spring and fill again the following winter. The annual vegetation species in these pools is uniquely adapted to tolerate winter inundation and summer desiccation. The annual forbs and grasses that occur in the bottom of the pools are short in stature (<1 foot) and often sparsely scattered across the pool. Perennial grasses may ring the pools. Trees or shrubs do not occur in vernal pools.

Vernal pools typically occur in relatively flat or gently rolling terrain where they are surrounded by grasslands. The pools may be connected to one another by vernal swales, but more commonly, they are hydrologically isolated. In the summer, it may be difficult to locate vernal pools in a sea of upland grasses. In late spring after water has evaporated from native vernal pools, brilliant yellow, white and purple annual forbs bloom in profusion.

Northern claypan vernal pools occur on "neutral to alkaline, silica-cemented hardpan soils," which are sometimes saline (Sawyer and Keeler-Wolf, 1995). In contrast, northern hardpan vernal pools occur on "acidic, iron-silica cemented soils including Corning, Redding, and

San Joaquin soil series." The Unit's vernal pools are situated within mapped soil types (*e.g.*, Auburn/Sobrante, Ahwanhee, Xerolls – alluvial terraces) that are not characterized by cemented of hardpan conditions (see Soils Section). However, the pools may be located upon localized inclusions of such conditions within the larger mapped soil types. It is also possible that previous human activities, such as earthmoving, farming or mining) have created compacted soil conditions in the pool locations that emulate natural hardpan soil types. Both types of vernal pools occur in the Central Valley at elevations lower than 325 feet (100 meters).

Characteristic Plant Species. The vegetation in the Unit's two vernal pool types is, for all practical purposes, identical. In relatively undisturbed pools in the Unit, the early-mid spring vegetation is dominated by native annuals such as Sacramento pogogyne (*Pogogyne ziziphoroides*), vernal pool buttercup (*Ranunculus bonariensis* var. *trisepalus*), threadstem navarretia (*Navarretia filicaulis*), Solano downingia (*Downingia ornatissima*) and slender popcorn flower (*Plagiobotrys stipatus*). In the late spring/early summer, these species give way to annual hairgrass (*Deschampsia danthonioides*), yellow-ray goldfields (*Lasthenia glaberima*), Fremont goldfields (*Lasthenia fremontii*) and coyote thistle (*Eryngium castrense*). Disturbed vernal pools are typically dominated by Italian ryegrass and pennyroyal, with a smattering of the native vernal pools species listed above. Table PL-2 provides a list of all plant species known or expected to occur in each vegetation community type in the Unit.

Occurrence in the Unit. An estimated 0.5-2 acres of vernal pools are found in the Unit, occurring in various locations in the vicinity of Lake Natoma and southeast of Folsom Lake (Figures PL-14a and PL-14b). The highest quality wetlands, as defined by vernal pool plant species diversity and abundance, are located at the Nimbus Overlook (southwest end of Lake Natoma) and the Mormon Island Wetland Preserve (southeast of Folsom Lake). At Nimbus Overlook there are two small vernal pools (in addition to seasonal wetlands), each less than 100 square feet in size. The pool locations and the disturbance history for the area suggest that these pools basins are naturally occurring. The Mormon Island Wetland Preserve area was a borrow area for the Folsom Dam construction. The large seasonal wetlands in this area are created features, however the majority of the vernal pools appear to be native based upon their size and location in the undulating landscape. Seven mid-sized vernal pools (all approximately 500 square feet) and six small pools (all less than 100 square feet) were observed here.

Lower quality vernal pools are located near Snowberry Way (northwest of Lake Natoma), west of Folsom Boulevard and south of Willow Creek (southeast side of Lake Natoma), in the Snipes-Pershing Park (northwest side of Lake Natoma), and near Beek's Bight. The Snowberry Way location supports one large vernal pool (approximately 14,000 square feet), that appears to receive run-off from neighboring yards during the winter. The pool has low vegetative cover and is being shaded out by eucalyptus trees, but nevertheless contains several native vernal pool species (annual hairgrass and Fremont goldfields).

Four vernal pools and one deeper wetland feature were observed west of Folsom Boulevard and south of Willow Creek. The bottoms of these vernal pools are lined with cobble and the vegetation in three of the four suggests a very short hydroperiod, that is likely due to pool drainage. These three pools may have been physically or hydrologically altered as a result of soil movement in the area. The fourth pool appears to be less altered and contains small quantities of native vernal pool species.

Four vernal pools and three seasonal wetlands were observed at the Snipes-Pershing Park. These pools are native to the site, but are dominated by non-native vegetation (primarily Italian ryegrass) indicative of site disturbance.

Associated Special Status Plant Species. Special status species that may occur within the vernal pools of the Unit are the same as those described above for the seasonal wetland community type. Table PL-3 provides information on special status plant species expected to occur in the Unit.

Management Considerations. Vernal pools contain a large number of species that occur in no other habitat. As a consequence, they constitute one of the most sensitive vegetation communities found in the Unit. A study by Holland and Jain (1990) indicates that of approximately 100 species typically found in vernal pools, 55 species are endemic to California. The expansion of agriculture and other development has taken a heavy toll on vernal pools in the Sacramento Valley. In Sacramento County, where vernal pools once proliferated, less than 1 percent of land area remains in vernal pools (Holland and Jain 1990).

A number of conditions threaten the sustainability of vernal pools in the Unit. The single large vernal pool in the vicinity of Snowberry Way appears to receive run-off from neighboring yards during the winter, which can be a source of undesirable nutrient enrichment. Such enrichment can lead to a decline of native vernal pool plants and an expansion of ruderal and non-native weedy hydrophytic species. Additionally, the Snowberry Pool appears to have been mowed. This can be desirable for maintaining native annual pool species if conducted in the summer after flowering is completed. However, if conducted prior to the completion of flowering, mowing can lead to a decline of native annual species.

Vernal pools do not follow a classic successional trajectory from early colonizers to late successional competitive species, as seen in other community types. Instead, vernal pools display seasonal cycles associated with hydrological fluctuations. Undisturbed native vernal pools exhibit a characteristic topographic zonation of concentric rings. The pool margins often support a completely different suite of plants than are found only a few feet away in the bottom of the pool. The zonation is thought to be the result of differential germination as water levels drop and of soil chemistry gradients resulting from evaporative processes.

The effect of fire on germination and species occurrence is not well documented for vernal pools. Their location in a grassland matrix suggests that vernal pools experienced regular fire events in the past, but its effect on succession is not known.

Vernal pools are usually subject to U.S. Army Corps of Engineers jurisdiction under Section 404 of the Clean Water Act, and Regional Water Quality Control Board jurisdiction under Section 401 of the Clean Water Act. The parameters by which the limits of jurisdictional area can be determined are described above under "Freshwater Marsh."

Lake Shoreline Fluctuation Zone

General Description. Water elevations along the shoreline of Folsom Lake fluctuate annually between mean annual low and high water elevations (466 feet NGVD). This zone is subject to extreme fluctuations in moisture conditions. During high pool conditions from late winter to mid-spring, this fluctuation zone is partially to fully inundated and has water depths

ranging from <1 foot at its upper reaches to >20 feet at its lower reaches. During low pool conditions over the rest of the year, the shoreline fluctuation zone has fully desiccated soils at its upper reaches and saturated or near-saturated soil conditions at its lower reaches.

The shoreline fluctuation zone can vary in width from 30 feet to more than 1,000 feet depending upon the shoreline slope and water level drop. The fluctuation zone is particularly wide where gently sloping arms of the lake extend well inland in such places as Beek's Bight, Indian Springs and Browns Ravine (Figures PL-16a and PL-16b).

The upper elevation of the fluctuation zone is defined by the ordinary high water line (OHWL) of the reservoir, and is the upper edge of U.S. Army Corps of Engineers jurisdiction under Section 404 of the Federal Clean Water Act, except in locations where wetlands occur above the OHWL. Corps jurisdiction extends to the landward edge of such wetlands. (Figure PL-11).

The Lake Natoma shoreline is not subject to annual water level fluctuations. Rather, water levels typically fluctuate up and down by several feet each day based on water releases from Nimbus Dam for the purposes of re-regulating power releases from Folsom Dam.

Appearance. When exposed, much of the shoreline zone remains barren or poorly vegetated with sparse, patchy stands of ruderal species, probably due to one or more conditions that are unfavorable to vegetation colonization including steep slope, unconsolidated or poorly consolidated substrates, rapid desiccation of exposed soils and trampling from human uses (Figures PL-17 and PL-18). However, other portions of the shoreline zone are seasonally or permanently vegetated. Where the shoreline slope is not too steep, it is colonized in the spring by broad-leaved ruderal forbs and later develops stands of annual grasses.

Where intermittent drainages enter the lake, or where soil moisture conditions prevent soil desiccation (possibly due to subsurface inflows or due to perched water tables), perennial wetland graminoids and forbs may persist during and after periods of inundation, spreading by rhizomes as water levels drop. Typical examples of these perennially vegetated "wet meadows" are found in the upper shoreline fluctuation zones at Brown's Ravine and at Beeks' Bight.

Additionally, in many shoreline locations, intermittent stands of willows are found. These willow stands are able to tolerate partial or even full inundation under high water conditions. Under low water conditions they can tolerate dry soil conditions because they are able to extend long taproots that reach the water table.

Characteristic Plant Species. Within the mix of plants found along the lake margins, there are species adapted to wet environments and those more typical of ruderal areas. Following lake water level drops, stands of common broadleaf forbs colonize the newly-exposed soils in many locations, producing wildflower displays of such species as miniature lupine (*Lupinus bicolor*) and vetch (*Vicia sativa*). Later in the season, sparse non-native annual grasses become dominant including wild oat, ripgut brome and Italian ryegrass. The uppermost (and driest) reaches of shoreline zone often contain stands of yellow starthistle.

In more mesic shoreline locations, such as the lake arms mentioned above, stands of prickle grass (*Crypsus niliaca*), lovegrass (*Eragrostis* sp.), silversheath knotweed (*Polygonum argryrocoleon*), bermuda grass (*Cynodon dactylon*), willow herb (*Epilobium brachycarpum*)

and weedy cudweed (*Gnapthalum* sp.) are found. Pockets of wetland vegetation occur in the shoreline zone in areas of persistent soil moisture, such as Beek's Bight and Indian Springs. Species in these locations include cocklebur (*Xanthium strumarirm*), bristly oxtongue (*Picris echioides*), spikerush (*Eleocharis* spp.), sow thistle (*Sonchus asper*) and Baltic rush (*Juncus balticus*).

Along some portions of the shoreline, early springtime growth produces wildlfower displays of such common ruderal and grassland species as clovers (*Trifolium* spp.), butter and eggs (*Triphysaria eriantha*), mustard (*Brassica rapa*) and pearly everlasting (*Anaphalis margaritacea*). Table PL-2 provides a list of all plant species known or expected to occur in each vegetation community type in the Unit.

Occurrence in the Unit. The lake shoreline fluctuation zone occurs around the perimeter of Folsom Lake in varying widths depending on shoreline topography.

Associated Special Status Plant Species. No special status species are known to occur in this community. Table PL-3 provides information on special status plant species expected to occur in the Unit.

Management Considerations. Most of the shoreline zone plant community is arrested in an early successional stage that favors annual grass and forb species adapted to colonization. Disturbance from regular water level changes and other human activities (*e.g.*, driving vehicles below waterline, trampling) prevents the vegetation from developing into a more mature community.

Little or no fire potential exists in the shoreline zone. Thin stands of vegetation with low cover and large patches of barren ground have reduced fuel loads. Higher soil moisture conditions also reduce the wildfire potential. However, ignition potential may be higher than more remote areas of the park simply because human use is greater. The possibility of fire spread is low within these areas, but if not suppressed, may jump to adjacent vegetation communities with higher fuel loads.

Ruderal and Barren Areas

General Description. Ruderal (disturbed, weedy) and barren areas do not constitute a community type, per se, but nevertheless occur as a common cover type in the Unit. Ruderal areas have no direct analog in the Sawyer and Keeler-Wolf (1995) or Holland (1986) classification systems. Ruderal and barren areas occur throughout the Unit but are most prominent along the reservoir shoreline (see discussion above) and, along roadsides and boat-launch aprons, in camping and picnic areas, and other areas where human activity has compacted the soil or otherwise heavily impacted the vegetation.

Characteristic Plant Species. Ruderal areas are dominated by a mix of weedy plant species typical of much of Northern and Central California. Common species include the same species as those described above for the non-wetland shoreline, as well as invasive exotic plant species such as yellow starthistle, Italian thistle (*Carduus pycnocephalus),* and white sweet clover (*Melilotus albus*). Table PL-2 provides a list of all plant species known or expected to occur in each vegetation community type in the Unit.

Occurrence within the Unit. Ruderal and barren areas (including the shoreline fluctuation zone) occupy approximately 1,035 acres of the Unit, occurring along roadsides and boat-launch aprons, in camping and picnic areas, and other areas where human activity has compacted the soil or otherwise heavily impacted the vegetation (Figures PL-16a and PL-16b).

Associated Special Status Plant Species. No special status species are known or expected to occur in this community.

Management Considerations. Similar to the lake shoreline, the disturbed/ruderal community is arrested in an early successional stage that favors annual grass and forb species adapted to colonization. Disturbance from human activities (driving vehicles below waterline, camping, and trampling) prevents the vegetation from developing into a more mature community.

Disturbed areas that support vegetation have low to moderate fuel loads. Ignition potential may be higher than in more remote areas of the Unit simply because human use of disturbed and ruderal areas is proportionately greater. For example, ruderal vegetation stands along roadsides are particularly prone to wildfires due to such ignition sources as tossed cigarette butts and contact with hot catalytic converters beneath idling vehicles. The possibility of fire spread is low within the ruderal areas, but if not suppressed, may jump to adjacent vegetation communities with higher fuel loads.

Aquatic Vegetation

Aquatic vegetation consists of all rooted, submerged or floating plant species found in lakes, streams or ponds but does not include emergent wetland species or other marsh plants. Rooted aquatic vegetation is rare throughout most of Folsom Lake. This lack of aquatic vegetation may be a function of turbid water conditions limiting light penetration, plus a decreasing water level as the summer progresses that exposes large areas of formerly submerged substrate.

Aquatic vegetation in Lake Natoma is restricted to intrusions of water hyacinth (*Eichhornia crassipes*) in the areas of Alder Creek and Willow Creek, duckweed (*Lemna* sp.) in Alder Creek, and several other aquatic plant species in the backwaters of the Teichert property portion of Mississippi Bar. These shallow ponds may contain *Elodea* spp., *Potamogeton* spp., and *Myriophyllum* spp., all of which are submerged species. However, at the time of observation in October 2002, these ponds were 80 percent covered with Eurasian milfoil (*Myriophyllum spicatum*) with sparse false loosetrife (*Ludwigia peploides*) along the edges. The Ludwigia and water hyacinth are both floating aquatic plants.

All of the aquatic plant species that are known to occur in the Unit are considered non-native aquatic weed species. Therefore, they are discussed in more detail in the Invasive Exotic Plant*s* section below. The locations within which they generally occur are depicted in Figures PL-19a and PL-19b.

Special Status Plants

A special-status plant species, as defined here, meets one or more of the following criteria:

- Officially listed by the California Department of Fish and Game (CDFG) as rare, threatened, or endangered and/or by the U.S. Fish and Wildlife Service (USFWS) as threatened or endangered or proposed for listing.

- A federal or State candidate species for listing as threatened or endangered or State candidate for listing as rare. Such a species may become formally listed during the course of a project.

- Listed under one of the following categories in the California Native Plant Society's (CNPS) Inventory of Rare and Endangered Vascular Plants of California (Skinner and Pavlik 1994) and/or the Electronic Inventory of Rare and Endangered Vascular Plants of California (Skinner and Pavlik 1994; update 2001):

  List 1A – Plants presumed extinct in California.

  List 1B – Plants rare, threatened, or endangered in California and elsewhere.

  List 2 – Plants rare, threatened, or endangered in California but more common elsewhere.

List 1A, List 1B, and List 2 species may meet the definition of rare and endangered under the California Environmental Quality Act (CEQA) (Sect. 15380); a species not included on any formal list "shall nevertheless be considered rare or endangered if the species can be shown to meet the criteria" for listing. List 3 species are plants for which necessary information is lacking to assign them to any of the other lists, and List 4 species are plants of limited distribution. Therefore, there is usually not enough information available for species on List 3 and List 4 to meet the CEQA definition of rare and endangered plants.

Based on a review of prior records, 24 special-status species (including List 3 species) were identified as occurring in the general vicinity of the Unit (Table PL-3). Occurrence records for these species were located in the *California Natural Diversity Data Base* (CNDDB 2002) and the California Native Plant Society's *Electronic Inventory* (CNPS 2001) covering the 16 U.S. Geological Survey (USGS) 7.5-minute Quadrangles that encompass the Unit and adjacent areas: Pilot, Clarks, Folsom, Rocklin, Auburn, Goldhill, Lincoln, Roseville, Citrus Heights, Folsom SE, Buffcreek, Carmike, Greenwood, Coloma, Shinglesprings and Latrobe.

As indicated in Table PL-3, there are 9 known occurrences of special status plant species within the Unit or in the vicinity of the Unit (less than 1 mile from the Unit boundary). These special status plant species are Bisbee Peak rush rose (*Helianthemum suffrutescens*), Brandegee's clarkia (*Clarkia biloba* ssp. *brandegeae*), El Dorado bedstraw (*Galium californicum* ssp. *sierrae*), El Dorado County mule ears (*Wyethia reticulata*), Layne's ragwort (*Senecio layneae*), pincushion navarretia (*Navarretia myersii* ssp. *myersii*), red-hills soaproot (*Chlorogalum grandiflorum*), Sacramento orcutt grass (*Orcuttia viscida*), and Stebbin's morning glory (*Calystegia stebbinsii*).

Based on their habitat requirements, there is the potential for 13 other special status plant species to occur in the Unit (Table PL-3). Two special status plant species (San Joaquin

spearscale and hispid bird's-beak) are unlikely to occur in the Unit because they are found on alkali soils that are not known to occur in the vicinity.

The habitat types that have the potential to support special status species in the Unit are chaparral, woodland, vernal pool, and freshwater marsh. Several species are likely to occur in multiple habitat types. The specific habitat requirements for each special status species, as well as their Federal/State/CNPS listing status, is provided in Table PL-3. The locations of known occurrences or potential habitat for special status plants are depicted in Figures PL-20a and PL-20b.

Chaparral and Woodland Special Status Plant Species

The following special status species have the potential to occur in both chaparral and cismontane (mid-elevational) woodland vegetation communities in the Unit:[7]

- Big-scale balsamroot (*Balsamorhiza macrolepis*) - 1B
- Stebbin's morning glory (*Calystegia stebbinsii*) - FE, SE, 1B
- Pine Hill ceanothus (*Ceanothus roderickii*) - FE, SR, 1B
- Red Hills soaproot (*Chlorogalum grandiflorum*) - 1B
- Brandegee's clarkia (*Clarkia biloba ssp. brandegeae*) - 1B
- Pine Hill flannelbush (*Fremontodendron decumbens*) - FE, SR, 1B
- Butte County fritillary (*Fritillaria eastwoodiae*) - 3
- El Dorado bedstraw (*Galium californicum ssp. sierrae*) - FE, SR, 1B
- Bisbee Peak rush rose (*Helianthemum suffrutescens*) - 3
- Red Bluff dwarf rush (*Juncus leiospermus* var. *leiospermus*) - 1B
- Layne's ragwort (*Senecio layneae*) - FT, SR, 1B
- El Dorado County mule ears (*Wyethia reticulata*) - 1B

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[7] FE - Federally-listed as endangered.
FT - Federally-listed as threatened.
SE - State-listed as endangered.
SR - State-listed as rare.
CNPS List 1B - California Native Plant Society - plants rare, threatened or endangered in California and elsewhere.
CNPS List 2 - California Native Plant Society - plants rare, threatened, or endangered in California but more common elsewhere.
CNPS List 3 - California Native Plant Society - plants about which we need more information – a review list.

All of these species are known to occur within the four USGS quadrangles that surround the Unit, with the exception of Butte County fritillary and the Red Bluff dwarf rush (Table PL-3). El Dorado County mule ears is known to occur within the boundaries of the Unit, west of Salmon Falls, opposite Indian Springs Creek (Figure PL-20a). Brandegee's clarkia and El Dorado bedstraw are known to occur within or immediately outside the Unit boundary in the vicinity of Salmon Falls Road at Sweetwater Creek (Figure PL-20a). Pine Hill ceanothus occurs in the vicinity of Salmon Falls to the north and south of the South Fork of the American River. Layne's ragwort and Stebbin's morning-glory are found just outside the boundaries of the Unit in the vicinity of the Salmon Falls Road Bridge, south of the South Fork of the American River (Figure PL-20a).

The Pine Hill Ecological Reserve, located approximately 4 miles southeast of the South Fork, also contains Stebbin's morning glory, Pine Hill flannelbush, Layne's ragwort, Pine Hill ceanothus, El Dorado mule ears, and El Dorado bedstraw. Table PL-3 provides information on the distance from the Unit to the nearest known populations of each special status plant species.

Soil characteristics determine the location and the composition of the vegetation community in which these species occur. The soils are dry and rocky and often have serpentine or gabbroic characteristics. When these species occur in chaparral communities, they are typically found in mixed chaparral and not chamise chaparral (the type that occurs at the Unit). On this basis, the likelihood of occurrence for these species decreases. However, pockets of mixed chaparral that simply were not detected during ground-truthing surveys may occur within larger stands of chamise chaparral.

The chaparral and woodland communities in which these species occur are most threatened by residential development and alteration of fire regimes. Acquisition of adjacent parcels and the development of a fire management plan (particularly for chaparral) would be the best way to ensure the integrity of these vegetation communities and thus, protect potential populations of these special status species.

Special status species surveys should focus on areas within the Unit where soils are serpentine or gabbroic in origin. Generally, these soils occur along the South Fork of the American River. The El Dorado County Soils map identifies small pockets of serpentine and gabbroic soils and should be the primary source for soil information. The survey team should visit the Pine Hill Ecological Reserve to become familiar with the species and the vegetation community in which they occur.

Woodland Special Status Plant Species

The following species have the potential to occur in woodlands but are not found in chaparral communities:

- Tuolumne button-celery (*Eryngium pinnatisectum*) - 1B
- Dubious pea (*Lathyrus sulphureus* var. *argillaceaus*) - 3

Table PL-3 provides information on the distance from the Unit to the nearest known populations of each special status plant species.

The closest known occurrence of Tuolumne button-celery to the Unit is in the Folsom SE USGS quadrangle, Sacramento County. The dubious pea has been located in the Auburn quadrangle, Placer County. Both species have been found in cismontane woodlands. Occurrences of button celery within woodlands are most likely located along a riparian creek, or wetland, as button celery require moist soil conditions. Little additional information exists regarding favorable microclimate or soil characteristics that might foster these species.

Given the limited information regarding habitat requirements, it is possible that these species could occur in either interior live oak or blue oak woodland communities at the Unit. It appears more likely that they would occur in the interior live oak community because it is a more mesic environment. Within a woodland community, the button celery is most likely to occur in association with a wetland or moist drainage.

The button-celery is thought to have been heavily impacted by agricultural activities that have disrupted its habitat. The dubious pea is likely to have been affected by habitat loss due to woodland thinning and clearing.

Before special status species surveys are implemented, it would be instructive for the biologist to visit a herbarium with specimens of these two species. Field surveys would also be more effective if additional information could be found regarding detailed site characteristics where these species have been found in the past. Specific vegetation communities, soil types, or slope/aspect features would be particularly helpful for the dubious pea. Such information may exist in unpublished form through the California Native Plant Society.

Vernal Pools and Other Seasonal Wetland Special Status Plant Species

The following special status species have the potential to occur in vernal pools in the Unit and may also possibly occur in other seasonal wetlands:

- Dwarf downingia (*Downingia pusilla*) - 2
- Tuolumne button-celery (*Eryngium pinnatisectum*) - 1B
- Boggs Lake hedge-hyssop (*Gratiola heterosepala*) - SE, 1B
- Ahart's dwarf rush (*Juncus leiospermus* var. *ahartii*) - 1B
- Red Bluff dwarf rush (*Juncus leiospermus* var. *leiospermus*) - 1B
- Legenere (*Legenere limosa*) - 1B
- Pincushion navarretia (*Navarretia myersii* spp. *myersii*) - 1B
- Slender Orcutt grass (*Orcuttia tenuis*) - FT, SE, 1B
- Sacramento Orcutt grass (*Orcuttia viscida*) - FT, SE, 1B

Table PL-3 provides information on the distance from the Unit to the nearest known populations of each special status plant species. Of these plants, only 4 species have been observed within the four quadrangles that surround and include the Unit: Tuolumne button-

celery, Boggs Lake hedge-hyssop, Pincushion navarretia, and Sacramento Orcutt grass. The closest known occurrence of Tuolumne button-celery to the Unit is in the Folsom SE USGS quadrangle, Sacramento County. The Boggs Lake hedge-hyssop has been found in the Rocklin quadrangle in Placer County to the west of the Unit. Pincushion navarretia and Sacramento orcutt grass are known to occur in the Phoenix Ecological Preserve, east of the Unit boundary in the vicinity of Mississippi Bar. These species are threatened by loss and/or degradation of habitat due to agricultural and residential development, heavy grazing and vehicular impacts.

These species are most likely to occur in high quality vernal pools in the Unit. Secondarily, they may be found along the margins of seasonal wetlands, but not in areas with seasonal wetland vegetation. These species occur within the disturbed zone around the Folsom Lake reservoir. Special status species surveys should concentrate on known vernal pool locations.

Freshwater Marsh Special Status Plant Species

The following species have the potential to occur in freshwater marshes in the Unit:

- Boggs Lake hedge-hyssop (*Gratiola heterosepala*) - SE, 1B
- Sanford's arrowhead (*Sagittaria sanfordii*) - 1B

The Boggs Lake hedge-hyssop is known to occur within approximately 3.5 miles of the Unit within vernal pools in the Roseville vicinity. Sanford's arrowhead is known to occur within approximately 3.5 miles of the Unit in the Citrus Heights vicinity. Table PL-3 provides information on the distance from the Unit to the nearest known populations of each special status plant species.

The arrowhead occurs in ditches, slow-moving drainages, and around the margins of lakes and ponds. It has been observed in association with cattails, smartweed and other species of arrowheads, as well as in isolated stands on sandy soil. The hedge-hyssop observations are primarily from vernal pool habitats (see section above), but may also occur along the margin of a freshwater marsh.

Special status species surveys should concentrate on the Mormon Island freshwater marsh restoration and the marshes of Mississippi Bar. Although Avery's Pond is densely populated with non-native species, it is also a possible location to search for both species.

Invasive Exotic Plants

This section briefly describes invasive exotic plant species known to occur or that could potentially occur in the Unit. Both terrestrial and aquatic species are covered. Sources of the information provided in the following section are TNC (2002); Univ. of Liverpool (2002); Univ. of Florida (2002); Washington State Department of Ecology (2002); Whitson (2001); Bossard, Randall and Hoshovsky (2000); CalEPPC (2002); Hickman (1993) and Sunset Western Garden Book (1988). Figures PL-21a and PL-21b depict known infestations of invasive exotic plants in the Unit.

Brazilian waterweed (*Egeria densa*, family Hydrocharitaceae) is a mat forming aquatic plant that can be found below 7,000 feet elevation in freshwater lakes, ponds and slow moving channels with turbid water. Only the male plant of this species is known to occur in California. Spread is by vegetative reproduction (i.e., root sprouting from fragmented stems). These stem fragments float on water and can be distributed to new locations by water flow, boats, animals, water fowl, and by humans dumping aquariums into freshwater systems. Brazilian waterweed was not observed in the Unit but is likely to occur in ponds and backwater areas of Mississippi Bar as well as in the perennial tributaries of Lake Natoma.

Bull thistle (*Cirsium vulgare*, family Asteraceae) can be found in many habitats in California below 7,000 feet elevation. Most commonly, this species is found where there is a high degree of disturbance, including but not limited to overgrazed range-land, forest clearcuts, and along road-sides in ditches and fence rows. Bull thistle's only form of reproduction is through production of abundant amounts of wind-dispersed seeds. Bull thistle is ubiquitous throughout the Unit, occurring in virtually all upland habitat types.

Chinese tallow (*Sapium sebiferum*) is a tree that grows and spreads rapidly, and tends to take over large areas by out-competing native plants. Although not observed in the Unit, Chinese tallow has been found growing elsewhere in native vegetation along the American River Parkway in Sacramento, California. The tree can thrive in well-drained uplands as well as in bottomlands and shores of lakes. The tree is most likely to spread to wildlands adjacent to or downstream from areas landscaped with Chinese tallow. This plant grows rapidly, begins reproduction at three years by producing abundant viable seed, and can reproduce from cuttings. Seed are spread by birds, and may also float for great distances.

English ivy (*Hedera helix*, family Araliaceae) has two growth forms: woody vine and evergreen shrub. English ivy is most likely to be found in riparian forests near urban areas below 3,300 feet elevation. English ivy is a popular plant to use for erosion control because of its ability to root at nodes and along the stem. The seeds are bird dispersed. Vegetative reproduction can also occur from root pieces displaced by removal efforts. English ivy was observed growing in the Unit near the Granite Bay subdivision.

Firethorn (*Pyracantha angustifolia*) is an evergreen shrub that can form dense stands, up to 10 feet high. It produces prolific red berries that are dispersed by birds and will readily germinate in disturbed areas and along roadsides. Firethorn was observed in the Alder Creek, Negro Bar and Mississippi Bar areas of the Unit.

French broom (*Genista monspessulana*, family Fabaceae) has similar habitat requirements as Scotch broom. It's commonly found in disturbed areas such as road cuts, forest clearcuts, neglected lots as well as in undisturbed natural communities in lower elevations. French broom can also thrive on low fertility/high pH alkaline soils and a wide range of moisture gradients. As is the case with Scotch broom, French broom populations can establish from only one plant due to prolific seed production and its long distance seed dispersal method. Dispersal can also be accomplished by seeds floating in rainwater and by mud lodged in crevices of boots and machinery. French broom was not observed in the Unit, however there is a strong potential for it to occur, given the presence of Scotch broom.

Giant reed (*Arundo donax*, family Poaceae) is a bamboo-like perennial grass that prefers to invade and colonize low-gradient riparian areas under 1,000 feet elevation. Giant reed can

grow on a broad range of soil types providing there is adequate soil moisture. Colony establishments in California are limited to vegetative reproduction either by extension of underground rhizomes or from drifting plant fragments that later produce roots. Giant reed was not observed in the Unit, however there is a strong potential for it to colonize areas in and near perennial streams and ponds, particularly in the Lake Natoma area.

Himalayan blackberry (*Rubis discolor*, family Rosaceae) is a woody perennial that is found throughout California at low elevation sites with adequate soil moisture. Himalayan blackberry is most common along riparian areas and can also be found growing in upland sites such as fields, pastures and roadsides. Himalayan blackberry can thrive on a variety of low fertility soils and a wide range soil pH and texture. The long-lived blackberry seeds are dispersed after passing though the digestive system of animals. Vegetative reproduction occurs when the cane tips contact the ground, root and form new clones. Clone reproduction can also occur from root pieces displaced by removal efforts. Himalayan berry is ubiquitous in the Unit, occurring in riparian zones, pond edges, moist ravines, and along the edges of Lake Natoma and Mississippi Bar. Despite its invasive nature, Himalayan berry is a food plant for small mammals and avifauna that frequent riparian areas.

Hydrilla (*Hydrilla verticillata*, family Hydrocharitaceae) is a perennial submersed aquatic weed that can invade any freshwater system in California. Spread is mainly from vegetative reproduction of fragmented stems, tubers, and trunions. Colonization of new areas occurs when propagules root in sediment. These propagules can be distributed to new locations by sticking to boats, fishing equipment and wildlife. Hydrilla was not observed in the Unit, but it could occur in either Lake Natoma or Folsom Lake.

Italian thistle (*Carduus pycnocephalus*, family Asteraceae) is common throughout much of California at low elevations and can be found in fields, disturbed areas, roadsides and pastures. Seeds of this species are spread primarily by wind, although they may also be spread by animals, seed-contaminated soils and hay. Italian thistle is ubiquitous throughout the Unit, occurring in virtually all upland habitat types.

Klamathweed (*Hypericum perforatum*, family Hypericaceae) is a yellow-flowered perennial forb that is widespread in northern California and the Pacific Northwest. Klamathweed reproduces both vegetatively and from seed. It grows new stems each year from a taproot and from spreading rhizomes. It is capable of producing viable seed with or without pollination and is capable of invading grasslands and wet meadows, where it replaces native plants. It occurs in the vicinity of the Snipes-Pershing preserve (Van Ess 1994).

Medusahead (*Taeniatherum caput-medusae*) is an annual grass characterized by multiple awned inflorescences that superficially resembles foxtail or squirreltail grasses. Medusahead originated in southern Europe and northern Africa and was introduced to California in the late 1800s. Medusahead has subsequently spread throughout the state, primarily in grassland habitats. Medusahead outcompetes native and non-native grass and forb species and forms extremely dense stands that contribute to an elevated fire danger. The mature plants contain a high silica content, making them unpalatable to livestock and native grazing animals. The grass is rapidly spread by wind, on the coats of grazing animals and on machinery and clothing. Medusahead is ubiquitous in the Lake Unit occurring commonly in grasslands throughout the Unit.

Nuttall's waterweed (*Elodea nuttallii*, family Hydrocharitaceae) is a submerged native to California's still or slow flowing water systems such as freshwater lakes, ponds, and ditches. This plant can continue to grow unrooted as floating fragments. Vegetative reproduction is by stem fragments floating away to root and start new plants. Nuttall's waterweed provides habitat for aquatic invertebrates and cover for young fish and amphibians as well as food for waterfowl. Also, it is of economic importance as an attractive and easy to keep aquarium plant. Nuttall's waterweed was not observed in the Unit but is likely to occur in ponds and backwater areas of Mississippi Bar as well as in the perennial tributaries of Lake Natoma.

Oleander (*Nerium oleander*, family Apocynaceae) is an ornamental plant that is not considered invasive in California. This highly toxic plant is able to grow in poorly drained, compacted soils, and is drought tolerant. Oleander has been reported in riparian areas in both the Central Valley and the San Bernardino Mountains and has historically been planted along state highways. Oleander is a victim of Pierce's Disease, being one of the host plants for the glassy-winged sharpshooter. Oleander grows in the Negro Bar vicinity. It has been planted by non-park personnel at Folsom Point picnic and kiosk area, and has been observed invading drainages near houses (Sally Walters, CDPR, *pers. com.*).

Pampas grass (*Cortaderia selloana*, family Poaceae) is an escaped ornamental grass that is commonly found in disturbed areas such as roadside ditches, conservation areas, forest clearcuts and plantations. It is an established weed along the American River near Sacramento. Both seed and root may sprout vegetative parts that enable the species to spread. Since pampas grass is dioecious, seed production depends on the presence of both male flower producing plants and female flower producing plants. However, vegetative reproduction can occur by root runners sprouting new plants up to 13 feet away from the parent plant. Root pieces displaced from the parent plant can also produce new plants if adequate moisture is available.] Pampas grass was observed growing in disturbed areas around Mississippi Bar and Negro Bar, and along the shoreline of Lake Natoma. The plant undoubtedly occurs elsewhere in the Unit.

Parrot's feather, Eurasian milfoil (*Myriophyllum aquaticum*, family Haloragaceae) is a dense mat forming aquatic plant that can be found in freshwater lakes, ponds and slow moving channels. This species is not known to produce viable seed in California. Spread is only known from vegetative reproduction (root sprouting from fragmented stems). These stem fragments float on water and can be distributed to new locations by water flow, boats, animals, water fowl, and by humans dumping aquariums into freshwater systems. Parrot's feather was observed in the Teichart ponds and may occur in other ponds and backwaters of Lake Natoma.

Perennial pepperweed (*Lepidium latifolium*, family Brassicaceae) is a perennial herb that is found from the California coast eastward to the Great Basin up to 10,000 feet elevation. Habitats are variable and include but are not limited to alkaline wetlands, marshes, roadsides, native fields and meadows. Perennial pepperweed also occurs as an agricultural weed. Perennial pepperweed is tolerant of saline and alkaline soils. Spread of this species is by either seed or fragments of the underground stem. Short-distance spread of seed is by water or wind-borne seed; long-distance spread is by contaminated rice straw, and possibly waterfowl. Perennial pepperweed was not observed in the Unit but is likely to colonize seasonal wetlands and marsh habitats.

Periwinkle (*Vinca major*, family Apocynaceae) is a perennial that is found throughout California at frost-free, low elevation sites with adequate soil moisture, usually wooded drainages near old home sites or wet, roadside areas where illegal dumping occurs. Vegetative root sprouting from fragmented stems is its only known form of reproduction in California. These broken stem fragments are able to float on water to begin new periwinkle colonies. Periwinkle was observed growing near homes in Granite Bay and near Negro Bar.

Pondweed (*Potamogeton spp.*, family Potamogetonaceae) is a common aquatic perennial that can be found in lakes, ponds, marshes, and streams. Spread of this plant, like other aquatic plants is by vegetative reproduction of fragmented stems. Pondweed also has viable seeds that float. Pondweed was not observed in the Unit but could occur in Lake Natoma, as well as associated backwaters and tributary streams.

Privet (*Ligustrum vulgare*, family Oleaceae) is a shrub or small tree that is common in ornamental plantings throughout California. This plant produces abundant berry like fruit that are eaten and spread by birds. The seeds remain viable and produce multitudes of seedlings. Privet was observed growing in the Granite Bay area of the Unit and in the Lake Natoma vicinity.

Rush skeletonweed (*Chondrilla juncea,* family Asteraceae) is a deep-rooted perennial or biennial forb that infests well-drained, light-textured soils in disturbed, usually agricultural, sites. It reproduces only by cloning, either vegetatively from roots or from seed apomixis (seeds produced without pollination). One plant can produce 15,000 to 20,000 seeds in a season (Dodd and Panetta, 1987). Once established, rush skeletonweed can dominate disturbed sites for many years. It occurs in the vicinity of the Snipes-Pershing preserve (Van Ess 1994).

Russian thistle (*Salsola tragus,* family Chenopodiaceae), also known as "tumbleweed," is a bushy annual that grows to 3-1/2 feet high with slender semi-woody branches. It reproduces prolifically by seed and is noted for the tendency its mature individuals to break free from the soil and be blown about. Although it readily colonizes disturbed areas, it can also threaten native plant ecosystems, particularly grasslands and seasonal wetland. Where plants accumulate along tree rows and fence lines, it posing a serious fire hazard. It occurs in the vicinity of the Snipes-Pershing preserve (Van Ess 1994).

Salt cedar (*Tamarix parviflora*, family Tamaricaceae) is a shrub or small tree that is found throughout California in places where surface or subsurface water is available for most of the year. These areas can be disturbed or non-disturbed and include pond margins, ditches, springs and washes. Salt cedar prefers saline soils where other species cannot survive. It spreads by both vegetative root sprouting and by prodigious production of long-distance dispersed seeds. The seeds are dispersed by both wind and water. Salt cedar was not observed in the Unit, however it could readily colonize the edges of perennial streams and ponds, particularly in the Lake Natoma area.

Scarlet wisteria tree (*Sesbania punicea*, syn. *S. tripetii*, family Fabaceae) is a deciduous ornamental shrub or small tree that may be found in thickets along rivers, streams, wetlands, and marshes. The Nature Conservancy Wildland Invasive Species Team reports that scarlet wisteria tree has been found spreading into California native vegetation along the American River Parkway in Sacramento (TNC 2002). The team also lists the following undocumented reports that scarlet wisteria tree occurs in marshes around Suisun Marsh, and on the north

shore of the North Forebay of Oroville Dam. This plant has abundant production of buoyant seed pods that may be dispersed long-distance by water. It is possible that this plant can spread to wildlands adjacent to or downstream from ornamental plantings. This species as not observed in the Unit.

Scotch Broom (*Cytisus scoparius*, family Fabaceae) is a perennial shrub commonly found in disturbed areas such as road cuts, forest clearcuts, and neglected lots but it can also be found in undisturbed natural communities below 4,000 feet elevation. Scotch broom can thrive on low fertility soils and a wide range of moisture gradients. Large populations can result from only one plant due to prolific seed production and its long distance seed dispersal method. Scotch broom was observed at two locations in the Unit: Bender's Beach and Negro Bar.

Spanish broom (*Spartium junceum*, family Fabaceae) is a perennial shrub commonly found in disturbed areas such as eroding slopes, riverbanks, road cuts, as well as neglected lots and is able to colonize post-burn chaparral sites. The abundant seeds are transported via erosion, rain-wash as well as ants. Spanish broom was not observed in the Unit, but could occur in numerous disturbed locations.

Stipa X (*Stipa spp.*, family Poaceae). Little is known about the invasiveness of the grass species. However one large stand (1-2 acres) is known to occur in the Unit in a grassland area of the Peninsula.

Tree of heaven (*Ailanthus altissima*, family Simaroubaceae) is a deciduous thicket forming tree that can be found in many areas along the California coast and Sierra foothills. These areas can be disturbed or non-disturbed and include open fields, urban lots, roadsides, riparian zones. This species is tolerant of many different and extreme soil chemistries and types. Tree of heaven is a prolific root sprouter with root runners sprouting new plants up to 50 feet away from nearest shoot. Short-lived seeds are light and wind dispersed and are often spread by water, birds and on farm equipment. Tree of heaven grows in the Negro Bar area.

Water hyacinth (*Eichhornia crassipes*) is a native of tropical South America that has spread to more than 50 countries on five continents and has become a problem in the waterways of most of these countries. Its air-filled tissue enables it to float and spread rapidly within and between connected water bodies. The plant reproduces asexually by breaking apart into pieces, each of which develops into a separate plant. This results in a rapid increase in biomass; continuous mats of living and decaying water hyacinth up to 6.5 feet thick covering the water surface have been reported. Water hyacinth can also reproduce sexually by producing self-pollinating flowers between mid-summer and late-fall. These flowers produce seed that sink to the bottom. The released seeds can remain viable in the bottom sediments for several years, however, they require warm, shallow waters and high light intensity for germination. These conditions apparently exist in Alder Creek, where sexual propagation of water hyacinth has been observed (Sandi Richerson, BOR, *pers. com.*).

Water hyacinth was introduced to North America in 1884 via the Cotton States Exposition in New Orleans, where it was displayed in ornamental ponds and distributed as souvenirs to visitors; excess was dumped into nearby creeks and lakes. The 1884 Cotton States Exposition was probably also the initial source of the water hyacinth that was reported from the Sacramento River near Clarksburg, California in 1904. Once in California, water hyacinth spread gradually for many decades, reaching the Delta by the late 1940s or early 1950s, the federal Bureau of Reclamation tried controlling it with herbicides around 1957.

In 1982, California Senate Bill 1344 became law and directed the California Department of Boating and Waterways (CDBW) to control water hyacinth in the Delta. CDBW set up barriers to keep large masses of floating plants out of navigation channels and sprayed herbicides including Weedar (2,4-D), Diquat and Rodeo (glyphosphate). In some areas, mechanical harvesting has been used to control hyacinth, but this is more expensive than chemical spraying and disposal of the hyacinth can be a problem. Because of the cost, CDBW does not use mechanical harvesting.

In 1982 and 1983, CDBW, working with the U. S. Department of Agriculture, imported and released three insects from South America as biological controls, the moth *Sameodes albiguttali*s (which did not survive) and the weevils *Neochetina bruchi* and N. *eichhomia*e. Although the two weevils became established in the Delta, there is still a need for mechanical harvesting to control the water hyacinth.

Water hyacinth has historically occurred in Lake Natoma at three locations: the mouths of Alder Creek and Willow Creek, and in the backwaters of the Teichert property portion of Mississippi Bar. The water hyacinth in the ponds of Mississippi Bar appears to have been eradicated a number of years ago through chemical spraying by the CDBW. During the past 6 years, the BOR has funded a program with consultant, Ken Davis, to manually remove water hyacinth in Lake Natoma. The choice of manual removal over aquatic herbicide applications is due to the inability of herbicide to kill the water hyacinth seeds, which remain viable for 15 years (Sandi Richerson, BOR, *pers. com.*). Current eradication efforts at the mouths of Alder Creek and Willow Creek rely on this manual removal program. The focus of the Alder Creek effort has been the removal of water hyacinth from Alder Pond, the ponded portion of Alder Creek on the south side of Hwy 50. Water hyacinth at the confluence of Willow Creek Lake Natoma and in Willow Creek within the Unit, have also been removed manually. Additionally, both species of biocontrol weevils were released into the Willow Creek area in the summer of 2002 (Ken Davis *pers. com.)*. While not yet eradicated from these sites, water hyacinth has been mostly removed and controlled (Ken Davis, *pers. com.*; Brian Deason, BOR, *pers. com.*). At present, little evidence of water hyacinth exists in the main body of Lake Natoma.

Woolly mullein (*Verbascum thapsus,* family Scrophulariaceae) is an erect, yellow-flowered biennial herb that infests a variety of habitats in California. It reproduces only from seed. Individual plants are capable of producing 100,000 to 240,000 seeds, which can remain viable in the soil for 35 to 100 years (Pitcairn, 2000). In montane areas of California, woolly mullein invades disturbed sites, but also is capable of invading undisturbed native meadows and moist areas within sagebrush scrub. The seeds of this plant are long-lived in the soil. It displaces native vegetation in meadow habitats and frequently becomes established following logging or fires in forested habitats (Pitcairn, 2000). It occurs in the vicinity of the Snipes-Pershing preserve (Van Ess 1994).

Yellow starthistle (*Centaurea* solstitialis, family Asteraceae) is a warm season annual with flowers that have long stiff spines at their base. Yellow starthistle is found in many habitats throughout northern California below 7,500 feet elevation. This species is found in disturbed and non-disturbed sites such as rangelands, grasslands, pastures, roadsides and recreational areas that have exposed areas of fertile, drier soils. Seed are the Yellow starthistle's only form of reproduction. Short-distance spread of this species is achieved by the seed head attaching itself to animal fur and/or human clothing. Seeds are also spread over long

distances Ion the tires of vehicles and road maintenance machinery. The seed is also spread by deposition of seed-contaminated soils and hay.

Yellow starthistle is ubiquitous throughout the Unit, occurring in virtually all upland habitats. Dense infestations occur in grasslands throughout the Unit except in the Peninsula where its presence in most grasslands is still low.

Yellow water iris (*Iris pseudacorus,* family Iridaceae) is a herbaceous thicket forming perennial wetland plant that can be found in or very near water. Habitat for this species include lakesides, freshwater wetlands, and salt marshes. Yellow water iris spreads by underground rhizomes and seeds. This species is an escaped ornamental that continues to be sold through garden and plant dealers and over the Internet. Within the Unit, Yellow water iris occurs in Avery's Pond as well as in Mississippi Bar ponds.

Recommendations

Chaparral Management

Prescribed Burn Plan

The extensive stands of chamise chaparral in the Peninsula and South Fork vicinity are dependent on a cyclic pattern of fires. The absence of such fires will lead to excessive fuel accumulation and development of a senescent or mature vegetation structure with increasingly poor habitat value for endemic flora. Conditions will gradually become more favorable for a catastrophic wildfire that would be a major concern from both public safety and biological standpoints.

CDPR is currently preparing a Unit-wide Burn Plan for the Folsom Lake State Recreation Area. The portion of the Burn Plan that deals with chaparral should seek to emulate natural fire cycles that will both reduce the fire hazard and sustain chamise chaparral stands. The plan should establish a patchwork network of burn units that will promote a mix of chaparral stand ages. The plan should also take into account the possibility that chaparral areas may contain inclusions of gabbroic and serpentine soils that support pockets of mixed chaparral and oak woodland vegetation. These pockets are potential habitat for several listed plant species (see below) that will benefit from proper fire management.

Prescribed burning plans, as well as other vegetation management efforts, shall be coordinated with the BOR. Consultation with the U.S. Fish and Wildlife Service shall be conducted as necessary, and all work shall be performed in accordance with the Operations and Maintenance Plan (O&M Plan) of the Bureau of Reclamation's Central California Area Office (Bureau of Reclamation 2000).

Special Status Plant Surveys

As shown on the vegetation maps, several locations within the Peninsula and South Fork chaparral communities may have soil conditions potentially suitable for supporting the following federally-listed endangered or threatened plant species: Eldorado bedstraw, Layne's ragwort, Pine Hill ceanothus, Pine Hill flannelbush and Stebbin's morning glory. Focused special status plant surveys should be conducted in these areas in the spring and summer in accordance with California Native Plant Society guidelines. If one or more of

these species are determined to be present, the burn plan should include provisions for ensuring that burns are conducted in a manner that maintains and promotes habitat for these species.

Public Access

Chaparral areas present a significant risk for public access due to high fire hazard and the need for long-term fuel management. Public access is also a concern with respect to the potential presence of federally-listed plants species. Therefore, new public trail access or roads should be discouraged within or along the edges of the chaparral areas. Until a fuels management plan is designed and implemented, the CDPR should consider restricting public access during periods of high fire danger (*i.e.* "Red Flag" Days).

Oak Woodlands, Savannas and Grasslands Management

In most regions of the Unit, these three vegetation communities form an interrelated complex that is well suited to integrated management approaches. This structurally and compositionally diverse mix of vegetation communities offer a wide range of habitat opportunities for many wildlife species. As described below, the most suitable management approach for this mix of communities will vary depending on location within the Unit.

Prescribed Burn Plan

Where deemed practical and safe under the Unit Burn Plan, the preferred management approach should be prescribed burning that will maintain both safe fuel levels and the existing mix of vegetation communities. Properly timed light burns should help maintain grasslands and oak savannas by preventing young oaks from getting their start. In other locations, such burns may promote the growth of oak savanna and woodland by encouraging rapid crown sprouting from seedlings and saplings, by releasing nutrients to the soil and by reducing competition from other species. To maximize habitat diversity, the burn plan should seek to establish a mosaic of stand types of varying post-burn successional stages.

Prescribed Burning of Dense Starthistle Grasslands

Where grasslands have become heavily invaded by yellow starthistle, the burn plan should aim to control starthistle in order to reduce fuels and enhance habitat. Grassland areas of the Unit where yellow starthistle is dense are depicted on the vegetation maps. Under this approach, repeated burns would be used to gradually reduce the starthistle seedbank (DiTomaso *et al.*1999). Timing is critical for such burns to be effective. Typical burns must be conducted during the early summer (June-July) after native species have dispersed their seeds, but prior to maturation of starthistle seedheads. However, given the dearth of native species in many of the Unit's grasslands, the primary determining factor as to when burns should be conducted will be the status of starthistle seedhead maturation.

Limited Grazing

Where the Unit Burn Plan determines that existing constraints (*e.g.,* the proximity of development and infrastructure, level of fuels, size of areas) would make prescribed burning infeasible or risky, CDPR should consider the limited use of grazing animals to accomplish the same goals as prescribed fires. Under this approach, livestock, such as cows, goats or

sheep, would be allowed to intensively graze fenced pastures for brief periods. Cows and/or sheep would be more appropriate where the forage is mainly grasses and forbs while goats would be more appropriate where the forage includes more woody vegetation.

Stocking rates would need to be determined based on an analysis of the Unit forage and fuels. Grazing would be limited to the portion of the growing season when annual forage is at its maximum, thereby achieving an effective reduction in fuels. Grazing would commence at the approximate pre-flowering stage of the life cycle of non-native annual species in the grasslands. Over the long-term, this could achieve a reduction in the annuals and could promote the expansion of native perennial grasses if accompanied by a native grass re-introduction program.

Grazing should not be conducted during the dry summer and autumn and the early winter months because green herbaceous forage is not available during this period. Under these circumstances, cattle will preferentially select oak foliage and acorns as well as other woody browse, threatening reproduction and long-term persistence of oak woodlands and savannas (Barrett and Menke 1976). Cattle and sheep generally select green herbaceous forage as long as it is available, but can damage young oak trees and seedlings by browsing foliage and consuming acorns during the seasons when green herbaceous forage is not available. Livestock hoof traffic can damage oak seedlings by severing plant bases or roots.

A number of advantages and disadvantages exist for the use of livestock for vegetation management. Grazing is less risky than prescribed fires and can be very effective in both reducing fuel loads and enhancing grassland and savanna habitats if properly timed. However, grazing incurs costs to install additional fencing (either temporary in the case of sheep or permanent in the case of cattle), and may create conflicts with visitor usage of the Unit.

Proper timing of grazing would be particularly important if cattle are to be used in the vicinity of vernal pools. Cattle will readily enter vernal pools to graze on native vernal pool vegetation, whereas sheep will generally avoid water, thereby minimizing the potential for damage to pool vegetation until pool water levels have dropped. Therefore the period of time for cattle grazing around pools needs to be more restricted than for sheep.

Grazing to Manage Yellow Starthistle

Grasslands with starthistle may be managed using grazing. Moderate grazing with cattle, sheep or goats can gradually reduce the presence of this plant, in the same manner as prescribed burns (Thomsen *et al*. 1996). In order to be successful, the timing for grazing is important. It must be conducted in the late spring and early summer, before the starthistle seedheads have matured.

Management of Medusahead

In some grasslands of the Unit, medusahead is as widespread of a problem as yellow starthistle. Known infestations are depicted on the vegetation maps. Similar to starthistle, properly timed applications of grazing and/or fire can effectively reduce the presence of medusahead. Grazing or fire treatments should be conducted in the late spring or early summer after seeds have set but before they have shattered (Bossard *et. al.* 2000).

Biological Control of Yellow Starthistle

The U.S. Department of Agriculture has approved the use of several insect species (weevils and flys) that are the natural enemies of yellow starthistle. The California Department of Food and Agriculture (CDFA) may be willing to release one or more of the insects into the Unit if it is determined (as is likely) that the population of yellow starthistle is large enough to sustain the insects at a level where they can be effective. The use of biological controls may be the most cost effective and safe means of controlling starthistle. The insects are all host specific to yellow starthistle and do not require significant investments in infrastructure or personnel. However, the insects may not be effective in significantly reducing yellow starthistle populations, except over an extended period of many years (Bossard *et. al.* 2000).

Special Status Plant Surveys

Within some woodland areas, it is possible that one or more of the special status species described for chaparral areas (see above) could occur. These areas are shown on the vegetation maps. Focused special status plant surveys should be conducted in these areas in the spring and summer in accordance with California Native Plant Society guidelines. If one or more of these species are determined to be present, vegetation management plans should include provisions for ensuring that these species are maintained.

Riparian Management

Management of Invasive Exotic Weed Infestations.

Several mapped infestations of tree-of heaven, broom and privet within and adjacent to riparian areas are shown on the vegetation maps. Failure to manage these weed species will cause a further decline in the biological value of the Unit's riparian habitats. Recommended control approaches for each of these species are briefly discussed below.

The most appropriate control method for tree-of-heaven will depend on the size of individual trees. In the case of seedlings, hand pulling is effective if conducted after a rain when the entire seedling and root system can be pulled (Bossard *et. al.* 2000). For larger seedlings and small saplings, pulling the trees with "weed wrenches" may be effective, provided that the work is conducted under very wet soil conditions. Hand removal is ideal work for volunteer groups, particularly given the accessibility of tree-of-heaven infestations along Lake Natoma. For larger saplings and mature trees, cutting or girdling, immediately followed by applications of systemic herbicides, is recommended (Bossard *et. al.* 2000). Following all treatment approaches, it is essential that there be follow-up monitoring for one or more growing seasons, because tree-of-heaven is prone to root re-sprouting. All root sprouts should be removed until they no longer appear. Similarly, broom infestations and privet saplings can be effectively managed by pulling with weed wrenches and follow-up monitoring and removal of seedings. Mature privets should be treated in the same manner as mature tree-of heaven.

All weed management activities in the Unit should be performed in accordance with the Bureau of Reclamation's CCAO Operations and Maintenance Plan (BOR 2002).

Himalayan Blackberry Management

This weed is ubiquitous along riparian areas and is very difficult to control. A realistic and cost-effective management program for the Unit should entail the identification of key locations along riparian corridors (*e.g*., outlier populations, places where human or large wildlife access should be facilitated). In these locations, Himalayan berry should be physically removed by cutting the branches as far back as possible or by pulling with weed wrenches, if practical. This should be followed by herbicide applications and replanting of the infested areas with rapidly growing native riparian shrub species.

The yellow-breasted chat, a California Species of Special Concern (see Natural Resources – Animal Life – page AL-39), is known to frequent riparian areas with dense stands of Himalayan blackberry. Therefore, surveys for this species during the nesting season (early May- mid-July) would need to be conducted within any area proposed for Himalayan blackberry management. No management work should be conducted until the nesting season is completed, all young have fledged and the nests abandoned.

Monitoring for Invasive Exotic Weeds

Although not yet observed in the Unit, there is a strong potential for riparian areas to become infested with giant reed *(Arundo donax*) and salt cedar (*Tamarix ramosissima*). A proactive approach is recommended for preventing such infestations. Volunteer teams should be organized to conduct annual monitoring of perennial riparian corridors, which are the most likely locations for initial colonization by these species. If any individuals are observed, they should be immediately treated and their exact locations recorded using GPS technology so that follow up visits can be conducted.

Mississippi Bar Enhancement

Mississippi Bar has tremendous potential for ecological enhancement through removal of dredger mine tailing piles and restoration of a system of riparian wetlands that emulates historical riverine floodplain systems. A particularly viable opportunity to do this will occur in the next few years due to the proposed Corps of Engineers/SAFCA Folsom Dam raising project to improve flood storage potential (ACOE 2001). The project will require a huge amount of fill material for levee construction and the Mississippi Bar tailings have been identified as suitable for this purpose (Tom Washburn, SAFCA, public statement). Material can be removed and wetland/riparian systems restored at no cost to the State of California.

Dredge mine tailings at Mississippi Bar were deposited in an undulating and unnatural pattern of rock piles interspersed with slicken deposits.[8] Due to their lower floodplain elevations, the slickens have become well-vegetated with riparian and marsh vegetation. However the tailing rock piles are barren or are sparsely vegetated with ruderal and exotic plant species that provide little habitat value. A restoration plan could remove the tailing piles and re-establish a range of elevations, keyed to the range of water stages in Lake Natoma during normal hydrological years. Permanently and seasonally flowing backwater channels and oxbow ponds could also be excavated by connecting slicken zones or by more deeply excavating the zones from which mine tailing piles have been removed. In this way, a mosaic of riparian and wetland habitat types could be planted and allowed to develop, similar

[8] "Slickens" are clay deposits left from past mining activities.

to the mosaic of habitats that naturally develop in riverine floodplain systems of bars and terraces, backwater channels and oxbows.

The value of such a restored floodplain ecosystem to local, regional and seasonally migratory fauna would be inestimable, particularly given the large size of Mississippi Bar and its proximity to the open waters of Lake Natoma. Moreover, the proximity to urbanized areas would provide a significant interpretive opportunity for the local community, demonstrating how long-term ecological damage can be restored in conjunction with a needed flood protection project.

Development of a Mississippi Bar habitat restoration plan would not only require extensive coordination with the BOR, ACOE and SAFCA but also with key regulatory agencies such as the Regional Board, CDFG, USFWA and EPA. It would require a careful analysis and predictive modeling of fluvial geomorphology and hydrology of Mississippi Bar and Lake Natoma, and should also be designed based on the structural and vegetation pattern of similar natural floodplain systems in the region.

Vernal Pools and Freshwater Marsh Management

Watershed Protection.

Maintenance of the quantity and quality of localized run-off is important for protecting vernal pool ecosystems. Placement of fill material, excavations or other surface alterations of the watershed area's vernal pools should be strictly avoided. Nutrient-laden or sediment-laden run-off of adjacent development areas should not be allowed to flow into the pool systems. Activities that would cause extensive human intrusion into pools (*e.g.*, trampling of pool sideslopes, collection of flowering annuals, litter) should also be discouraged. It is recommended that CDPR, in coordination with the BOR, establish zones of protection, marked with interpretive and cautionary signage around the Unit's vernal pool systems similar to what has already been installed at Doton's Point. The protected zones in each location should ideally encompass the entire system of vernal pools and seasonal wetlands as well as associated watershed. At a minimum, roughly two times as much watershed area should be protected as area of vernal pool and seasonal wetland (*i.e.*, if vernal pools encompass 1 acre, then at least 2 acres of watershed should be protected.

Grazing/Mowing

Vernal pools, particularly those that are in relatively disturbed conditions such as in the vicinity of Folsom Boulevard would benefit from an annual sheep grazing or mowing regime conducted in the early-mid summer after native annuals have completed flowering and seed release. Grazing or mowing (in which the clippings are removed) prevents non-native annual grasses from forming dense thatches that inhibit the growth of native vernal pool annuals. This program could be particularly effective in promoting high quality vernal pools if coupled with a native annual plant re-introduction program.

Special Status Plant Surveys

It would be desirable to conduct spring and early summer surveys of vernal pools for special status plants, particularly the two federally-listed species that have the potential to occur, slender Orcutt grass and Sacramento Orcutt grass.

Aquatic Weed Management

Continued management of water hyacinth in the Lake Natoma vicinity is highly recommended, particularly at the three locations where it is known to occur: Alder Creek, Willow Creek, and the Teichert property. Management has entailed manual removal combined with introduction of a biological control agent (*Neochetina* weevil). A vigilant annual monitoring program for water hyacinth, as well as other aquatic weeds such as elodea and Eurasian milfoil is also recommended. This program could be conducted by trained volunteers.

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Table PL-1. Summary of Terrestrial Vegetation Communities in Folsom Lake SRA

Vegetation Community	Classification under Sawyer and Keeler-Wolf (1995)	Dominant/Subdominant Species	Elevation Range in Folsom Lake S.R.A. (approximate)	Total Area in Folsom Lake S.R.A. (estimates rounded to nearest 5 acres)
Chamise Chaparral	**Chamise Series**; Chamise/Creeping Sage Association	**Canopy:** chamise (*Adenostema fasciculatum)* **Ground Layer:** creeping sage (*Salvia sonomensis*), foxtail chess (*Bromus madritensis*), needlegrass (*Nassella sp.*)	425-675 feet	450 acres
Interior Live Oak Woodland	**Interior Live Oak Series**; Interior Live Oak-Blue Oak-Foothill Pine Association	**Canopy:** interior live oak (*Quercus wislizenii*), foothill pine (*Pinus sabiniana*), blue oak (*Quercus douglasii*) **Understory:** poison oak (*Toxicodendron diversilobupm*), California buckeye (*Aesculus californica*) **Ground Layer:** blue wild rye (*Elymus glaucus*), hedgehog dogtail grass (*Cynosurus echinatus*), ripgut brome (*Bromus diandrus*)	200-775 feet	3,890 acres
Blue Oak Woodland and Savanna	**Blue Oak Series**; Blue Oak/Annual Grass Association	**Canopy:** blue oak **Ground Layer:** hedgehog dogtail grass, Italian thistle (*Carduus pycnocephalus*), wild oats (*Avena fatua*), ripgut brome, soft chess (*Bromus hordeaceus*), rose clover (*Trifolium hirtum*), deergrass (*Muhlenbergia rigens*), purple needlegrass (*Nassella pulchra*)	400-825 feet	1,930 acres
California Annual Grassland	**California Annual Grassland Series**	**Ground Layer:** brachypodium (*Brachypodium distachyon*), ripgut brome, soft chess brome, wild oats (*Avena fatua*), yellow starthistle (*Centaurea solstitialis*), medusa head (*Taeniatherum caput-medusae*), mustard (*Brassica nigra*)	100-625 feet	1,120 acres

Table PL-1. Summary of Terrestrial Vegetation Communities in Folsom Lake SRA

Vegetation Community	Classification under Sawyer and Keeler-Wolf (1995)	Dominant/Subdominant Species	Elevation Range in Folsom Lake S.R.A. (approximate)	Total Area in Folsom Lake S.R.A. (estimates rounded to nearest 5 acres)
Cottonwood/ Willow Riparian	**Fremont Cottonwood Series** **Mixed Willow Series**	**Canopy:** Fremont cottonwood (*Populus fremontii*), black willow (*Salix gooddingii*), Northern California black walnut var. hindsii (*Juglans californica*), California ash (*Fraxinus dipetala*), narrowleaf willow (*Salix exigua*), arroyo willow (*Salix lasiolepis*) **Understory:** Buttonbush (*Cephalanthus occidentalis*), white alder (*Alnus rhombofolia*), California buckeye (*Aesculus californica*), arroyo willow, California grape (*Vitis californica*)	150-550	390 acres
Freshwater Marsh	**Cattail Series;** Cattail-Bulrush Association	**Deeper water emergent vegetation:** cattails (*Typha* spp.) bulrush (*Scirpus californicus*); **Shallower water emergent vegetation:** sedges (*Carex* spp.), spikerush (*Eleocharis macrostachya*), spreading rush (*Juncus patens*)	100-375	10 acres
Seasonal Wetlands	**Spikerush Series** (longer hydroperiod wetlands); (No classification for shorter hydroperiod wetlands)	**Longer hydroperiod wetlands:** sedges (*Carex* spp. and *Cyperus* spp.), rushes (*Juncus* spp.), spikerush **Shorter hydroperiod wetlands:** Italian ryegrass (*Lolium multiflorum*); rabbits-foot grass (*Polypogon monspeliensis*)	125-500	<5 acres

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Vegetation Community	Classification under Sawyer and Keeler-Wolf (1995)	Dominant/Subdominant Species	Elevation Range in Folsom Lake S.R.A. (approximate)	Total Area in Folsom Lake S.R.A. (estimates rounded to nearest 5 acres)
Vernal Pools	**Northern Claypan and Northern Hardpan Vernal Pools**	**Early-mid spring:** Sacramento pogogyne (*Pogogyne ziziphoroides*), vernal pool buttercup (*Ranunculus bonariensis* var. *trisepalus*), threadstem navarretia (*Navarretia filicaulis*), Solano downingia (*Downingia ornatissima*), slender popcorn flower (*Plagiobotrys stipatus*). **Late spring/early summer:** annual hairgrass (*Deschampsia danthonioides*), yellow-ray goldfields (*Lasthenia glaberima*), Fremont goldfields (*Lasthenia fremontii*), coyote thistle (*Eryngium castrense*).	125-400	<5 acres
Lake Shoreline Fluctuation Zone **Ruderal and Barren Areas**	(none)	**Drier areas:** wild oat, ripgut brome, Italian ryegrass, minature lupine (*Lupinus bicolor*), vetch (*Vicia sativa*), prickle grass (*Crypsus niliaca*), lovegrass (*Eragrostis* sp.), bermuda grass (*Cynodon dactylon*), willow herb (*Epilobium brachycarpum*), clovers (*Trifolium* spp.), butter and eggs (*Triphysaria eriantha*), mustard (*Brassica rapa*), yellow starthistle, Italian thistle (*Carduus pycnocephalus),* and white sweet clover (*Melilotus albus* **Wetter areas:** cocklebur (*Xanthium strumarirm*), bristly oxtongue (*Picris echioides*), spikerush (*Eleocharis* spp.), sow thistle (*Sonchus asper*) and Baltic rush (*Juncus balticus*)	400-475 feet (lake shoreline fluctuation zone) 100-675 feet (ruderal/barren areas)	1,035 acres

Table PL-2. Plant Species Observed or Potentially Occurring in Folsom Lake SRA Vegetation Communities

Family	Scientific Name	Common Name	Native/Introduced	California Annual Grassland	Chamise Chaparral	Live Oak Woodland	Blue Oak Woodland & Savanna	Cottonwood/Willow Riparian	Freshwater Marsh	Seasonal Wetland	Vernal Pool	Lake Shoreline Fluctuation Zone	Aquatic/Submerged	Ruderal/Barren
Pteridophytes (Ferns and Fern Allies)														
Blechnaceae	*Woodwardia fimbriata*	Giant chain fern	n					x						
Dennstaedtiaceae	*Pteridium aquilinum*	Bracken fern	n	x		x	x							
Dryopteridaceae	*Dryopteris arguta*	Wood fern	n			x								
Equisetaceae	*Equisetum* sp.	Horsetail rush	n						x	x				x
Isoetaceae	*Isoetes* sp.	Quillwort	n							x	x			
Polypodiaceae	*Polypodium californicum*	Licorice fern	n		x	x	x	x						
Pteridaceae	*Adiantum jordanii*	California maidenhair fern	n			x								
Pteridaceae	*Aspidotis californica*	California lace fern	n		x	x	x							
Pteridaceae	*Pellaea mucronata*	Bird's-oot fern	n		x	x	x							
Pteridaceae	*Pellaea andromedaefolia*	Coffee fern	n											
Pteridaceae	*Pentagramma triangularis*	Goldback fern	n											
Pteridaceae	*Pentagramma triangularis*	Goldback fern	n		x	x	x							
Gymnosperms (Cone-bearing Plants)														
Cupressaceae	*Calocedrus decurrens*	Incense cedar	n			x								
Pinaceae	*Pinus ponderosa*	Pacific ponderosa pine	n			x								
Pinaceae	*Pinus sabiniana*	Foothill pine	n		x	x	x							
Pinaceae	*Pseudotsuga menziesii*	Douglas fir	n			x								
Taxaceae	*Taxus brevifolia*	Western yew	n			x								
Taxaceae	*Torreya californica*	California nutmeg	n		x	x	x							
Angiosperms - Dicots (Flowering Plants)														
Aceraceae	*Acer negundo* var. *californicum*	Box elder	n			x		x						

Table PL-2. Plant Species Observed or Potentially Occurring in Folsom Lake SRA Vegetation Communities

Family	Scientific Name	Common Name	Native/Introduced	California Annual Grassland	Chamise Chaparral	Live Oak Woodland	Blue Oak Woodland & Savanna	Cottonwood/Willow Riparian	Freshwater Marsh	Seasonal Wetland	Vernal Pool	Lake Shoreline Fluctuation Zone	Aquatic/Submerged	Ruderal/Barren
Anacardiaceae	*Rhus trilobata*	Skunkbrush	n		x									
Anacardiaceae	*Toxicodendron diversilobum*	Poison oak	n		x	x	x							
Anacardiaceae	*Pistacia atlantica*	Mt. Atlas pistachio	i											x
Anacardiaceae	*Pistacia chinensis*	Chine pistachio	i											x
Apiaceae	*Anthriscus caucalis*	Bur-chervil	i			x		x						
Apiaceae	*Apium graveolens*	Celery	i					x	x					
Apiaceae	*Conium maculatum*	Poison hemlock	i					x	x	x				
Apiaceae	*Daucus carota*	Queen Anne's lace	i	x										x
Apiaceae	*Daucus pusillus*	Rattlesnake weed	n	x										
Apiaceae	*Eryngium castrense*	Coyote thistle	n							x	x			
Apiaceae	*Eryngium vaseyi*	Coyote-thistle	n							x	x			
Apiaceae	*Eryngium pinnatisectum*	Tuolumne button-celery	n			x	x							
Apiaceae	*Foeniculum vulgare*	Sweet fennel	i	x								x		x
Apiaceae	*Lomatium marginatum* var. *marginatum*	Hartweg's lomatium	n		x	x								
Apiaceae	*Lomatium utriculatum*	Common lomatium	n	x		x	x							
Apiaceae	*Perideridia kelloggii*	Kellog's yampah	n	x	x									
Apiaceae	*Sanicula bipinnata*	Poison sanicle	n	x		x								
Apiaceae	*Sanicula bipinnatifida*	Purple sanicle	n	x	x	x								
Apiaceae	*Sanicula crassicaulis*	Snakeroot	n	x		x	x							
Apiaceae	*Sanicula tuberosa*		n	x	x	x	x							
Apiaceae	*Scandix pecten-veneris*	Venus' needle	i	x										
Apiaceae	*Tauschia hartwegii*		n		x	x								
Apiaceae	*Torilis arvensis*	Hedge parsley	i		x	x								

Table PL-2. Plant Species Observed or Potentially Occurring in Folsom Lake SRA Vegetation Communities

Family	Scientific Name	Common Name	Native/Introduced	California Annual Grassland	Chamise Chaparral	Live Oak Woodland	Blue Oak Woodland & Savanna	Cottonwood/Willow Riparian	Freshwater Marsh	Seasonal Wetland	Vernal Pool	Lake Shoreline Fluctuation Zone	Aquatic/Submerged	Ruderal/Barren
Apiaceae	*Torilis nodosa*	Knotted hedge parsley	i		x	x								
Apiaceae	*Yabea microcarpa*		n	x	x	x	x							
Apocynaceae	*Vinca major*	Greater periwinkle	i			x		x						
Apocynaceae	*Nerium oleander*	Oleander	i					x						x
Araliaceae	*Hedera helix*	English ivy	i			x								x
Aristolochiaceae	*Aristolochia californica*	Dutchman's pipe	n		x	x		x						
Asclepiadaceae	*Asclepias cordifolia*	Purple milkweed	n	x	x	x	x							
Asclepiadaceae	*Asclepias fascicularis*	Narrow-leaf milkweed	n	x										
Asclepiadaceae	*Asclepias speciosa*	Showy milkweed	n	x	x	x	x							
Asteraceae	*Achillea millefolium*	Yarrow	n	x	x	x	x							
Asteraceae	*Achyrachaena mollis*	Blow-wives	n	x										
Asteraceae	*Agoseris grandiflora*	California dandelion	n	x	x	x	x							
Asteraceae	*Agoseris heterophylla*	Mountain dandelion	n	x	x	x	x							
Asteraceae	*Ambrosia psilostachya*	Ragweed	n	x								x		x
Asteraceae	*Anaphalis margaritacea*	Pearly everlasting	n	x		x	x					x		x
Asteraceae	*Anthemis cotula*	Mayweed	i	x	x	x	x					x		x
Asteraceae	*Artemisia douglasiana*	Mugwort	n	x		x	x	x		x				
Asteraceae	*Aster chilensis*	Common California aster	n	x										x
Asteraceae	*Baccharis pilularis*	Coyote brush	n	x	x	x	x							
Asteraceae	*Balsamorhiza deltoidea*	Balsam-root	n	x	x	x	x							
Asteraceae	*Balsamorhiza macrolepis*	Balsam-root	n	x	x	x	x							
Asteraceae	*Balsamorhiza macrolepis* var. *macrolepis*	Big-scale balsam-root	n			x	x							
Asteraceae	*Bidens frondosa*	Begger ticks	i	x										x

Table PL-2. Plant Species Observed or Potentially Occurring in Folsom Lake SRA Vegetation Communities

Family	Scientific Name	Common Name	Native/Introduced	California Annual Grassland	Chamise Chaparral	Live Oak Woodland	Blue Oak Woodland & Savanna	Cottonwood/Willow Riparian	Freshwater Marsh	Seasonal Wetland	Vernal Pool	Lake Shoreline Fluctuation Zone	Aquatic/Submerged	Ruderal/Barren
Asteraceae	*Blennosperma nanum* var. *nanum*	Common blennosperma	n	x	x	x	x			x	x			
Asteraceae	*Brickellia californica*	Brickellbush	n	x	x	x	x							
Asteraceae	*Calycadenia multiglandulosa*	Rosin weed	n	x	x		x							
Asteraceae	*Calycadenia truncata*	Rosin weed	n	x	x		x							
Asteraceae	*Carduus pycnocephalus*	Italian thistle	i	x			x					x		x
Asteraceae	*Centaurea melitensis*	Tocalote	i	x			x					x		x
Asteraceae	*Centaurea solstitialis*	Yellow star-thistle	i	x		x	x					x		x
Asteraceae	*Chaenactis glabriuscula*	Yellow pincushion	n	x	x		x							
Asteraceae	*Chamomilla suaveolens*	Pineapple weed	i	x				x						x
Asteraceae	*Chondrilla juncea*	Rush skeletonweed	i	x										x
Asteraceae	*Cichorium intybus*	Chicory	i	x			x					x		x
Asteraceae	*Cirsium occidentale* var. *californicum*	California thistle	n	x		x	x					x		x
Asteraceae	*Cirsium vulgare*	Bull thistle	i	x								x		x
Asteraceae	*Conyza bonariensis*	South American conyza	i									x		x
Asteraceae	*Conyza canadensis*	Horseweed	i									x		x
Asteraceae	*Cotula coronopifolia*	Brass buttons	i	x					x	x				
Asteraceae	*Ericameria arborescens*	Golden-fleece	n	x	x	x	x							
Asteraceae	*Erigeron foliosus*	Fleabane	n	x	x	x	x							
Asteraceae	*Eriophyllum lanatum*	Woolly sunflower	n	x	x	x	x							
Asteraceae	*Euthamia occidentalis*	Western goldenrod	n	x				x	x	x				
Asteraceae	*Filago gallica*	Narrow-leaved filago	i									x		x
Asteraceae	*Gnaphalium* sp.	Cudweed	n									x		x

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Family	Scientific Name	Common Name	Native/Introduced	California Annual Grassland	Chamise Chaparral	Live Oak Woodland	Blue Oak Woodland & Savanna	Cottonwood/Willow Riparian	Freshwater Marsh	Seasonal Wetland	Vernal Pool	Lake Shoreline Fluctuation Zone	Aquatic/Submerged	Ruderal/Barren
Asteraceae	*Gnaphalium canescens ssp. Beneolens*	Fragrent everlasting	n	x	x	x	x							
Asteraceae	*Gnaphalium californicum*	California everlasting	n	x	x	x	x							
Asteraceae	*Gnaphalium palustre*	Everlasting	n	x						x	x			
Asteraceae	*Grindelia camporum*	Gumplant	n	x						x		x		x
Asteraceae	*Helenium puberulum*	Sneezeweed	n					x	x	x				
Asteraceae	*Helianthella californica*	Diablo helianthella	n	x		x	x							
Asteraceae	*Helianthus annuus*	Common sunflower	n	x	x	x	x					x		x
Asteraceae	*Helianthus californicus*	California sunflower	n	x			x	x		x				
Asteraceae	*Hemizonia fitchii*	Fitch's spikeweed	n	x		x	x							
Asteraceae	*Heterotheca grandiflora*	Telegraph-weed	n	x								x		x
Asteraceae	*Holocarpha virgata*	Virgate tarweed	n	x										
Asteraceae	*Hypochaeris glabra*	Smooth cat's-ear	n	x								x		x
Asteraceae	*Lactuca serriola*	Prickly lettuce	i	x								x		x
Asteraceae	*Lasthenia chrysantha*	Goldfields	n								x			
Asteraceae	*Lasthenia californica*	Goldfields	n								x			
Asteraceae	*Lasthenia fremontii*	Fremont's goldfields	n								x			
Asteraceae	*Lasthenia glaberrima*	Yellow-ray goldfields	n								x			
Asteraceae	*Layia fremontii*	Tidytips	n	x										
Asteraceae	*Layia pentachaeta*	Tidytips	n	x		x	x							
Asteraceae	*Leontodon taraxacoides*	Hairy hawkbit	i	x								x		x
Asteraceae	*Lessingia leptoclada*		n	x			x							
Asteraceae	*Madia anomala*	Plum-seeded madia	n	x			x							

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Family	Scientific Name	Common Name	Native/Introduced	California Annual Grassland	Chamise Chaparral	Live Oak Woodland	Blue Oak Woodland & Savanna	Cottonwood/Willow Riparian	Freshwater Marsh	Seasonal Wetland	Vernal Pool	Lake Shoreline Fluctuation Zone	Aquatic/Submerged	Ruderal/Barren
Asteraceae	*Madia elegans ssp. densiflora*	Common madia	n	x			x							
Asteraceae	*Madia elegans ssp. vernalis*	Spring madia	n	x			x							
Asteraceae	*Madia gracilis*	Slender tarweed	n	x		x	x							
Asteraceae	*Madia rammii*	Tarweed	n	x			x							
Asteraceae	*Madia subspicata*	Tarweed	n	x		x	x							
Asteraceae	*Micropus californicus*	Slender cottonweed	n	x			x			x		x		x
Asteraceae	*Microseris acuminata*	Sierra foothills microserus	n	x										
Asteraceae	*Microseris sylvatica*	Sylvan scorzonella	n	x			x							
Asteraceae	*Picris echioides*	Bristly oxtongue	i	x								x		x
Asteraceae	*Pseudobahia heermannii*		n	x	x	x	x							
Asteraceae	*Psilocarphus brevissimus*	Wooly marbles	n								x			
Asteraceae	*Psilocarphus tenellus*	Slender wooly marbles	n								x			
Asteraceae	*Stebbinsoseris heterocarpa*		n	x	x									x
Asteraceae	*Senecio flaccidus* var. *douglassii*	Groundsel	n		x									
Asteraceae	*Senecio vulgaris*	Ragwort	i									x		x
Asteraceae	*Senecio layneae*	Layne's ragwort	n		x	x	x							
Asteraceae	*Silybum marianum*	Milkthistle	i	x								x		x
Asteraceae	*Solidago californica*	California goldenrod	n	x		x	x					x		x
Asteraceae	*Soliva sessilis*	Common soliva	i									x		x
Asteraceae	*Sonchus asper*	Prickly sow-thistle	i	x				x		x		x		x
Asteraceae	*Sonchus oleraceus*	Common sow-thistle	i	x								x		x
Asteraceae	*Stephanomeria virgata*		n	x			x							
Asteraceae	*Taraxacum officinale*	Dandelion	i	x								x		x

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Family	Scientific Name	Common Name	Native/Introduced	California Annual Grassland	Chamise Chaparral	Live Oak Woodland	Blue Oak Woodland & Savanna	Cottonwood/Willow Riparian	Freshwater Marsh	Seasonal Wetland	Vernal Pool	Lake Shoreline Fluctuation Zone	Aquatic/Submerged	Ruderal/Barren
Asteraceae	*Tragopogon porrifolius*	Salsify	i								x			x
Asteraceae	*Tragopogon pratensis*	Meadow salsify	i							x		x		x
Asteraceae	*Tragopogon dubius*	Goat's beard	i	x								x		x
Asteraceae	*Wyethia augustifolia*	Mules ears	n	x			x							
Asteraceae	*Wyethia helenioides*	Mules ears	n	x	x									
Asteraceae	*Wyethia reticulata*	Eldorado County mules ears	n		x	x	x							
Asteraceae	*Xanthium spinosum*	Spiny cocklebur	n	x								x		x
Asteraceae	*Xanthium strumarium*	Cocklebur	n	x					x			x		x
Berberidaceae	*Berberis aquifolium* var. *dictyota*	Barberry	n	x	x	x	x							
Betulaceae	*Alnus rhombifolia*	White alder	n					x						
Bignoniaceae	*Catalpa speciosa*	Western catalpa	i											x
Boraginaceae	*Amsinckia menziesii* var. *intermedia*	Fiddleneck	n	x								x		x
Boraginaceae	*Amsinckia menziesii* var. *menziesii*	Fiddleneck	n	x								x		x
Boraginaceae	*Cryptantha flaccida*	Flaccid cryptantha	n	x	x		x							
Boraginaceae	*Cryptantha intermedia*	White forget-me-not	n			x	x							
Boraginaceae	*Cynoglossum grande*	Hound's tongue	n	x	x	x	x							
Boraginaceae	*Myosotis discolor*	Forget-me-not	i	x						x				
Boraginaceae	*Myosotis laxa*	Forget-me-not	n					x	x	x		x		x
Boraginaceae	*Plagiobothrys greenei*	Greene's plagiobothrys	n	x		x	x	x	x	x	x			
Boraginaceae	*Plagiobothrys nothofulvus*	Popcorn-flower	n	x		x	x							
Boraginaceae	*Plagiobothrys stipitatus*	Popcorn-flower	n	x						x	x			
Brassicaceae	*Arabidopsis thaliana*	Mouse-ear cress	i	x								x		x

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Brassicaceae	*Athysanus pusillus*		n	x	x		x							
Brassicaceae	*Brassica rapa*	Field mustard	i	x								x		x
Brassicaceae	*Brassica nigra*	Black mustard	i	x								x		x
Brassicaceae	*Capsella bursa-pastoris*	Shepard's purse	i	x								x		x
Brassicaceae	*Cardamine oligosperma*	Bitter cress	n					x		x				
Brassicaceae	*Draba verna*	Whitlow meadowgrass	i	x								x		x
Brassicaceae	*Erysimum capitatum*	Western wallflower	n	x		x	x							
Brassicaceae	*Hirschfeldia incana*	Mediterranean mustard	i					x				x		x
Brassicaceae	*Lepidium nitidum*	Peppergrass	n	x						x				
Brassicaceae	*Lepidium latifolium*	Perennial pepperweed	i					x	x	x	x	x		x
Brassicaceae	*Lepidium oblongum var. oblongum*	Peppergrass	n		x							x		x
Brassicaceae	*Lobularia maritima*	Sweet alyssum	i	x								x		x
Brassicaceae	*Raphanus raphanistrum*	Jointed charlock	i	x								x		x
Brassicaceae	*Raphanus sativus*	Radish	i	x								x		x
Brassicaceae	*Rorippa nasturtium-aquaticum*	Water cress	n					x	x					
Brassicaceae	*Rorippa palustris* var. *occidentalis*	Yellow cress	n					x		x				
Brassicaceae	*Sisymbrium irio*	London rocket	i	x								x		x
Brassicaceae	*Sisymbrium officinale*	Hedge mustard	i	x								x		x
Brassicaceae	*Streptanthus diversifolius*	Varied-leaved jewelflower	n			x	x							
Brassicaceae	*Streptanthus polygaloides*	Milkwort jewelflower	n		x	x								
Brassicaceae	*Thlaspi arvense*	Penny-cress	i	x								x		x

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Brassicaceae	*Thysanocarpus curvipes*	Fringe-pod	n					x		x				
Brassicaceae	*Thysanocarpus radians*	Fringe-pod	n	x						x				
Brassicaceae	*Tropidocarpum gracile*		n	x										
Callitrichaceae	*Callitriche marginata*	California water starweed	n					x	x		x			
Campanulaceae	*Downingia ornatissima*	Solano downingia	n								x			
Campanulaceae	*Downingia pusilla*	Dwarf downingia	n								x			
Campanulaceae	*Githopsis specularioides*	Bluecup	n		x	x	x							
Campanulaceae	*Legenere limosa*	Legenere	n								x			
Caprifoliaceae	*Lonicera hispidula*	Honeysuckle	n			x		x						
Caprifoliaceae	*Lonicera interrupta*	Honeysuckle	n		x	x								
Caprifoliaceae	*Sambucus mexicana*	Blue elderberry	n			x	x	x						
Caprifoliaceae	*Symphoricarpos albus* var. *laevigatus*	Snowberry	n			x		x						
Caryophyllaceae	*Cerastium glomeratum*	Mouse-ear chickweed	i	x	x		x					x		x
Caryophyllaceae	*Minuartia californica*	Sandwort	n		x									
Caryophyllaceae	*Petrorhagia prolifera*	Rock fissure	i									x		x
Caryophyllaceae	*Saponaria officinalis*	Bouncing bet, soapwort	i			x	x	x				x		x
Caryophyllaceae	*Silene californica*	Indian pink	n		x	x	x							
Caryophyllaceae	*Silene gallica*	Windmill pink	i	x								x		x
Caryophyllaceae	*Spergula arvensis* ssp. *arvensis*	Stickwort	i	x								x		x
Caryophyllaceae	*Spergularia rubra*	Purple sand spurrey	i	x			x		x	x		x		x
Caryophyllaceae	*Stellaria media*	Common chickweed	i	x		x	x					x		x
Caryophyllaceae	*Velezia rigida*	Velezia	i	x	x	x	x	x						
Chenopodiaceae	*Salsola tragus*	Russian thistle	i									x		x

Table PL-2. Plant Species Observed or Potentially Occurring in Folsom Lake SRA Vegetation Communities

Family	Scientific Name	Common Name	Native/Introduced	California Annual Grassland	Chamise Chaparral	Live Oak Woodland	Blue Oak Woodland & Savanna	Cottonwood/Willow Riparian	Freshwater Marsh	Seasonal Wetland	Vernal Pool	Lake Shoreline Fluctuation Zone	Aquatic/Submerged	Ruderal/Barren
Cistaceae	*Helianthemum scoparium*	Peak rush-rose	n		x	x	x							
Cistaceae	*Helianthemum suffrutenscens*	Bisbee Peak rush rose	n		x									
Chenopodiaceae	*Chenopodium ambrosioides*	Mexican tea	i	x								x		x
Convolvulaceae	*Calystegia occidentalis*	Morning-glory	n	x	x	x								
Convolvulaceae	*Calystegia stebbinsii*	Stebbin's morning-glory	n		x	x	x							
Convolvulaceae	*Convolvulus arvensis*	Bindweed	i	x							x	x		x
Cornaceae	*Cornus glabrata*	Brown dogwood	n			x		x						
Crassulaceae	*Crassula aquatica*	Water Pigmy Weed	n							x	x		x	
Crassulaceae	*Crassula connata*	Pigmy weed	n	x			x					x		x
Crassulaceae	*Dudleya cymosa*	Rock lettuce	n		x	x								
Crassulaceae	*Parvisedum pumilum*		n		x	x					x			
Crassulaceae	*Sedum spathulifolium*	Stonecrop	n		x	x								
Cucurbitaceae	*Marah fabaceus*	Wild cucumber	n			x		x						
Cucurbitaceae	*Marah fabaceus* var. *agrestis*	Valley man-root	i					x						
Cucurbitaceae	*Marah watsonii*	Man root	n			x		x						
Cuscutaceae	*Cuscuta* sp.	Dodder	n		x			x		x				
Dipsacaceae	*Dipsacus fullonum*	Wild teasel	i	x						x				
Ericaceae	*Arbutus menziesii*	Madrone	n			x								
Ericaceae	*Arctostaphylos manzanita*	Parry manzanita	n		x	x								
Ericaceae	*Arctostaphylos viscida*	White leaf-manzanita	n		x	x								
Euphorbiaceae	*Chamaesyce maculata*	Spotted spurge	i	x								x		x
Euphorbiaceae	*Chamaesyce ocellata*	Valley spurge	n		x							x		x

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Euphorbiaceae	*Eremocarpus setigerus*	Turkey mullein	n	x								x		x
Euphorbiaceae	*Euphorbia crenulata*	Chinese caps	n	x	x		x							
Euphorbiaceae	*Euphorbia spathulata*	Reticulate-seeded spurge	n									x		x
Euphorbiaceae	*Sapium sebiferum*	Chinese tallow	i					x				x		x
Fabaceae	*Albizzia julibrissin*	Silk tree	i											x
Fabaceae	*Amorpha californica*	False indigo	n		x	x	x							
Fabaceae	*Astragalus gambellianus*	Milkvetch	n	x	x									
Fabaceae	*Cercis occidentalis*	Western redbud	n	x	x	x	x	x						
Fabaceae	*Cytisus scoparius*	Scotch broom	i	x	x	x								x
Fabaceae	*Genista monspessulana*	French broom	i	x	x	x								x
Fabaceae	*Lathyrus latifolius*	Everlasting pea	i	x								x		x
Fabaceae	*Lathyrus nevadensis*	Pea	n			x								
Fabaceae	*Lathyrus sulphureus*	Pea	n			x	x							
Fabaceae	*Lathyrus sulphureus* var. *argillaceus*	Dubious pea	n			x	x							
Fabaceae	*Lotus grandiflorus*	Largeflower lotus	n	x	x	x	x	x						
Fabaceae	*Lotus humistratus*	Colchita	n	x		x	x							
Fabaceae	*Lotus micranthus*	Small-flowered lotus	n		x	x	x					x		x
Fabaceae	*Lotus purshianus*	Spanish lotus	n	x	x	x	x	x				x		x
Fabaceae	*Lotus scoparius*	California broom	n	x	x									
Fabaceae	*Lotus strigosus*	Hairy lotus	n	x	x	x	x					x		x
Fabaceae	*Lotus wrangelianus*	California lotus	n	x	x							x		x
Fabaceae	*Lupinus albifrons*	Silver lupine	n		x							x		x
Fabaceae	*Lupinus benthamii*	Spider lupine	n		x							x		x

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Fabaceae	*Lupinus bicolor*	Miniature lupine	n	x								x		x
Fabaceae	*Lupinus formosus*	Summer lupine	n	x		x								
Fabaceae	*Lupinus latifolius*	Broadleaf lupine	n	x		x	x							
Fabaceae	*Lupinus microcarpus* var. *densiflorus*	Chick lupine	n	x	x							x		x
Fabaceae	*Lupinus microcarpus* var. *microcarpus*	Whitewhorl lupine	n									x		x
Fabaceae	*Lupinus stiversii*	Harlequin lupine	n	x	x	x	x							
Fabaceae	*Lupinus succulentus*	Arroyo lupine	n	x			x					x		x
Fabaceae	*Medicago arabica*	Bur clover	n									x		x
Fabaceae	*Medicago polymorpha*	California bur clover	n	x			x					x		x
Fabaceae	*Medicago sativa*	Alfalfa	i	x			x					x		x
Fabaceae	*Melilotus albus*	White sweet clover	i	x			x					x		x
Fabaceae	*Melilotus indica*	Yellow sweet clover	i									x		x
Fabaceae	*Pickeringia montana*	Chaparral pea	n		x	x								
Fabaceae	*Robinia pseudoacacia*	Black lotus	i	x		x								x
Fabaceae	*Sesbania punicea*	Scarlet wisteria	i											x
Fabaceae	*Spartium junceum*	Spanish broom	i											x
Fabaceae	*Trifolium barbigerum*	Clover	n	x	x	x	x			x		x		x
Fabaceae	*Trifolium campestre*	Hop clover	i	x			x					x		x
Fabaceae	*Trifolium ciliolatum*	Tree clover	n	x	x	x						x		x
Fabaceae	*Trifolium depauperatum*	Clover	n	x			x					x		x
Fabaceae	*Trifolium dubium*	Shamrock clover	i	x			x					x		x
Fabaceae	*Trifolium glomeratum*	Cluster clover	i									x		x

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Fabaceae	*Trifolium hirtum*	Rose clover	i	x								x		x
Fabaceae	*Trifolium incarnatum*	Crimson clover	i	x			x					x		x
Fabaceae	*Trifolium microcephalum*	Small head clover	n	x	x	x	x	x				x		x
Fabaceae	*Trifolium obtusiflorum*	Creek clover	n					x	x	x				
Fabaceae	*Trifolium pratense*	Red clover	i	x			x					x		x
Fabaceae	*Trifolium repens*	White clover	i	x			x					x		x
Fabaceae	*Trifolium subterraneum*	Subterranean clover	i									x		x
Fabaceae	*Trifolium variegatum*	White-tipped clover	n							x		x		x
Fabaceae	*Trifolium willdenovii*	Tomcat clover	n	x	x					x		x		x
Fabaceae	*Vicia americana*	American vetch	n			x	x	x				x		x
Fabaceae	*Vicia sativa* ssp. *nigra*	Narrow-leaved vetch	i	x		x	x					x		x
Fabaceae	*Vicia sativa* ssp. *sativa*	Spring vetch	i	x			x					x		x
Fabaceae	*Vicia villosa*	Hairy vetch	i	x			x					x		x
Fabaceae	*Vicia villosa* ssp. *varia*	Vetch	i									x		x
Fabaceae	*Vicia villosa* ssp. *villosa*	Wooly vetch	i									x		x
Fagaceae	*Quercus chrysolepis*	Maul oak, canyon live oak	n		x	x	x							
Fagaceae	*Quercus douglasii*	Blue oak	n			x	x							
Fagaceae	*Quercus dumosa*	Nuttall's scrub oak	n		x									
Fagaceae	*Quercus durata*	Leather oak	n		x									
Fagaceae	*Quercus kelloggii*	California black oak	n			x	x							
Fagaceae	*Quercus lobata*	Valley oak	n	x		x	x							
Fagaceae	*Quercus x morehus*	Oracle oak	n			x	x							
Fagaceae	*Quercus wislizenii*	Interior live oak	n		x	x	x							

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Garryaceae	*Garrya congdonii*	Silk tassel bush	n		x									
Garryaceae	*Garrya fremontii*	Silk tassel bush	n		x									
Gentianaceae	*Centaurium muehlenbergii*	Centaury	n	x			x							
Gentianaceae	*Centaurium venustum*	Canchalagua	n	x										
Gentianaceae	*Cicendia quadrangularis*	Microcala	n		x									x
Geraniaceae	*Erodium botrys*	Broadleaf filaree	i								x			x
Geraniaceae	*Erodium brachycarpum*	Stork's-bill	i								x			x
Geraniaceae	*Erodium cicutarium*	Red-stem filaree	i								x			x
Geraniaceae	*Erodium moschantum*	White-stem filaree	i								x			x
Geraniaceae	*Geranium carolinianum*	Carolina geranium	n	x										
Geraniaceae	*Geranium dissectum*	Cutleaf geranium	i	x							x			x
Geraniaceae	*Geranium molle*	Dove's-foot geranium	i	x	x		x				x			x
Haloragaceae	*Myriophyllum aquaticum*	Eurasian milfoil	i										x	
Hippocastanaceae	*Aesculus californica*	California buckeye	n			x		x						
Hydrocharitaceae	*Elodea nuttallii*	Nuttall's waterweed	i										x	
Hydrocharitaceae	*Egeria densa*	Brazilian waterweed	i										x	
Hydrocharitaceae	*Hydrilla verticillata*	Hydrilla	i										x	
Hydrophyllaceae	*Eriodictyon californicum*	Yerba santa	n	x	x									x
Hydrophyllaceae	*Nemophila heterophylla*	Variable-leaved nermmophila	n	x	x			x			x			x
Hydrophyllaceae	*Nemophila maculata*	Fivespot	n	x			x				x			x
Hydrophyllaceae	*Nemophila menziesii*	Baby blue-eyes	n	x			x				x			x
Hydrophyllaceae	*Phacelia cicutaria*	Fiddleneck	n	x	x		x							
Hydrophyllaceae	*Phacelia imbricata*		n	x	x	x	x				x			x

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Hydrophyllaceae	*Phacelia tanacetifolia*		n	x								x		x
Hypericaceae	*Hypericum mutilum*	St. John's wort	i					x						
Hypericaceae	*Hypericum perforatum*	Klamath weed	i	x								x		x
Juglandaceae	*Juglans californica var. hindsii*	Black walnut	n					x						
Lamiaceae	*Lamium amplexicaule*	Dead nettle	i									x		x
Lamiaceae	*Lepechinia calycina*	Pitcher sage	n		x		x							
Lamiaceae	*Lycopus americanus*	Water horehound	n					x		x		x		x
Lamiaceae	*Marrubium vulgare*	Horehound	i									x		x
Lamiaceae	*Mentha arvensis*	Mint	n					x	x					
Lamiaceae	*Mentha pulegium*	Pennyroyal	i					x	x	x	x	x		
Lamiaceae	*Mentha spicata*	Spearmint	n					x	x					
Lamiaceae	*Melissa officinalis*	Lemon balm	i	x				x		x		x		x
Lamiaceae	*Monardella sheltonii*	Hairy monardella	n		x	x	x							
Lamiaceae	*Monardella villosa*	Coyote mint	n		x		x							
Lamiaceae	*Pogogyne zizyphoroides*	Sacramento pogogyne	n							x	x			
Lamiaceae	*Prunella vulgaris* var. *lanceolata*	Self-heal	n			x	x	x						
Lamiaceae	*Salvia sonomensis*	Sage	n		x		x							
Lamiaceae	*Salvia spathacea*	Pitcher sage	n		x	x	x							
Lamiaceae	*Scutellaria californica*	Skull cap	n	x	x		x							
Lamiaceae	*Scutellaria siphocampyloides*	Skull cap	n	x			x			x				
Lamiaceae	*Scutellaria tuberosa*	Skull cap	n		x		x							
Lamiaceae	*Stachys stricta*	Hedge nettle	n			x		x		x				

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Lamiaceae	*Trichostema lanceolatum*	Vinegar weed	n								x		x
Lauraceae	*Umbellularia californica*	California bay laurel	n		x	x								
Lemnaceae	*Lemna* sp.	Duckweed	n									x		
Limnanthaceae	*Limnanthes alba*	Meadow foam	n	x		x	x			x	x			
Limnanthaceae	*Limnanthes striata*	Meadow foam	n					x			x			
Loasaceae	*Mentzelia laevicaulus*	Blazing star	n	x			x					x		x
Lythraceae	*Lythrum hyssopifolium*	Purple loosestrife	i						x	x				
Malvaceae	*Malva parviflora*	Cheeseweed	i									x		x
Malvaceae	*Sidalcea calycosa* ssp. *calycosa*	Checker	n					x	x	x	x			
Malvaceae	*Sidalcea hartwegii*	Checkerbloom	n	x	x									
Molluginaceae	*Mollugo verticillata*	Carpet weed	i							x		x		x
Moraceae	*Morus* sp.	Mulberry	i											x
Myricaceae	*Myrica hartwegii*	Sierra sweet bay	n		x			x	x					
Oleaceae	*Fraxinus dipetala*	California ash	n			x		x						
Oleaceae	*Ligustrum lucidum*	Glossy privet	i					x						x
Oleaceae	*Olea europaea*	Olive	i											x
Onagraceae	*Clarkia biloba* ssp. *biloba*	Bilobed clarkia	n	x	x	x	x							
Onagraceae	*Clarkia biloba* ssp. *brandegeae*	Brandegee's clarkia	n		x	x	x							
Onagraceae	*Clarkia purpurea*	Purple clarkia	n	x										
Onagraceae	*Clarkia purpurea* ssp. *quadriveulnera*	Four spot purple clarkia	n	x	x									
Onagraceae	*Clarkia rhomboidea*	Tongue clarkia	n		x		x							
Onagraceae	*Clarkia unguiculata*	Elegant clarkia	n			x	x							

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Onagraceae	*Epilobium brachycarpum*	Willow-herb	n	x			x					x		
Onagraceae	*Epilobium canum*	California fuchsia, zauschneria	n		x		x							
Onagraceae	*Epilobium cilatum* ssp. *cilatum*	Northern willow-herb	n					x		x		x		
Onagraceae	*Epilobium cleistogamum*	Boisduvalia	n								x			
Onagraceae	*Epilobium densiflorum*	Denseflower willow-herb	n					x				x		x
Onagraceae	*Ludwigia peploides*	False loosestrife, water primrose	n					x	x				x	
Onagraceae	*Oenothera elata var. hirsutissima*	Evening primrose	n					x	x					
Onagraceae	*Oenothera elata ssp. hookeri*	Evening primrose	n					x	x	x				
Orobanchaceae	*Orobanche uniflora*	Naked broom-rape	n					x	x	x				
Oxalidaceae	*Oxalis laxa*	Annual oxalis	i									x		x
Papaveraceae	*Dendromecon rigida*	Bush poppy	n		x									x
Papaveraceae	*Eschscholzia caespitosa*	Foothill poppy	n		x									
Papaveraceae	*Eschscholzia californica*	California poppy	n	x										
Papaveraceae	*Eschscholzia lobbii*	Frying pans	n	x										
Papaveraceae	*Meconella californica*	Little poppy	n	x								x		x
Papaveraceae	*Platystemon californicus*	Cream cups	n	x										
Philadelphaceae	*Philadelphus lewisii*	Wild mock orange	n			x	x	x						
Plantaginaceae	*Plantago coronopus*	Cut-leaved plantain	i	x	x							x		x
Plantaginaceae	*Plantago elongata*	Annual plantain	n								x			
Plantaginaceae	*Plantago erecta*		n	x			n							
Plantaginaceae	*Plantago lanceolata*	English plantain	i									x		x

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Plantaginaceae	*Plantago major*	Common plantain	i									x		x
Platanaceae	*Platanus racemosa*	Western sycamore	n					x						
Polemoniaceae	*Allophyllum divaricatum*		n		x	x								
Polemoniaceae	*Gilia capitata*	Gilia	n	x										
Polemoniaceae	*Gilia tricolor*	Bird's eyes	n	x										
Polemoniaceae	*Gilia tricolor* ssp. *diffusa*	Bird's eyes gilia	n	x			x							
Polemoniaceae	*Linanthus androsaceus*		n		x	x	x							
Polemoniaceae	*Linanthus bicolor*		n	x	x	x	x							
Polemoniaceae	*Linanthus dichotomus*	Evening snow	n		x					x				
Polemoniaceae	*Linanthus montanus*	Mustang clover	n			x	x							
Polemoniaceae	*Navarretia filicaulis*	Threadstem navarretia	n								x			
Polemoniaceae	*Navarretia intertexta*		n	x						x	x			
Polemoniaceae	*Navarretia leucocephala* ssp. *leucocephala*	White-flowered navarretia	n								x			
Polemoniaceae	*Navarretia myersi* ssp. *myersi*	Pincushion navarretia	n								x			
Polemoniaceae	*Navarretia pubescens*		n		x					x				
Polemoniaceae	*Navarretia squarrosa*	Skunkweed	n		x									
Polemoniaceae	*Phlox gracilis*	Phlox	n	x						x				
Polygalaceae	*Polygala cornuta*	Milkwort	n		x		x							
Polygonaceae	*Chorizanthe membranaceae*	Pink spineflower	n	x	x	x	x							
Polygonaceae	*Eriogonum latifolium*	Coast buckwheat	n											
Polygonaceae	*Eriogonum umbellatum*	Sulfur buckwheat	n	x										
Polygonaceae	*Polygonum arenastrum*	Common knotweed	i							x		x		x

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Polygonaceae	*Polygonum argyrocoleon*	Silversheath knotweed	i								x			x
Polygonaceae	*Polygonum convolvulus*	Black bindweed	i											x
Polygonaceae	*Polygonum hydropiper*	Water pepper	i							x		x		
Polygonaceae	*Polygonum punctatum*	Water smartweed, knotweed	n					x	x					
Polygonaceae	*Rumex acetosella*	Sheep sorrel	i						x			x		x
Polygonaceae	*Rumex conglomeratus*	Clustered dock	i					x	x					
Polygonaceae	*Rumex crispus*	Curly dock	i					x		x		x		x
Polygonaceae	*Rumex pulcher*	Fiddle dock	i											x
Portulacaceae	*Calandrinia ciliata*	Red-maids	n	x								x		x
Portulacaceae	*Claytonia perfoliata*	Miner's lettuce	n			x				x		x		x
Portulacaceae	*Montia fontana*	Water chickweed	n					x	x		x		x	
Portulacaceae	*Portulaca oleracea*	Common purslane	i									x		x
Primulaceae	*Anagallis arvensis*	Scarlet pimpernel	i									x		x
Primulaceae	*Centunculus minimus*	Chaaffweed	n							x	x			
Primulaceae	*Dodecatheon clevelandii*	White shooting-star	n	x										
Primulaceae	*Dodecatheon hendersonii*	Mosquito bills	n			x	x	x						
Ranunculaceae	*Aquilegia formosa*	Columbine	n		x	x	x	x						
Ranunculaceae	*Clematis lasiantha*	Pipestems	n	x	x	x	x							
Ranunculaceae	*Clematis ligusticifolia*	Virgins bower, Yerba de chiva	n					x	x					
Ranunculaceae	*Delphinium hansenii*	Hansen's larkspur	n		x		x							
Ranunculaceae	*Delphinium hesperium*	Western larkspur	n	x		x	x							
Ranunculaceae	*Delphinium patens*	Spreading larkspur	n	x		x	x							

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Ranunculaceae	*Delphinium variegatum*	Royal larkspur	n	x		x	x							
Ranunculaceae	*Kumlienia hystricula*	Kumlienia	n					x						
Ranunculaceae	*Ranunculus aquatilus*		n					x	x					
Ranunculaceae	*Ranunculus bonariensis* var. *trisepalus*	Vernal pool buttercup	n								x			
Ranunculaceae	*Ranunculus californicus*	California buttercup	n	x		x	x							
Ranunculaceae	*Ranunculus hebecarpus*		n		x	x	x							
Ranunculaceae	*Ranunculus muricatus*	Spiny-fruit buttercup	i							x	x	x		x
Ranunculaceae	*Ranunculus occidentalis*	Western buttercup	n	x		x	x							
Ranunculaceae	*Thalictrum fendleri var. polycarpum*	Meadow rue	n			x	x	x						
Rhamnaceae	*Ceanothus cuneatus*	Buck brush	n	x	x									
Rhamnaceae	*Ceanothus integerrimus*	Deer brush	n		x									
Rhamnaceae	*Ceanothus lemmonii*		n		x	x	x							
Rhamnaceae	*Ceanothus leucodermis*	Chaparral whitethorn	n		x									
Rhamnaceae	*Ceanothus roderickii*	Pine Hill ceanothus	n		x	x	x							
Rhamnaceae	*Rhamnus californica*	California coffeeberry	n		x	x	x							
Rhamnaceae	*Rhamnus crocea*	Spiny red berry	n		x									
Rhamnaceae	*Rhamnus ilicifolia*	Holly-leaved redberry	n		x									
Rhamnaceae	*Rhamnus tomentella*	Coffeeberry	n		x	x								
Rosaceae	*Adenostoma fasciculatum*	Chamise	n		x									
Rosaceae	*Amelanchier utahensis*	Utah service berry	n		x									
Rosaceae	*Cercocarpus betuloides*	Mountain mahogany	n		x	x	x							
Rosaceae	*Chamaebatia foliolosa*	Mountain misery	n			x								

Table PL-2. Plant Species Observed or Potentially Occurring in Folsom Lake SRA Vegetation Communities

Family	Scientific Name	Common Name	Native/Introduced	California Annual Grassland	Chamise Chaparral	Live Oak Woodland	Blue Oak Woodland & Savanna	Cottonwood/Willow Riparian	Freshwater Marsh	Seasonal Wetland	Vernal Pool	Lake Shoreline Fluctuation Zone	Aquatic/Submerged	Ruderal/Barren
Rosaceae	*Fragaria vesca*	Wood strawberry	n			x								
Rosaceae	*Heteromeles arbutifolia*	Toyon, Christmas berry	n		x	x								
Rosaceae	*Malus sylvestris*	Apple	i											x
Rosaceae	*Oemleria cerasiformis*	Oso berry	n		x	x	x							
Rosaceae	*Potentilla glandulosa*		n	x		x	x	x						
Rosaceae	*Prunus ilicifolia*	Islay, holly-leafed cherry	n		x	x	x							
Rosaceae	*Prunus virginiana var. demissa*	Western chokecherry	n		x	x	x							
Rosaceae	*Pyracantha angustifolia*	Firethorn	i	x				x						x
Rosaceae	*Pyracantha crenatoserrata*	Pyracantha, firethorn	n					x						x
Rosaceae	*Rosa californica*	California rose	n					x						
Rosaceae	*Rubus discolor*	Himalayan blackberry	i					x						
Rosaceae	*Rubus leucodermis*	Blackcap rasberry	n		x			x						
Rosaceae	*Rubus ursinus*	California blackberry	n					x						
Rosaceae	*Sanguisorba minor*	Garden burnet	i											x
Rubiaceae	*Cephalanthus occidentalis var. californicus*	California button willow	n					x	x					
Rubiaceae	*Galium aparine*	Goose grass	n	x										
Rubiaceae	*Galium californicum* ssp. *sierrae*	Eldorado bedstraw	n		x	x	x							
Rubiaceae	*Galium murale*	Tiny bedstraw	i	x				x		x				
Rubiaceae	*Galium nuttallii*	San Diego bedstraw	n		x	x								
Rubiaceae	*Galium parisiense*	Wall bedstraw	i	x	x									
Rubiaceae	*Galium porrigens* var. *tenue*	Climbing bedstraw	n		x	x	x							

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Family	Scientific Name	Common Name	Native/Introduced	California Annual Grassland	Chamise Chaparral	Live Oak Woodland	Blue Oak Woodland & Savanna	Cottonwood/Willow Riparian	Freshwater Marsh	Seasonal Wetland	Vernal Pool	Lake Shoreline Fluctuation Zone	Aquatic/Submerged	Ruderal/Barren
Salicaceae	*Populus fremontii ssp. fremontii*	Fremont's cottonwood	n					x						
Salicaceae	*Salix exigua*	Narrow-leaved willow	n					x	x					
Salicaceae	*Salix gooddingii*	Goodding's black willow	n					x		x		x		
Salicaceae	*Salix laevigata*	Red willow	n					x	x			x		
Salicaceae	*Salix lasiolepis*	Arroyo willow	n					x	x	x		x		
Salicaceae	*Salix lucida* ssp. *lasiandra*	Yellow willow	n											
Salicaceae	*Salix melanopsis*	Dusky willow	n					x						
Saxifragaceae	*Boykinia occidentalis*		n					x						
Saxifragaceae	*Lithophragma affine*	Woodland star	n	x										
Saxifragaceae	*Lithophragma heterophyllum*		n			x	x							
Saxifragaceae	*Saxifraga californica*	Saxifrage	n			x	x	x						
Scrophulariaceae	*Antirrhinum vexillo-calyculatum*	Wiry snapdragon	n		x							x		x
Scrophulariaceae	*Castilleja attenuata*	Valley tassels	n	x			x							
Scrophulariaceae	*Castilleja foliolosa*	Woolly Indian paintbrush	n		x									
Scrophulariaceae	*Castilleja subinclusa*		n		x									
Scrophulariaceae	*Collinsia heterophylla*	Chinese houses	n		x	x	x							
Scrophulariaceae	*Collinsia sparsiflora*		n	x	x									
Scrophulariaceae	*Collinsia sparsiflora* ssp. *collina*	Blue-eyed mary	n	x	x		x					x		x
Scrophulariaceae	*Collinsia tinctoria*		n		x	x								
Scrophulariaceae	*Cordylanthus pilosus ssp. hansenii*	Bird's-beak	n		x	x								
Scrophulariaceae	*Gratiola ebracteata*	Bractless hedge-hyssop	n					x	x	x	x			

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Scrophulariaceae	*Gratiola heterosepala*	Boggs Lake hedge-hyssop	n								x			
Scrophulariaceae	*Linaria canadensis*	Blue toadflax	n		x									
Scrophulariaceae	*Keckiella breviflora*	Gaping penstemon	n		x	x	x							
Scrophulariaceae	*Mimulus aurantiacus*	Bush monkey-flower	n		x	x								
Scrophulariaceae	*Mimulus cardinalis*	Scarlet monkey-flower	n					x						
Scrophulariaceae	*Mimulus floribundus*	Monkey-flower	n					x						
Scrophulariaceae	*Mimulus guttatus*	Common monkey-flower	n					x	x					
Scrophulariaceae	*Mimulus kelloggii*		n		x							x		x
Scrophulariaceae	*Mimulus tricolor*		n								x			
Scrophulariaceae	*Orthocarpus sp.*	Owl's clover	n											
Scrophulariaceae	*Pedicularis densiflora*	Indian warrior	n		x	x								
Scrophulariaceae	*Penstemon heterophyllus*	Beardtongue	n	x	x	x								
Scrophulariaceae	*Scrophularia californica*	California figwort	n		x			x				x		x
Scrophulariaceae	*Triphysaria eriantha*	Butter-and-eggs	n	x								x		
Scrophulariaceae	*Verbascum blattaria*	Moth mullein	i									x		x
Scrophulariaceae	*Verbascum thapsus*	Wolly mullein	i									x		x
Scrophulariaceae	*Veronica persica*	Persian speedwell	i									x		x
Simaroubaceae	*Ailanthus altissima*	Tree of heaven	i											x
Solanaceae	*Datura stramonium*	Jimson weed	i											x
Solanaceae	*Datura wrightii*	Thorn-apple	n					x		x				
Solanaceae	*Nicotiana acuminata*	Tobacco	i	x										
Solanaceae	*Nicotiana attenuata*	Coyote tobacco	n	x	x									
Solanaceae	*Nicotiana glauca*	Tree tobacco	i											x

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Solanaceae	*Nicotiana quadrivalvis*	Indian tobacco	n	x				x						
Solanaceae	*Solanum americanum*	Nightshade	i											x
Solanaceae	*Solanum xanti*	Purple nightshade	n		x	x								
Sterculeaceae	*Fremontodendron californicum ssp. decumbens*	Pine Hill flannelbush	n		x	x	x							
Styracaceae	*Styrax officinalis*	Snowdrop bush	n		x	x	x							
Urticaceae	*Urtica dioica ssp. holosericea*	Hoary nettle	n				x	x				x		x
Valerianaceae	*Plectritis ciliosa*		n	x		x								
Valerianaceae	*Plectritis ciliosa ssp.ciliosa*		n	x		x								
Valerianaceae	*Plectritis macrocera*		n	x		x								
Verbenaceae	*Phyla nodiflora*	Lippia	n					x	x	x				
Verbenaceae	*Verbena bonariensis*		i						x					x
Verbenaceae	*Verbena hastata*		n											x
Violaceae	*Viola douglasii*	Douglas violet	i	x	x									
Viscaceae	*Arceuthobium campylopodum*	Western dwarf mistletoe	n			n								
Viscaceae	*Phoradendron macrophyllum*	Mistletoe	n					x						
Viscaceae	*Phoradendron villosum*	Oak mistletoe	n			n	n							
Vitaceae	*Vitis californica*	California wild grape	n					x						
Zygophyllaceae	*Tribulus terrestris*	Puncture vine	i											x
Angiosperms - Monocots (Grasses, sedges, lilies etc)														
Alismataceae	*Damasonium californicum*		n					x	x		x			

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Alismataceae	*Sagittaria latifolia*	Wapato, tule potato	n						x					
Cyperaceae	*Carex aquatilis*	Sedge	n					x	x	x	x	x		
Cyperaceae	*Carex bolanderi*	Wood sedge	n			x	x			x				
Cyperaceae	*Cyperus eragrostis*	Tall cyperus, Nut grass	n					x	x	x	x	x		
Cyperaceae	*Cyperus niger*	Shining cyperus	n						x	x				
Cyperaceae	*Eleocharis acicularis*	Needle spike-rush	n					x	x	x	x			
Cyperaceae	*Eleocharis macrostachya*	Spikerush	n					x	x	x		x		
Cyperaceae	*Eleocharis pachycarpa*	Spike-rush	n								x			
Cyperaceae	*Kyllinga brevifolia*	Kyllinga	i							x				x
Cyperaceae	*Scirpus acutus var. occidentalis*	Common tule	n					x	x					
Iridaceae	*Iris hartwegii*	Iris	n	x		x	x							
Iridaceae	*Iris macrosiphon*	Ground iris	n	x		x	x							
Iridaceae	*Iris pseudacorus*	Yellow iris	i					x	x					
Iridaceae	*Sisyrinchium bellum*	Blue-eyed grass	n	x		x	x			x				
Juncaceae	*Juncus articulatus*	Jointed rush	n							x	x	x		
Juncaceae	*Juncus balticus*	Baltic rush	n						x	x	x	x		x
Juncaceae	*Juncus bufonius*	Toad rush	n							x	x	x		
Juncaceae	*Juncus capitatus*	Capitate rush	i							x	x			
Juncaceae	*Juncus effusus* var. *pacificus*	Bog or soft rush	n					x	x	x	x	x		
Juncaceae	*Juncus oxymeris*	Pointed rush	n		x	x	x	x		x				
Juncaceae	*Juncus patens*	Spreading rush	n					x	x	x	x	x		
Juncaceae	*Juncus leiospermus* var. *leiospermus.*	Red Bluff dwarf rush	n	x	x	x	x	x		x	x			

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Juncaceae	*Juncus leiospermus* var. *ahartii*	Ahart's dwarf rush	n					x	x	x	x			
Juncaceae	*Juncus tenuis*	Slender rush	n					x	x	x	x	x		
Juncaceae	*Luzula comosa*	Bog or soft rush	n			x	x	x	x					
Lemnaceae	*Lemna sp.*	Duckweed	n				x	x						
Liliaceae	*Agave americana*	Century plant	i											x
Liliaceae	*Allium amplectens*	Narrow-leaved onion	n		x	x	x							
Liliaceae	*Alium hyalinum*	Wild onion	n	x										
Liliaceae	*Allium serra*		n	x										
Liliaceae	*Bloomeria crocea*	Common goldenstar	n	x	x	x	x							
Liliaceae	*Brodiaea coronaria*		n	x										
Liliaceae	*Brodiaea elegans*	Harvest brodiaea	n	x			x							
Liliaceae	*Brodiaea minor*	Small brodiaea	n								x			
Liliaceae	*Calochortus albus*	White globe lilly	n			x	x							
Liliaceae	*Calochortus argillosus*	Clay mariposa lily	n											
Liliaceae	*Calochortus luteus*	Yellow mariposa lily	n	x		x	x							
Liliaceae	*Calochortus venustus*	Mariposa lily	n	x	x									
Liliaceae	*Chlorogalum angustifolium*	Soap plant, amole	n	x			x							
Liliaceae	*Chlorogalum grandiflorum*	Red Hills soaproot	n		x	x	x							
Liliaceae	*Chlorogalum pomeridianum*	Soap plant, amole	n	x	x	x	x							
Liliaceae	*Dichelosterna capitatum* ssp. *capitatum*	Venal pool brodiaea	n								x			
Liliaceae	*Dichelostemma capitatum var. pauciflora*	Bluedicks	n	x			x							
Liliaceae	*Dichelostemma multiflora*	Wild hyacinth	n	x			x							

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Liliaceae	*Dichlostemma volubile*	Snake lily	n				x							
Liliaceae	*Erythronium multiscapoideum*	Fawn lily	n				x	x						
Liliaceae	*Fritillaria micrantha*	Brown bells	n	x										
Liliaceae	*Fritillaria eastwoodiae*	Butte County fritillary	n		x	x	x							
Liliaceae	*Lilium humboldtii*	Humboldt lily	n		x									
Liliaceae	*Lilium rubescens*	Redwood lily	n					x	x					
Liliaceae	*Odontostomum hartwegii*		n		x									
Liliaceae	*Triteleia hyacinthina*	White brodiaea	n	x						x				
Liliaceae	*Triteleia ixioides*	Golden brodiaea	n	x										
Liliaceae	*Triteleia laxa*	Ithuriel's spear	n	x			x							
Liliaceae	*Zigadenus venenosus*	Death camas	n	x						x				
Orchidaceae	*Piperia elegans*	Piperia	n	x			x							
Orchidaceae	*Piperia unalascensis*	Rein orchid	n			x	x							
Poaceae	*Aegilops triuncialis*	Barbed goatgrass	i									x		x
Poaceae	*Agrostis avenaceae*	Bent grass	i	x								x		x
Poaceae	*Agrostis sp.*	Redtop	i	x								x		x
Poaceae	*Aira caryophyllea*	Silver hairgrass	i	x								x		x
Poaceae	*Andropogon virginicus*	Broomsedge	i	x						x		x		x
Poaceae	*Arundo donax*	Giant reed-grass	i					x	x			x		
Poaceae	*Avena barbata*	Slender wild oat	i	x	x	x	x					x		x
Poaceae	*Avenaa fatua*	Wild oats	i	x	x	x	x					x		x
Poaceae	*Brachypodium distachyon*	Brachypodium	i	x		x	x					x		x
Poaceae	*Briza minor*	Quaking grass	i	x		x	x			x		x		x

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Poaceae	*Bromus carinatus*	California brome grass	n		x	x	x							
Poaceae	*Bromus diandrus*	Ripgut brome	i	x	x	x	x	x		x		x		x
Poaceae	*Bromus hordeaceus*	Soft chess	i	x	x	x	x					x		x
Poaceae	*Bromus laevipes*	Perennial brome grass	i		x	x	x							
Poaceae	*Bromus madritensis*	Foxtail chess	i		x		x							x
Poaceae	*Bromus madritensis* ssp. *madritensis*	Spanish brome grass	i		x		x					x		x
Poaceae	*Bromus madritensis* ssp. *rubens*	Red brome grass	i		x		x					x		x
Poaceae	*Bromus sterilis*	Sterile brome grass	i		x		x					x		x
Poaceae	*Cortaderia selloana*	Pampas grass	i					x	x	x		x		x
Poaceae	*Cynodon dactylon*	Bermuda grass	i							x		x		x
Poaceae	*Crypsis vaginiflora*	Prickle grass	i									x		x
Poaceae	*Cynosurus echinatus*	Hedgehog dogtail grass	n	x	x	x	x					x		x
Poaceae	*Deschampsia danthonioides*	Annual hairgrass	n							x	x			
Poaceae	*Echinochloa colona*	Jungle rice	i	x						x		x		x
Poaceae	*Echinochloa crus-galli*	Barnyard grass	i	x						x		x		x
Poaceae	*Elymus glaucus*	Blue wild rye	n			x	x	x		x		x		
Poaceae	*Eragrostis* sp.	Lovegrass	i									x		x
Poaceae	*Festuca subulata*	Bearded fescue	n			x	x	x		x				
Poaceae	*Gastridium ventricosum*	Nit grass	i	x	x							x		x
Poaceae	*Holcus lanatus*	Velvet grass	i	x								x		x
Poaceae	*Hordeum intercedens*	Little barley	n							x	x			
Poaceae	*Hordeum jubatum*	Foxtail barley	i/n	x	x	x	x	x				x		x

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Poaceae	*Hordeum marinum* ssp. *gussoneanum*	Mediterranean barley	i	x		x	x	x	x	x	x	x		x
Poaceae	*Hordeum marinum* ssp. *leporinum*	Wild barley	i	x		x	x	x	x	x	x	x		x
Poaceae	*Hordeum murinum*	Barley	i	x	x	x	x					x		x
Poaceae	*Leersia oryzoides*	Rice cutgrass	n					x	x					
Poaceae	*Lolium multiflorum*	Italian ryegrass	i	x	x	x	x	x		x	x	x		x
Poaceae	*Lolium perenne*	Perennial rye grass	i	x	x	x	x	x		x	x	x		x
Poaceae	*Melica californica*	California melic grass	n			x	x							
Poaceae	*Melica torreyana*	Torrey melic grass	n		x	x	x							
Poaceae	*Muhlenbergia rigens*	Deergrass	n			x	x	x						
Poaceae	*Nassella cernua*	Needlegrass	n		x	x	x							
Poaceae	*Nassella lepida*	Foothill needlegrass	n		x	x	x							
Poaceae	*Nassella pulchra*	Purple needlegrass	n	x	x	x	x							
Poaceae	*Nassella pulchra* x N. *formicarum*	Intergrade needlegrass	i	x										
Poaceae	*Orcuttia tenuis*	Orcutt grass	n							x	x			
Poaceae	*Orcuttia viscida*	Sacramento orcutt grass	n							x	x			
Poaceae	*Panicum acuminatum* var. *lindheimeri*	Lindheimer's panicum	n						x	x	x	x		
Poaceae	*Panicum capillare*	Old witch grass	n							x		x		x
Poaceae	*Paspalum dilatum*	Dallis grass	i							x		x		x
Poaceae	*Paspalum urvillei*	Vasey grass	i							x		x		x
Poaceae	*Poa annua*	Annual bluegrass	i											x
Poaceae	*Polypogon australis*	Beard grass	i					x						

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Poaceae	*Polypogon interruptus*	Interrupted beard grass	i					x						
Poaceae	*Polypogon maritimus*	Beard grass	i					x	x	x		x		x
Poaceae	*Polypogon monspeliensis*	Rabbit's-foot grass	i						x	x	x	x		x
Poaceae	*Setaria gracilis*	Bristlegrass	n	x	x		x							
Poaceae	*Sorghum halepense*	Johnson grass	i	x								x		x
Poaceae	*Taeniatherum caput-medusae*	Medusahead	i	x	x	x	x					x		x
Poaceae	*Vulpia myuros* ssp. *myuros*	Rat-tail fescue	i	x								x		x
Pontederiaceae	*Eichhornia crassipes*	Water hyacinth	i										x	
Potamogetonaceae	*Potamogeton* spp.	Pondweed	n/i										x	
Typhaceae	*Typha angustifolia*	Narrow-leaved cattail	n						x					
Typhaceae	*Typha domingensis*	Southern cattail	n						x					
Typhaceae	*Typha latifolia*	Broad-leaved cattail	n						x					

Notes:

1. Nomenclature as per Jepson (1993)
2. The following sources were used for this table:
- Field observations by LSA botanists, July-October, 2002
- Field observations by Folsom Lake SRA personnel, Sally Walters and Rodi Lee
- Field observation by Sandi Richerson, Bureau of Reclamation

Table PL-3. Special-Status Plant Species Occurring in the General Vicinity of the Folsom SRA

Species	Status/Federal /State/CNPS[1]	Habitat Requirements[2]	Blooming Period	Habitat on Folsom SRA	Nearest Known Occurrence[3]
Atriplex joaquiniana San Joaquin spearscale	-/-/1B	Chenopod scrub, alkali meadow, grassland; in seasonal alkali wetlands or alkali sink scrub.	Apr-Oct	Not present.	No known occurrences in the vicinity.
Balsamorhiza macrolepis var *macrolepis* Big-scale balsamroot	-/-/1B	Grassland, cismontane woodland; sometimes on serpentine.	Mar-Jun	Possible habitat throughout grasslands, woodlands and chaparral the SRA.	Occurs approximately 7 miles from the SRA in the vicinity of Roseville. Historic occurrence at Rattlesnake Bar – now under water.
Calystegia stebbinsii Stebbin's morning glory	FE/SE/1B	Chaparral, cismontane woodland; in open areas on red clay soils of the Pine Hill formation, or on gabbroic or serpentine soils. (Endemic to Pine Hill formation in El Dorado and Nevada counties.)	Apr-Jul	Suitable habitat present in chaparral and woodlands in the Peninsula area.	Just east of Salmon Falls road, approximately 1.7 miles south/southwest of the bridge over the South Fork American River.
Ceanothus roderickii Pine Hill ceanothus	FE/SR/1B	Cismontane woodland, chaparral; on gabbroic soils, often in "historically disturbed" areas. (Endemic to the Pine Hill Area in Eldorado County.)	May-Jun	Suitable habitat present in chaparral and woodlands in the Peninsula area.	Approximately 2.5 miles from the SRA in the vicinity of the landing strip west of Sweetwater Creek.
Chlorogalum grandiflorum Red Hills soaproot	-/-/1B	Cismontane woodland, chaparral, lower montane coniferous forest; on serpentine and gabbro substrates; often on "historically disturbed" sites.	May-Jun	Suitable habitat in chaparral and woodlands in the Peninsula area.	Within 1 mile of the SRA in the vicinity of Salmon Falls Road, south of the bridge crossing of the South Fork American River.
Clarkia biloba ssp. *brandegeae* Brandegee's clarkia	-/-/1B	Chaparral, cismontane woodland; often on roadcuts.	May-Jul	Suitable habitat in chaparral and woodlands in the Peninsula area. Possible habitat in woodlands elsewhere in the SRA.	Within or immediately outside SRA boundary in the vicinity of the Salmon Falls Road crossing of Sweetwater Creek.

Table PL-3. Special-Status Plant Species Occurring in the General Vicinity of the Folsom SRA

Species	Status/Federal /State/CNPS[1]	Habitat Requirements[2]	Blooming Period	Habitat on Folsom SRA	Nearest Known Occurrence[3]
Cordylanthus mollis ssp. *hispidus* Hispid bird's-beak	-/-/1B	Meadows, playas, grassland; in damp alkaline soils, especially in alkali meadows and sinks.	Jun-Sep	Not present.	Approximately 5 miles from the SRA in the Roseville vicinity.
Downingia pusilla Dwarf downingia	-/-/2	Mesic grassland, vernal pools; on margins of different types of vernal pools and vernal lakes.	Mar-May	Relatively undisturbed vernal pool habitats such as those at the Nimbus Overlook Vernal Pool Preserve and the Mormon Island Preserve.	Approximately 8 miles from the SRA within several vernal pool systems in the Roseville vicinity.
Eryngium pinnatisectum Tuolumne button-celery	-/-/1B	Cismontane woodland, lower montane coniferous forest, vernal pools; on mesic sites.	Jun-Aug	Possible habitat in woodlands, vernal pool sites, seasonal wetlands.	More than 15 miles to the southeast of Folsom Lake SRA.
Fremontodendron decumbens Pine Hill flannelbush	FE/SR/1B	Chaparral, cismontane woodland; on rocky ridges, often among rocks and boulders. Endemic to gabbroic and serpentine soils. (Endemic to Eldorado and Nevada Counties.)	Apr-Jul	Suitable habitat in chaparral and woodlands in the Peninsula area. Possible habitat in woodlands elsewhere in the SRA.	Approximately 2 miles from the SRA in the vicinity of Deer Valley Road, west of Pine Hill.
Fritillaria eastwoodiae Butte County fritillary	-/-/3	Chaparral, cismontane woodland, lower montane coniferous forest; usually on dry slopes in serpentine, red clay, or sandy loam soils; sometimes on mesic sites.	Mar-May	Suitable habitat in chaparral and woodlands in the Peninsula area. Possible habitat in woodlands elsewhere in the SRA.	Approximately 3 miles from the SRA in the vicinity of the confluence of the Middle and North Forks of the American River.
Galium californicum ssp. *sierrae* El Dorado bedstraw	FE/SR/1B	Cismontane woodland, chaparral, lower montane coniferous forest; on gabbroic soils in mostly oak woodland. (Endemic to El Dorado County.)	May-Jun	Suitable habitat present in chaparral and woodlands in the Peninsula area.	Within or immediately outside SRA boundary in the vicinity of the Salmon Falls Road crossing of Sweetwater Creek.

Table PL-3. Special-Status Plant Species Occurring in the General Vicinity of the Folsom SRA

Species	Status/Federal /State/CNPS[1]	Habitat Requirements[2]	Blooming Period	Habitat on Folsom SRA	Nearest Known Occurrence[3]
Gratiola heterosepala Boggs Lake hedge-hyssop	-/SE/1B	Freshwater marshes and swamps, vernal pools; in clay soils, usually in vernal pools, sometimes on lake margins.	Apr-Aug	Relatively undisturbed vernal pool habitats such as those at the Nimbus Overlook Vernal Pool Preserve and the Mormon Island Preserve. Possibly along the margins of perennial creeks such as New York Creek and Willow Creek.	Approximately 3.5 miles from the SRA in vernal pools east of Roseville.
Helianthemum suffrutescens Bisbee Peak rush rose	-/-/3	Chaparral; in openings, often on serpentine, gabbroic, or Ione formation soils.	Apr-Jun	Suitable habitat present in chaparral and woodlands in the Peninsula area.	Near boundary of Folsom Lake SRA – approximately 0.7 miles south of bridge over S. Fork American River.
Juncus leiospermus var. *ahartii* Ahart's dwarf rush	-/-/1B	Vernal pools; restricted to edges of pools.	Mar-May	Vernal pool and seasonal wetland habitats such as those at the Nimbus Overlook Vernal Pool Preserve, Mormon Island Preserve and Snowberry Vernal Pool Preserve and Snipes-Pershing Park.	Approximately 6 miles from the SRA in the vicinity of Blodgett Reservoir, southeast of Ranch Cordova.
Juncus leiospermus var. *leiospermus* Red Bluff dwarf rush	-/-/1B	Chaparral, grassland, cismontane woodland, vernal pools; in vernally mesic sites or at edges of vernal pools.	Mar-May	Possible habitat present along vernal pool margins and in other moist locations in natural habitats throughout the SRA.	Approximately 6 miles from the SRA along the margins of vernal pools in the Roseville vicinity.
Lathyrus sulphureus var. *argillaceus* Dubious pea	-/-/3	Cismontane woodland, lower and upper montane coniferous forest.	Apr	Possible habitat in woodlands.	No known occurrences in the vicinity.

Table PL-3. Special-Status Plant Species Occurring in the General Vicinity of the Folsom SRA

Species	Status/Federal /State/CNPS[1]	Habitat Requirements[2]	Blooming Period	Habitat on Folsom SRA	Nearest Known Occurrence[3]
Legenere limosa Legenere	-/-/1B	Vernal pools; in beds of pools. (Many historical occurrences extirpated.)	Apr-Jun	Relatively undisturbed vernal pool habitats such as those at the Nimbus Overlook Vernal Pool Preserve and the Mormon Island Preserve.	Approximately 5 miles from the SRA in the vicinity of Mather AFB.
Navarretia myersii ssp. *myersii* Pincushion navarretia	-/-/1B	Vernal pools, mesic grassland; on clay soils within non-native grassland.	May	Vernal pool and seasonal wetland habitats such as those at the Nimbus Overlook Vernal Pool Preserve, Mormon Island Preserve and Snowberry Vernal Pool Preserve and Snipes-Pershing Park	Phoenix Vernal Pool Preserve, west of Mississippi Bar area of the SRA.

Table PL-3. Special-Status Plant Species Occurring in the General Vicinity of the Folsom SRA

Species	Status/Federal /State/CNPS[1]	Habitat Requirements[2]	Blooming Period	Habitat on Folsom SRA	Nearest Known Occurrence[3]
Orcuttia tenuis Slender Orcutt grass	FT/SE/1B	Vernal pools.	May-Oct	Relatively undisturbed vernal pool habitats such as those at the Nimbus Overlook Vernal Pool Preserve and the Mormon Island Preserve.	Approximately 6 miles from the SRA in the vicinity of Mather AFB.
Orcuttia viscida Sacramento Orcutt grass	FE/SE/1B	Vernal pools. (Endemic to Sacramento County.)	Apr-Jul	Relatively undisturbed vernal pool habitats such as those at the Nimbus Overlook Vernal Pool Preserve and the Mormon Island Preserve.	Phoenix Vernal Pool Preserve, west of Mississippi Bar area of the SRA.
Sagittaria sanfordii Sanford's arrowhead	-/-/1B	Marshes and swamps; in standing or slow-moving, fresh-water ponds and ditches.	May-Oct	Ponds, freshwater marshes and perennial streams throughout Folsom Lake SRA.	Approximately 3.5 miles from the SRA in the Citrus Heights vicinity.
Senecio layneae Layne's ragwort	FT/SR/1B	Chaparral, cismontane woodland; on ultramafic soils; occasionally along streams.	Apr-Jul	Possible suitable habitat in chaparral and woodlands in the Peninsula area. Possible habitat in woodlands elsewhere in the SRA.	Near boundary of Folsom Lake SRA – approximately 0.75 miles south of bridge over S. Fork American River.
Wyethia reticulata El Dorado County mule ears	-/-/1B	Chaparral, cismontane woodland, lower montane coniferous forest; in openings on stony red clay and gabbroic soils. (Endemic to El Dorado County.)	May-Jul	Suitable habitat in chaparral and woodlands in the Peninsula area. Possible habitat in woodlands elsewhere in the SRA.	One known occurrence in the SRA above the South Fork American River, west of Salmon Falls, opposite Indian Springs Creek.

Footnotes:

[1] Status:
FE - Federally-listed as endangered.
FT - Federally-listed as threatened.
SE - State-listed as endangered.
SR - State-listed as rare.
1B - CNPS (California Native Plant Society): Plants rare, threatened or endangered in California and elsewhere.
2 - CNPS: Plants rare, threatened, or endangered in California but more common elsewhere.
3 - CNPS: Plants about which we need more information – a review list.
4 - CNPS: Plants of limited distribution – a watch list.

[2] Sources: CNPS (2001); CNDDB (2002); Hickman (1993)

[3] Source: CNDDB (2002)



Figure PL-1. Example of typical chamise chaparral with associated foothill pines in the vicinity of the Salmon Falls vicinity.

UNIT BOUNDARY

Vegetation Communities

- BLUE OAK WOODLAND & SAVANNA
- CHAMISE CHAPARRAL
- RUDERAL/BARREN/ LAKE FLUCTUATION ZONES
- GRASSLAND
- INTERIOR LIVE OAK WOODLAND
- LAKE
- MARSH
- ORCHARD
- POND
- RIPARIAN

N

0 0.3 0.6 1.2 1.8 2.4 Miles

FOLSOM LAKE STATE RECREATION AREA RESOURCE INVENTORY

FIGURE PL-2

Chamise Chaparral

Prepared by LSA Associates
Source: LSA Associates, USGS, CDPR



Figure PL-3: An example of interior live oak woodland near the Mississippi Bar area.

UNIT BOUNDARY

Vegetation Communities

- BLUE OAK WOODLAND & SAVANNA
- CHAMISE CHAPARRAL
- RUDERAL/BARREN/ LAKE FLUCTUATION ZONES
- GRASSLAND
- INTERIOR LIVE OAK WOODLAND
- LAKE
- MARSH
- ORCHARD
- POND
- RIPARIAN

FOLSOM LAKE STATE RECREATION AREA RESOURCE INVENTORY

FIGURE PL-4a

Interior Live Oak Woodland

N

0 0.3 0.6 1.2 1.8 2.4 Miles

Prepared by LSA Associates
Source: LSA Associates, USGS, CDPR

UNIT BOUNDARY

Vegetation Communities

- BLUE OAK WOODLAND & SAVANNA
- CHAMISE CHAPARRAL
- RUDERAL/BARREN/ LAKE FLUCTUATION ZONES
- GRASSLAND
- INTERIOR LIVE OAK WOODLAND
- LAKE
- MARSH
- ORCHARD
- POND
- RIPARIAN

FOLSOM LAKE STATE RECREATION AREA RESOURCE INVENTORY

FIGURE PL-4b

Interior Live Oak Woodland

N

0 0.150.3 0.6 0.9 1.2 Miles

Prepared by LSA Associates
Source: LSA Associates, USGS, CDPR



Figure PL-5: Example of Blue Oak Savanna in Peninsula Area.



Figure PL-6: Example of Blue Oak Woodland in Peninsula Area.

UNIT BOUNDARY

Vegetation Communities

- BLUE OAK WOODLAND & SAVANNA
- CHAMISE CHAPARRAL
- RUDERAL/BARREN/ LAKE FLUCTUATION ZONES
- GRASSLAND
- INTERIOR LIVE OAK WOODLAND
- LAKE
- MARSH
- ORCHARD
- POND
- RIPARIAN

N

0 0.3 0.6 1.2 1.8 2.4 Miles

FOLSOM LAKE STATE RECREATION AREA RESOURCE INVENTORY

FIGURE PL-7a

Blue Oak Woodland and Savanna

Prepared by LSA Associates
Source: LSA Associates, USGS, CDPR

UNIT BOUNDARY

Vegetation Communities

- BLUE OAK WOODLAND & SAVANNA
- CHAMISE CHAPARRAL
- RUDERAL/BARREN/ LAKE FLUCTUATION ZONES
- GRASSLAND
- INTERIOR LIVE OAK WOODLAND
- LAKE
- MARSH
- ORCHARD
- POND
- RIPARIAN

N

0 0.150.3 0.6 0.9 1.2 Miles

FOLSOM LAKE STATE RECREATION AREA RESOURCE INVENTORY

FIGURE PL-7b

Blue Oak Woodland and Savanna

Prepared by LSA Associates
Source: LSA Associates, USGS, CDPR



Figure PL-8: Typical annual grassland at the Mormon Island Wetland Preserve.



Figure PL-9: Annual grassland with high level of yellow star-thistle invasion near Granite Bay.

UNIT BOUNDARY

Vegetation Communities

- BLUE OAK WOODLAND & SAVANNA
- CHAMISE CHAPARRAL
- RUDERAL/BARREN/ LAKE FLUCTUATION ZONES
- GRASSLAND
- INTERIOR LIVE OAK WOODLAND
- LAKE
- MARSH
- ORCHARD
- POND
- RIPARIAN
- △ STANDS OF NATIVE GRASS

N

0 0.3 0.6 1.2 1.8 2.4 Miles

FOLSOM LAKE STATE RECREATION AREA RESOURCE INVENTORY

FIGURE PL-10a

Grassland

Prepared by LSA Associates
Source: LSA Associates, USGS, CDPR

UNIT BOUNDARY

Vegetation Communities

- BLUE OAK WOODLAND & SAVANNA
- CHAMISE CHAPARRAL
- RUDERAL/BARREN/ LAKE FLUCTUATION ZONES
- GRASSLAND
- INTERIOR LIVE OAK WOODLAND
- LAKE
- MARSH
- ORCHARD
- POND
- RIPARIAN
- △ STANDS OF NATIVE GRASS

N

0 0.150.3 0.6 0.9 1.2 Miles

FOLSOM LAKE STATE RECREATION AREA RESOURCE INVENTORY

FIGURE PL-10b

Grassland

Prepared by LSA Associates
Source: LSA Associates, USGS, CDPR



Figure PL-11: A cottonwood/willow riparian community along Sweetwater Creek.

UNIT BOUNDARY

Vegetation Communities

- BLUE OAK WOODLAND & SAVANNA
- CHAMISE CHAPARRAL
- RUDERAL/BARREN/ LAKE FLUCTUATION ZONES
- GRASSLAND
- INTERIOR LIVE OAK WOODLAND
- LAKE
- MARSH
- ORCHARD
- POND
- RIPARIAN
- CREEKS & STREAMS

N

0 0.3 0.6 1.2 1.8 2.4 Miles

FOLSOM LAKE STATE RECREATION AREA RESOURCE INVENTORY

FIGURE PL-12a

Riparian Woodland, Creeks and Streams

Prepared by LSA Associates
Source: LSA Associates, USGS, CDPR

UNIT BOUNDARY

Vegetation Communities

- BLUE OAK WOODLAND & SAVANNA
- CHAMISE CHAPARRAL
- RUDERAL/BARREN/ LAKE FLUCTUATION ZONES
- GRASSLAND
- INTERIOR LIVE OAK WOODLAND
- LAKE
- MARSH
- ORCHARD
- POND
- RIPARIAN
- CREEKS & STREAMS

N

0 0.150.3 0.6 0.9 1.2 Miles

FOLSOM LAKE STATE RECREATION AREA RESOURCE INVENTORY

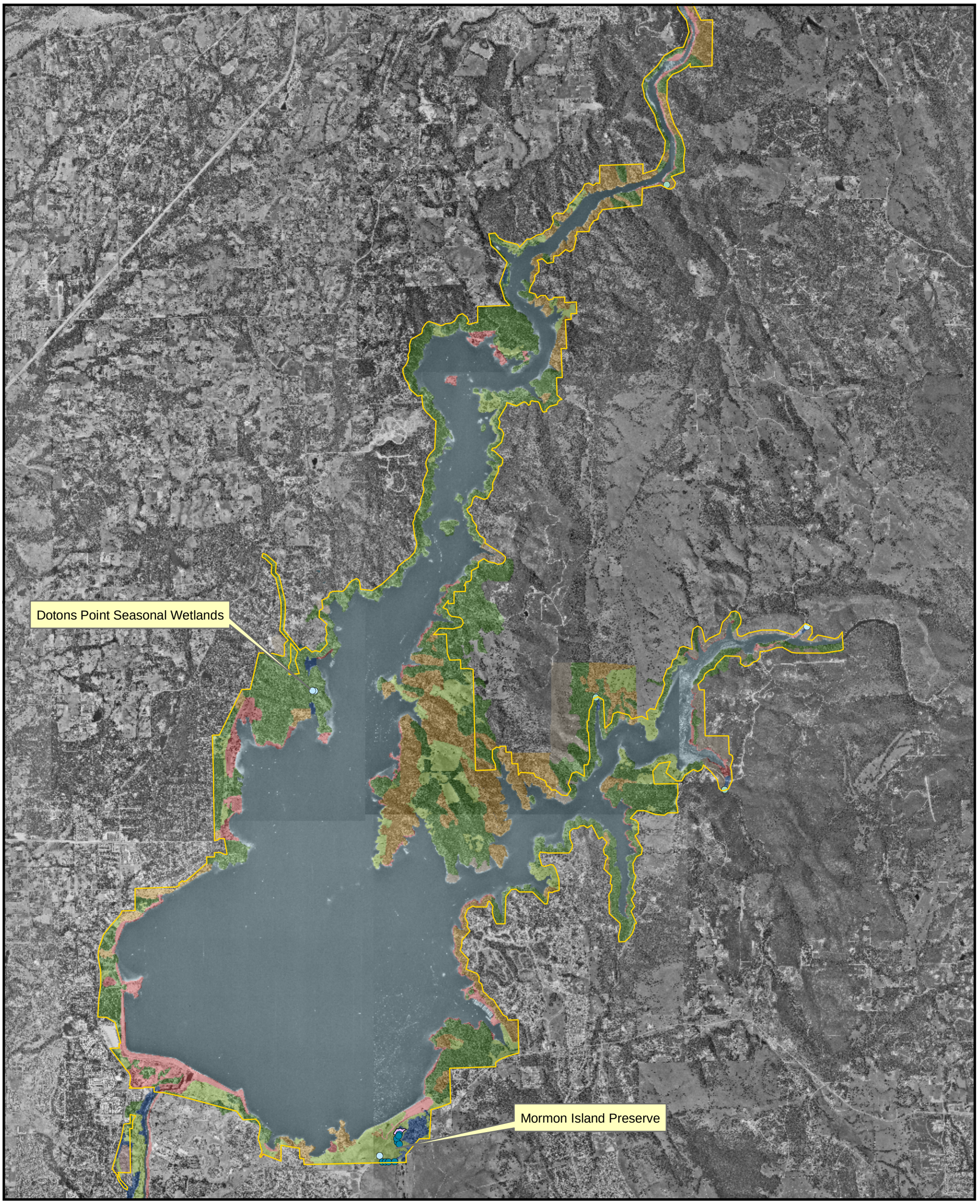
FIGURE PL-12b

Riparian Woodland, Creeks and Streams

Prepared by LSA Associates
Source: LSA Associates, USGS, CDPR



Figure PL-13: A freshwater marsh area adjacent to cottonwood/willow riparian in the Mormon Island Wetland Preserve.



UNIT BOUNDARY

Vegetation Communities

- BLUE OAK WOODLAND & SAVANNA
- CHAMISE CHAPARRAL
- RUDERAL/BARREN/ LAKE FLUCTUATION ZONES
- GRASSLAND
- INTERIOR LIVE OAK WOODLAND
- LAKE
- MARSH
- ORCHARD
- POND
- RIPARIAN
- SEASONAL WETLANDS
- UNDISTURBED RIPARIAN
- VERNAL POOL

N

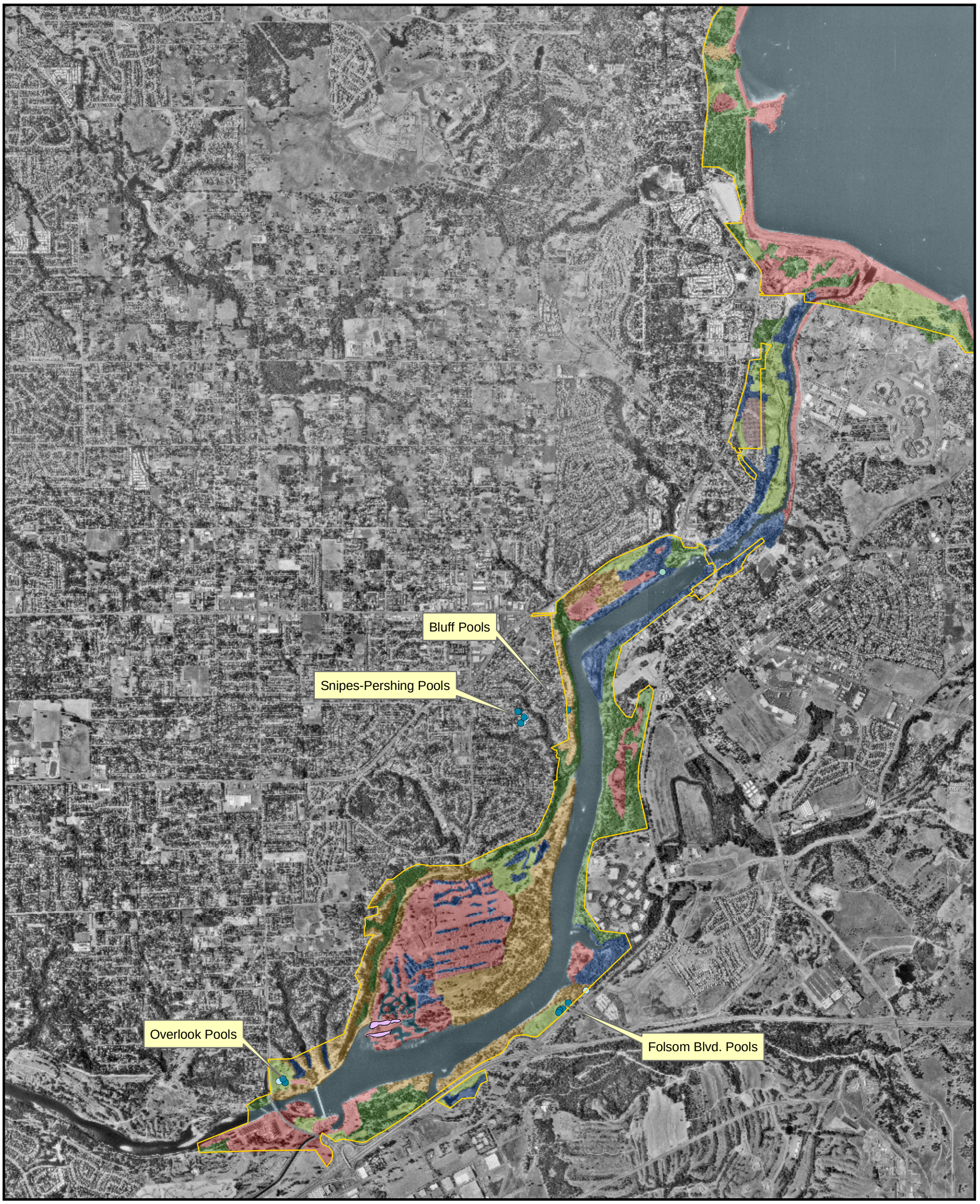
0 0.250.5 1 1.5 2 Miles

FOLSOM LAKE STATE RECREATION AREA RESOURCE INVENTORY

FIGURE PL-14a

Marsh and Wetlands

Prepared by LSA Associates
Source: LSA Associates, USGS, CDPR



UNIT BOUNDARY

Vegetation Communities

- BLUE OAK WOODLAND & SAVANNA
- CHAMISE CHAPARRAL
- RUDERAL/BARREN/ LAKE FLUCTUATION ZONES
- GRASSLAND
- INTERIOR LIVE OAK WOODLAND
- LAKE
- MARSH
- ORCHARD
- POND
- RIPARIAN
- SEASONAL WETLANDS
- UNDISTURBED RIPARIAN
- VERNAL POOL

FOLSOM LAKE STATE RECREATION AREA RESOURCE INVENTORY

FIGURE PL-14b

Marsh and Wetlands

N

0 0.150.3 0.6 0.9 1.2 Miles

Prepared by LSA Associates
Source: LSA Associates, USGS, CDPR



Figure PL-15: A dried seasonal wetland forming in a drainage below the high water line of Folsom Lake near Granite Bay.

UNIT BOUNDARY

Vegetation Communities

- BLUE OAK WOODLAND & SAVANNA
- CHAMISE CHAPARRAL
- RUDERAL/BARREN/ LAKE FLUCTUATION ZONES
- GRASSLAND
- INTERIOR LIVE OAK WOODLAND
- LAKE
- MARSH
- ORCHARD
- POND
- RIPARIAN

N

0 0.3 0.6 1.2 1.8 2.4 Miles

FOLSOM LAKE STATE RECREATION AREA RESOURCE INVENTORY

FIGURE PL-16a

Ruderal/Barren/ Lake Fluctuation Zones

Prepared by LSA Associates
Source: LSA Associates, USGS, CDPR

UNIT BOUNDARY

Vegetation Communities

- BLUE OAK WOODLAND & SAVANNA
- CHAMISE CHAPARRAL
- RUDERAL/BARREN/ LAKE FLUCTUATION ZONES
- GRASSLAND
- INTERIOR LIVE OAK WOODLAND
- LAKE
- MARSH
- ORCHARD
- POND
- RIPARIAN

N

0 0.150.3 0.6 0.9 1.2 Miles

FOLSOM LAKE STATE RECREATION AREA RESOURCE INVENTORY

FIGURE PL-16b

Ruderal/Barren

Prepared by LSA Associates
Source: LSA Associates, USGS, CDPR



Figure PL-17: Typical barren areas along Folsom Lake shoreline zone in the Granite Bay vicinity.



Figure PL-18: Typical area of shoreline zone with seasonal growth of ruderal (weedy) vegetation.

UNIT BOUNDARY

Vegetation Communities

- BLUE OAK WOODLAND & SAVANNA
- CHAMISE CHAPARRAL
- RUDERAL/BARREN/ LAKE FLUCTUATION ZONES
- GRASSLAND
- INTERIOR LIVE OAK WOODLAND
- LAKE
- MARSH
- ORCHARD
- POND
- RIPARIAN
- DENSE AQUATIC VEGETATION

N

0 0.3 0.6 1.2 1.8 2.4 Miles

FOLSOM LAKE STATE RECREATION AREA RESOURCE INVENTORY

FIGURE PL-19a

Lake Area and Aquatic Vegetation

Prepared by LSA Associates
Source: LSA Associates, USGS, CDPR

UNIT BOUNDARY

Vegetation Communities

- BLUE OAK WOODLAND & SAVANNA
- CHAMISE CHAPARRAL
- RUDERAL/BARREN/ LAKE FLUCTUATION ZONES
- GRASSLAND
- INTERIOR LIVE OAK WOODLAND
- LAKE
- MARSH
- ORCHARD
- POND
- RIPARIAN
- DENSE AQUATIC VEGETATION

N

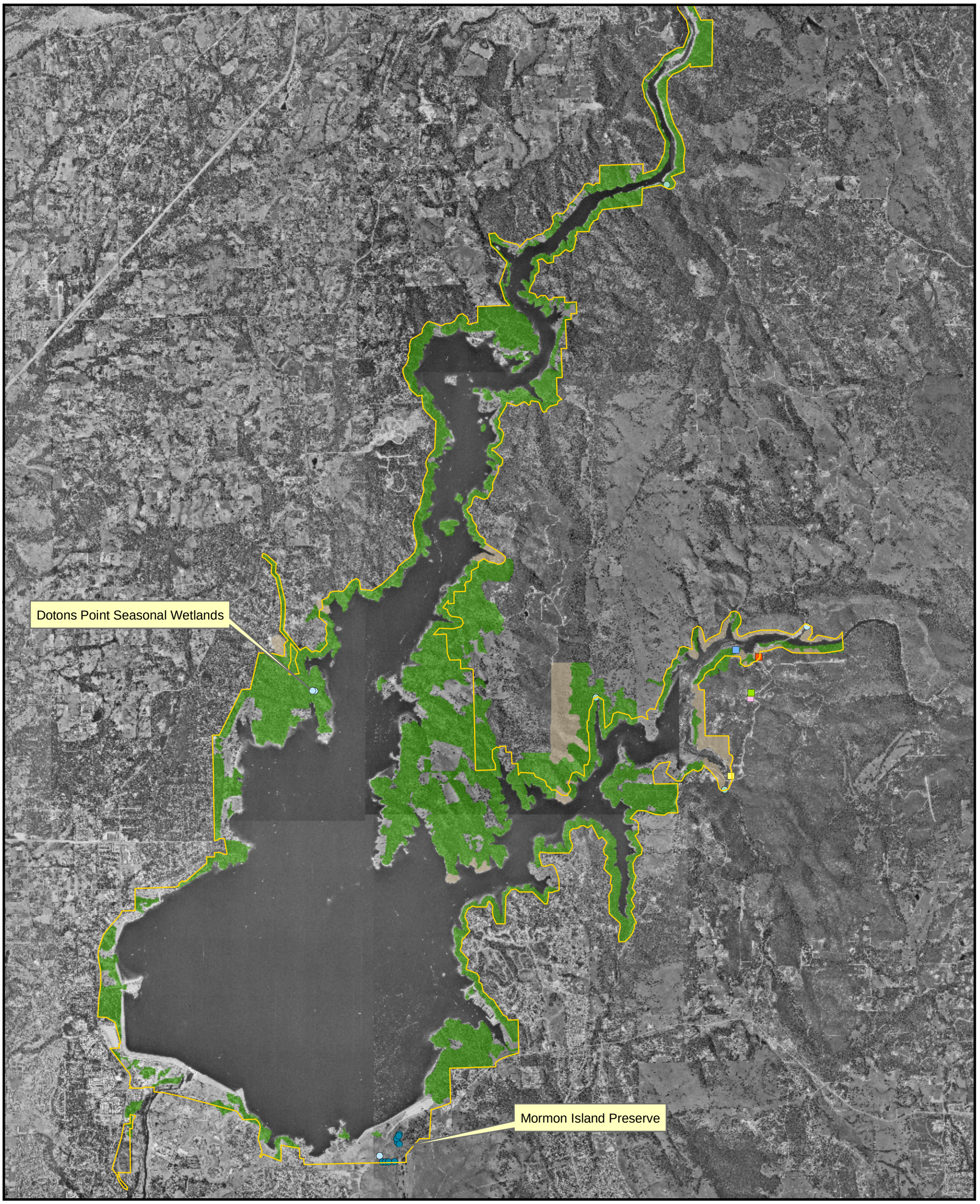
0 0.150.3 0.6 0.9 1.2 Miles

FOLSOM LAKE STATE RECREATION AREA RESOURCE INVENTORY

FIGURE PL-19b

Lake Area and Aquatic Vegetation

Prepared by LSA Associates
Source: LSA Associates, USGS, CDPR



UNIT BOUNDARY

IDENTIFIED OCCURRENCES

- EL DORADO BEDSTRAW & BRANDEGEE'S CLARKIA
- BISBEE PEAK RUSH ROSE
- EL DORADO MULE-EARS
- LAYNE'S BUTTERWEED
- STEBBINS MORNING GLORY

SPECIAL STATUS PLANT HABITAT

- SEASONAL WETLANDS
- UNDISTURBED RIPARIAN
- VERNAL POOL
- STANDS OF NATIVE GRASS
- CHAPARRAL
- OAK WOODLAND

N

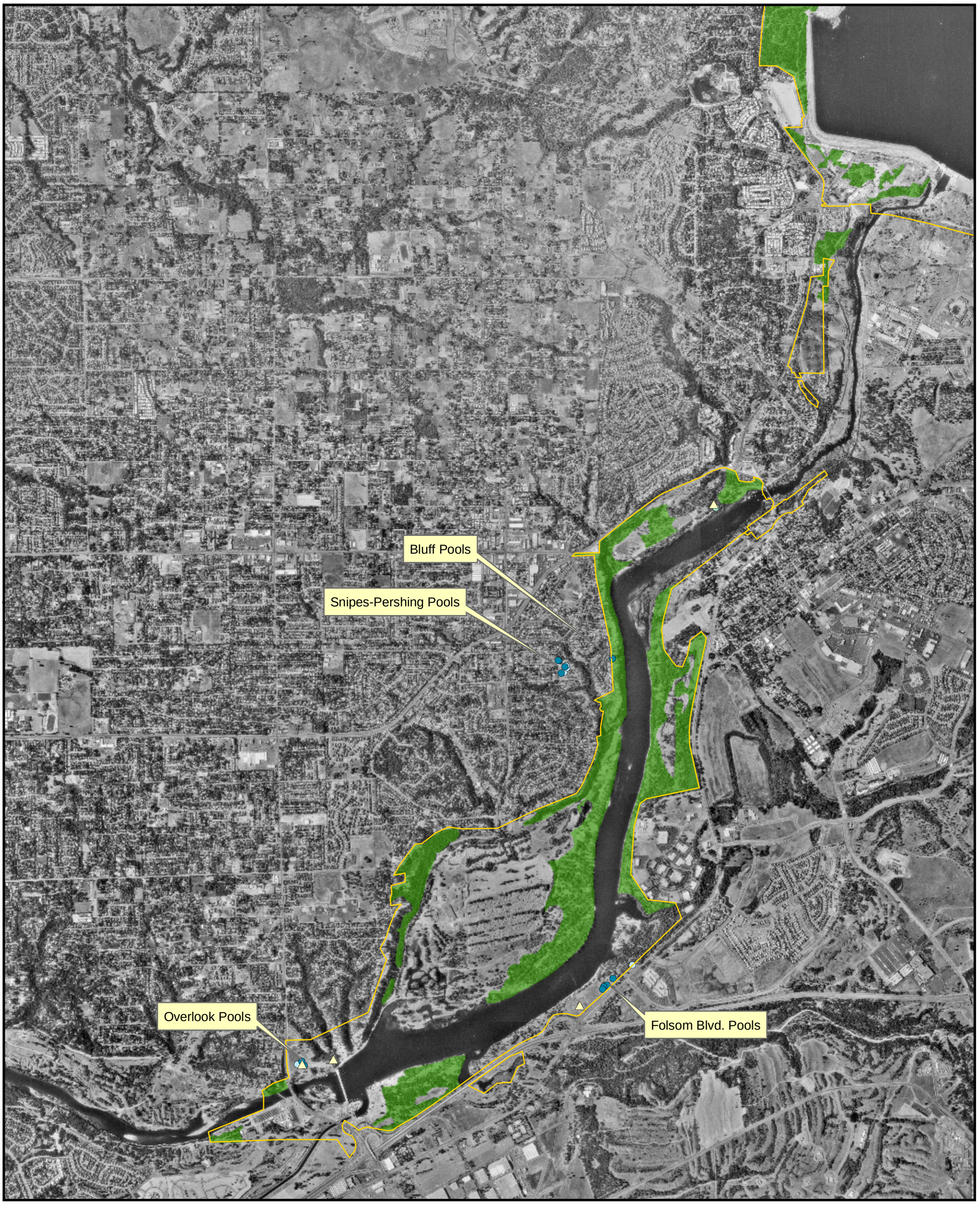
0 0.250.5 1 1.5 2 Miles

FOLSOM LAKE STATE RECREATION AREA RESOURCE INVENTORY

FIGURE PL-20a

Special Status Plant Habitat and Occurrences

Prepared by LSA Associates
Source: LSA Associates, USGS, CDPR



UNIT BOUNDARY

IDENTIFIED OCCURRENCES

- EL DORADO BEDSTRAW & BRANDEGEE'S CLARKIA
- BISBEE PEAK RUSH ROSE
- EL DORADO MULE-EARS
- LAYNE'S BUTTERWEED
- STEBBINS MORNING GLORY

SPECIAL STATUS PLANT HABITAT

- SEASONAL WETLANDS
- UNDISTURBED RIPARIAN
- VERNAL POOL
- STANDS OF NATIVE GRASS
- CHAPARRAL
- OAK WOODLAND

FOLSOM LAKE STATE RECREATION AREA RESOURCE INVENTORY

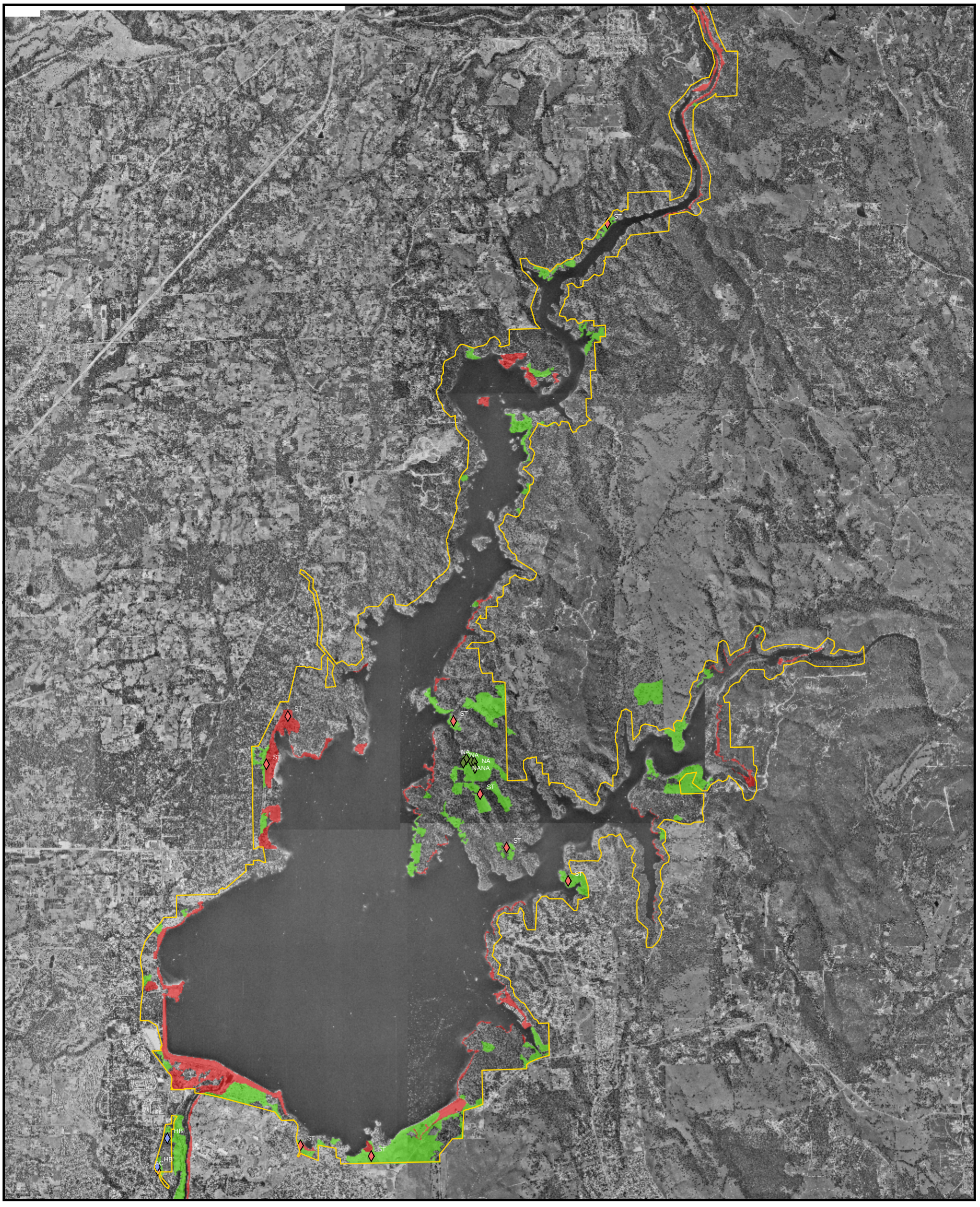
FIGURE PL-20b

Special Status Plant Habitat and Occurrences

N

0 0.15 0.3 0.6 0.9 1.2 Miles

Prepared by LSA Associates
Source: LSA Associates, USGS, CDPR



UNIT BOUNDARY

IDENTIFIED OCCURRENCES

- ACCACIA (AC)
- AILANTHUS (AI)
- BROOM (BR)
- COTONEASTER/OLIVE (CO)
- EXOTIC AQUATIC WEED (AW)
- FIG (FI)
- HIMALAYA BERRY (HB)
- LOCUST (LO)
- NASSELLA (NA)
- PAMPAS GRASS (PG)
- PYRACANTHA (PY)
- DENSE STANDS OF STAR THISTLE (ST)

POTENTIAL EXOTIC VEGETATION HABITAT

- RUDERAL/BARREN/ LAKE FLUCTUATION ZONES
- GRASSLAND

N

0 0.25 0.5 1 1.5 2 Miles

FOLSOM LAKE STATE RECREATION AREA RESOURCE INVENTORY

FIGURE PL-21a

Exotic Vegetation

Prepared by LSA Associates
Source: LSA Associates, USGS, CDPR

UNIT BOUNDARY

IDENTIFIED OCCURRENCES

- ACCACIA (AC)
- AILANTHUS (AI)
- BROOM (BR)
- COTONEASTER/OLIVE (CO)
- EXOTIC AQUATIC WEED (AW)
- FIG (FI)
- HIMALAYA BERRY (HB)
- LOCUST (LO)
- NASSELLA (NA)
- PAMPAS GRASS (PG)
- PYRACANTHA (PY)
- DENSE STANDS OF STAR THISTLE (ST)

POTENTIAL EXOTIC VEGETATION HABITAT

- RUDERAL/BARREN
- GRASSLAND

N

0 0.15 0.3 0.6 0.9 1.2 Miles

FOLSOM LAKE STATE RECREATION AREA RESOURCE INVENTORY

FIGURE PL-21b

Exotic Vegetation

Prepared by LSA Associates
Source: LSA Associates, USGS, CDPR

NATURAL RESOURCES

ANIMAL LIFE

Folsom Lake State Recreation Area

April 2003

by

LSA Associates

157 Park Place

Pt. Richmond, CA 94801

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ANIMAL LIFE

Introduction

This section describes and maps wildlife resources within Folsom Lake State Recreation Area (the Unit). Preparation of this section entailed three major tasks by the LSA study team: (1) initial information gathering, (2) field assessments, and (3) data analysis and recommendations. For the first task, LSA reviewed existing reports for the Unit area such as earlier resource management plans, resource inventories, and impact assessment studies associated with proposed reservoir improvements (California Department of Parks and Recreation - CDPR , 1978a,b; 1979; Quinn et al, 1991; Rhodes and Bowcutt, 1994; Surface Water Resources, 2001). Many of these documents also provided information on the special status wildlife species and their habitats in and around the Unit.

LSA also obtained special status species information from the U.S. Fish and Wildlife Service (USFWS 2002), from the California Department of Fish and Game (CDFG) website (CDFG 2003), and from the California Natural Diversity Data Base (CDFG - CNDDB 2002). Individuals having knowledge and expertise on wildlife in the Folsom Lake area were contacted and their information was used to augment LSA staff experience in the area. Individuals contacted were: Dennis Lee, CDFG Fisheries Biologist; Kyle Murphy, CDFG; Terry West, CDFG Nimbus Hatchery manager; Mike Healy, CDFG District Fisheries Biologist; Brian Deason, U.S. Bureau of Reclamation (BOR); Jim Micheaels, Sally Walters and Rodi Lee, Gold Fields District, California Department of Parks and Recreation (CDPR).

LSA used various literature sources to help assess the potential for various animal species to occur in the Unit's habitats, including Grinnell and Miller (1944), Ingles (1965), Moyle (1976), Burt and Grossenheider (1976), Cogswell (1977), Powell and Hogue (1979), Verner and Boss (1980), Williams (1986), Jameson and Peeters (1988), Thorp and Leong (1996), Stebbins (1954), Mayer and Laudenslayer (1988), Zeiner *et al.* (1988), Zeiner *et al.* (1990a; 1990b).

The description of Unit fisheries was developed from interviews with local fisheries experts with the CDFG and the BOR, and from a review of environmental documents involving Folsom Lake and/or the Lower American River below Nimbus Dam. Mike Healy and Dennis Lee of CDFG were key sources for fisheries information. Environmental documents used for source data included: Army Corps of Engineers – ACOE (2001a, 2001b); Placer County Water Agency - PCWA (2002); and Surface Water Resources, Inc - SWRI (2001).

Field assessments were conducted by the LSA study team during their vegetation and habitat mapping field visits conducted on July 16, 17, 18, 19, August 20, 21, September 9, October 17, 2002, and January 22, 2003. During these assessments observations on habitat conditions and wildlife utilization were made by an LSA wildlife biologist and botanist. All wildlife species and habitats observed during these visits were recorded. Although no formal surveys were conducted, habitat areas suitable for special status wildlife species were examined for evidence of their presence. Observed special status wildlife and their potential habitats were mapped and their locations were recorded using a Global Positioning System (GPS) receiver.

Terrestrial Habitats

Terrestrial habitats are environments located outside of waterbodies such as creeks, rivers, ponds, lakes and oceans. Wildlife species that have adapted to life in terrestrial habitats possess life histories for which water is not a primary component (*i.e.* water is necessary for drinking or only minor portions of their life histories). This is in contrast to animals such as waterfowl and frogs that require water for major components of their life histories, such as feeding or reproduction (Hickman *et al.* 1990).

The Unit supports six major terrestrial vegetation communities that are typical of the lower foothills of California's Central Valley. These vegetation communities are chamise chaparral, interior live oak woodland, blue oak woodland and savanna, annual grassland, and cottonwood/willow riparian. The Plant Life section of this Resource Inventory describes each of these vegetation communities in detail and categorizes them in accordance with the Sawyer and Keeler-Wolf (1995) vegetation classification system, under which each community is classified as one or more vegetation series.

Based on the Sawyer/Keeler-Wolf classification system, the Unit's wildlife habitats consist of the following vegetation series:

- *Grassland and oak savanna habitat* - consisting of California annual grassland series and blue oak/annual grass association (Sawyer and Keeler-Wolf 1995).
- *Chaparral habitat* – consisting of the chamise series (Sawyer and Keeler-Wolf 1995).
- *Oak woodland habitat* - consisting of interior live oak series and blue oak series, except in those locations where the blue oak series can be further classified as blue oak/annual grass association (Sawyer/Keeler-Wolf 1995).
- *Riparian woodland* – consisting of Fremont cottonwood series and mixed willow series (Sawyer/Keeler-Wolf 1995).

Plant series within each habitat type tend to share structural and biological characteristics that allow them to support similar groups of animal species. For example, California annual grassland and blue oak/annual grass association are both dry, open communities with widespread forage availability. Both series possess extensive stands of grasses that provide very similar habitat values. These habitat values are exploited by grassland adapted species.

Table AL-1 provides a matrix listing all observed or potentially occurring wildlife species by habitat type in the Unit. The following sections summarize habitat characteristics and typical wildlife species in each of the four terrestrial habitats at the Unit.

Grassland and Oak Savanna

General Description: Within the Unit, this habitat type is composed of the California annual grassland series and blue oak/annual grass association (see Plant Life section). Both vegetation series are typically composed of a dense cover of annual grasses and broad-leaved plants (forbs) growing up to three feet in height. Grasslands typically have little or no canopy cover. However in some grassland locations blue oak trees (*Quercus douglasii*) can provide a canopy cover of up to 10 percent. Oak savannas typically have between 10 and 30

percent canopy cover by blue oaks (Barbour and Major 1990). The difference in canopy cover between the two series is not significant from a wildlife utilization standpoint (Mayer and Laudenslayer, 1988). Both are open, dry communities with little cover and extensive production of forage during the winter, spring and early summer. The two plant series types often intergrade with one another with no clear boundary between the two.

Although grassland/savanna habitat is found throughout the Unit, the majority of this habitat type occurs in the southern and eastern portions of the Unit, particularly in the Mormon Island Wetland Preserve and around much of eastern side of Lake Natoma. See Figures AL-1a and AL-1b for the locations of grassland and savanna habitat in the Unit.

Wildlife Composition and Habitat Characteristics: Grassland/savanna habitat provides valuable forage for a large number of herbivorous species. Insects are common grassland/savanna herbivores and include grasshoppers (*Melanoplus devastator*), Jerusalem cricket (*Stenopelmatus fuscus*), and caterpillars. Rodent species such as deer mouse (*Peromyscus maniculatus*), California vole (*Microtus californicus*) and California ground squirrel (*Spermophilis beechyii*) are also common herbivores in this habitat. Other species, such as song sparrows (*Melospiza melodia*), dark-eyed junco (*Junco hyemalis*), black-tailed jackrabbit (*Lepus californicus*), desert cottontail (*Sylvilagus auduboni*) and mule deer (*Odocoileus hemionus*), prefer the cover provided by the denser vegetation in adjacent woodland and chaparral habitats, but nevertheless frequently move into grassland and savanna habitats to forage.

While many herbivores are able to locate food year-round, grasslands and savannas provide the bulk of their available forage during the late winter, spring and early fall. The warmth and moisture of this period promotes the growth of the annual grasses in this habitat. As the summer progresses, grasses begin to seed and die, providing a less suitable food source for grazers. The older, dying grasses tend to be less palatable to many grazers (Barbour and Major 1990).

The large number of herbivores foraging in grasslands and savannas provide a substantial prey base for many predatory species. In particular, an extensive insect prey base supports a large number of insectivorous predators that occupy several different niches in grassland habitats. Western kingbird (*Tyrannus verticalis*), western flycatcher (*Empidonax difficilis*), dragonflies (Odonata), and bats (*Myotis* sp.) feed on flying insects from the air. Yellow-billed magpie (*Pica nuttalli*) and loggerhead shrike (*Lanius ludovicianus*) feed on large insects such as butterflys and grasshoppers within the grasses and on the ground. California mantid (*Stagmomantis californica*), western toad (*Bufo boreas*), Gilbert's skink (*Eumeces gilberti*), southern alligator lizard (*Elgaria multicarinata*), and shrews (*Sorex* spp.) capture ground dwelling insects in the grasses and under surface objects.

Larger predators, such as common king snake (*Lampropeltis getula*), red-tailed hawk (*Buteo jamaicensis*), and coyotes (*Canis latrans*) commonly prey on rodents and insectivorous animals in grasslands and savannas. Raptors, including red tailed hawk (*Buteo jamaicensis*), white-tailed kite (*Elanus leucurus*), and golden eagle (*Aquila chrysaetos*) will typically forage in these habitats and will sometimes nest in nearby trees.

Animal species in the grassland/savanna habitat of the Unit survive the hot arid summers by limiting activity to nighttime hours and/or by living underground to avoid daytime heat and desiccation. Grasslands and savannas are often riddled with the tunnels of burrowing

rodents particularly California ground squirrel and pocket gopher (*Thomomys bottae*). When these burrows are abandoned, the tunnels are often used by wildlife species, such as western toad, gopher snake (*Pituophis catenifer*) and California vole. Other species, such as coyote will modify abandoned burrows for their own use.

Associated Special Status Animal Species: Seven special status wildlife species are associated with grassland/oak savanna habitat and are known to occur or have the potential occur in the vicinity of the Unit (CDPR 1978b, Quinn *et al.* 1991, USFWS 2002, CNDDB 2003). These species are the following:

- Valley elderberry longhorn beetle (*Desmocercus californicus dimorphus*) - FT[1] - Elderberry beetles may live in elderberry shrubs growing within grasslands or along the edges of grasslands near stream courses.

- Western spadefoot toad (*Spea hammondii*) - CSC[2] - This toad species will occupy abandoned rodent burrows in grasslands associated with ephemeral pools and drainages.

- California horned lizard (*Phrynosoma coronatum frontale*) - CSC - The horned lizard can be observed in open, sparsely vegetated grassland areas, usually areas with sandy soils.

- Northern harrier (*Circus cyaneus*) nesting - CSC - Harriers hide their nests on the ground in tall grass areas of open habitats.

- Sharp-shinned hawk (*Accipiter striatus*) nesting - CSC - Sharp-shinned hawks occasionally nest in blue oak trees, usually in areas with extensive canopies.

- White-tailed kite - FP[3] - This kite species will nest in trees and tall shrubs located in and adjacent to open habitats.

- Short-eared owl (*Asio flammeus*) nesting - CSC - Like harriers, short-eared owls hide their nests on the ground in tall grass areas of open habitats.

- Burrowing owl (*Athene cunicularia*) - CSC - This owl will nest in abandoned ground squirrel burrows in open habitats. They will occasionally use pipes, small culverts and rubble or debris piles in these same habitats.

- Loggerhead shrike - nesting - CSC - The loggerhead shrike prefers to nest in trees and tall shrubs located in and adjacent to open habitats.

The Special Status Wildlife section – page AL-30 provides a more detailed discussion of all special status wildlife species that occur or could potentially occur in grassland/woodland habitat. Table AL-2 lists all potentially occurring special status species and their listing status, describes their habitat requirements and provides their nearest known occurrences to the Unit.

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[1] FT = listed as Threatened under the federal Endangered Species Act.
[2] CSC = California Species of Special Concern.
[3] FP = California Fully Protected Species.

Introduced Species: Several non-native species of wildlife are known to use annual grasslands and blue oak savanna. These include the introduced honey bee (*Apis mellifera),* Argentine ants (*Lipepithema humile*), starling (*Sternus vulgaris*), rock dove (*Columba livia*), wild turkey (*Meleagris gallopavo*), and Virginia opossum (*Didelphis virginiana*).

Chaparral

General Description: Within the Unit, this habitat consists of the chamise series (see Plant Life Section). Chamise series is a scrub community, dominated by chamise (*Adenostema fasciculatum*), with little understory or upper canopy. Chaparral habitats are typically associated with rocky soils and are most often observed on the slopes of hills and mountains. Chamise is 3-8 feet tall at maturity and forms dense interwoven thickets that are difficult to traverse. Chaparral habitat occurs mainly along the South Fork of the American River on the east side of Folsom Lake (See Figures AL-1a and AL-1b).

The high density of the scrub vegetation in chaparral habitats prevents the growth of grasses and other herbaceous understory vegetation. As a result, chaparral consists mainly of woody plant species with little palatability for herbivorous animals (Barbour and Major 1990, Mayer and Laudenslayer, 1988). However, the dense stands of chamise and other woody shrubs in this habitat provide cover for species that forage in adjacent habitats where food resources are more readily available (Mayer and Laudenslayer, 1988). Additionally, foothill pines that occur within chaparral provide important roosting and nesting sites for raptors.

Historically, chaparral in the Unit probably provided better habitat for herbivorous species than it does today due to the changed fire regime. In the past, fires were more common in chaparral which contains plant species that are highly adapted to fires, often requiring fire for seed germination (Barbour and Major 1990). Because fire occurred more frequently, the amount of woody plant material was kept in check, leaving sparsely vegetated openings in the dense growth of chaparral habitats. These openings were likely important to chaparral inhabiting animals because they allowed sun penetration and provided new growth that could be used as forage (Barbour and Major 1990, Mayer and Laudenslayer, 1988).

With the suppression of firs during the last century, openings in chaparral habitats have become filled with woody vegetation and the scrub canopy has become dense and impenetrable, preventing palatable new growth and resulting in large amounts of woody material. This material provides fuel, making occasional fires burn hotter than they would have historically. Hotter fires are considered more devastating to the plants and wildlife occurring in these habitats (Barbour and Major 1990).

Wildlife Composition and Characteristics: Much of the fauna occurring in the chaparral habitat consists of species similar to those of grasslands and woodlands. The majority of these animal species rely on its dense vegetation to provide cover, but are more likely to forage in nearby woodlands and grasslands, where palatable plant species and prey are more common and accessible (Mayer and Laudenslayer, 1988). These species include California quail (*Callipepla californica*), white-crowned sparrow (*Zonotrichia leucophrys*), mule deer, striped skunk (*Mephitis mephitis*) and spotted skunk (*Spilogale gracilis*). Several bird species also rely on the dense vegetation in chaparral to hide their nesting sites. Typical nest-hiding species include California quail, spotted towhee (*Pipilo erythrophthalmus*), rufous-crowned sparrows (*Aimophila ruficeps*), Bewick's wren (*Thryomanes bewickii*), wrentit (*Chamaea fasciata*), and Anna's hummingbird (*Calypte anna*). A few animal species, such

as the California thrasher (*Toxostoma redivivum*) and California whipsnake (*Masticophis lateralis*), rely strictly on the food and cover resources available in the chaparral habitat.

Chaparral is a habitat that was historically little utilized by humans until the development pressures of the past several decades. As adjacent grasslands and savannas became increasingly developed, several animal species that were once common in these habitats found refuge in chaparral areas. California horned lizard, greater roadrunner (*Geococcyx californianus*), and spotted skunk (*Spilogale gracilis*) are species that are nowadays generally associated with chaparral, although historical accountings associate them with the grassland and savanna foothills of Central California (Grinnell and Miller 1944; Stebbins 1954). With the significant alteration of California grasslands and savannas, many species from these habitats may now be limited to chaparral habitats.

Associated Special Status Animal Species: Five special status wildlife species are associated with chaparral habitat and are known to occur or have the potential to occur in the vicinity of the Unit (CDPR 1978b, Quinn *et al.* 1991, USFWS 2002, CNDDB 2003). These species are the following:

- California horned lizard - CSC - Horned lizards can be observed in open, sparsely vegetated openings in chaparral and along the edges of these habitats, usually in areas with sandy soils.

- Peregrine falcon (*Falco peregrinus anatum*) nesting - CSC - Falcons nest on cliff ledges. Chaparral vegetation often grows above and/or below steep rocky faces where ledges can be found.

- Prairie falcon (*Falco mexicana*) nesting - CSC - Falcons nest on cliff ledges. Chaparral vegetation often grows above and/or below steep rocky faces where ledges can be found.

- Bell's sage sparrow (*Amphispiza belli belli*) – CSC - This species is a summertime visitor or occasionally rear-round resident in chaparral habitat. It breeds in dense chaparral.

The Special Status Wildlife section – page AL-30 provides a more detailed discussion of all special status wildlife species that occur or could potentially occur in chaparral habitat. Table AL-2 lists all potentially occurring special status species and their listing status, describes their habitat requirements and provides their nearest known occurrences to the Unit.

Non-native Species: Non-native wildlife species likely to use chaparral habitats include most of the species listed for the grasslands/savanna habitat, but are most likely to include wild turkey and Virginia opossum.

Oak Woodland

General Description: Oak woodland habitat includes both blue oak series and interior live oak series (see Plant Life section). It does not include those areas of the blue oak series that can be classified as blue oak/annual grass association (Sawyer and Keeler-Wolf 1995).

The structural diversity and plant species composition of both oak woodland series results in a wide variety of food, cover, shelter and nesting habitats that support many wildlife species (Barbour and Major 1990, Mayer and Laudenslayer, 1988). In both woodland types, tree canopies can vary considerably, ranging from a relatively open canopy structure to a nearly continuous canopy. However, in general, woodland canopy covers at least 30 percent of the area (Sawyer/Keeler-Wolf, 1995). Where the upper canopy is dense, shrubs are often present and form a dense understory that prevents the development of anything more than a sparse ground cover. Where the upper canopy is more open, shrubs are less common and grasses dominate the groundcover. Scattered foothill pines (*Pinus sabiniana*) extend above the oak canopy in both open and closed woodlands. Figures AL-1a and AL-1b show the locations of oak woodland in the Unit.

Wildlife Composition and Characteristics: The trees in oak woodlands, combined with the shrub and herbaceous understory layers, produce a structurally diverse habitat, attractive to a larger suite of resident species than found in other terrestrial habitats in the Unit. The woodland vegetation provides extensive forage for herbivorous species, which, in turn, permits the development of an extensive and complicated food chain (Barbour and Major 1990).

Several wildlife species depend on woodland trees and shrubs for much of their habitat requirements. Some insect species, such as longhorn beetles (Cerambycids) bore into tree trunks to feed on pith and other interior tree parts. Other insect species, like underwing moths (*Catocala* sp.), hide in bark cavities. Several woodland and forest insectivores have specialized behaviors to locate insects in trees. Acorn woodpeckers (*Melanerpes formicivorus*) consume insects on and under the bark of trees, as do Nuttall's woodpecker (*Picoides nuttallii*). Western fence lizards, (*Sceloporus occidentalis*), brown creepers (*Certhia americana*) and white-breasted nuthatch (*Sitta carolinensis*) climb tree trunks searching for insects hidden in the bark.

Foothill pines are an important component of the oak woodland habitat for wildlife. Bald eagles and golden eagles us foothill pines as roosting sites. Herons and egrets use foothill pines as nesting sites in locations where oak woodlands occur in the vicinity of Folsom Lake and Lake Natoma.

Many insects, such as caterpillars and aphids, feed on the leaves, buds, and fluids of trees and shrubs. These herbivorous insects are, in turn, eaten by predacious insects such as lady bugs (*Hippodamia* sp.) and mantids. Birds that glean insects from foliage and branches include Hutton's vireo (*Vireo huttoni*), yellow-rumped warbler (*Dendroica coronata*), black-throated gray warbler (*Dendroica nigrescens*), and oak titmouse (*Baeolophus inornatus*). Western bluebird (*Sialia mexicana*) and American robin (*Turdus migratorius*) also forage for insects in woodland habitats during the nesting season.

The trees in the Unit's woodlands provide numerous nesting locations and perching sites for birds. Ash-throated flycatcher (*Myiarchus cinerascens*) and western scrub-jay (*Aphelocoma californica*) commonly use oak woodlands for perches, food, and nesting. Large trees provide nesting sites for golden eagle and red-tailed hawk, which require the height of tall trees to protect their nests. Holes and other openings in trees provide nest locations for cavity nesters such as western bluebird, American kestrel (*Falco sparverius*) and screech owl (*Otus kennicottii*). Acorn woodpeckers nest within cavities in the dead wood of live or dead trees (Zeiner *et al.* 1990a).

Oak mast (acorns) is an important food source for many wildlife species including acorn woodpecker and band-tailed pigeon (*Columba fasciata*). Acorn woodpeckers use live and dead trees for granaries. Common woodland seed eating birds include California towhee (*Pipilo crissalis*), spotted towhee (*Pipilo maculatus*), and house finch (*Carpodacus mexicanus*). Western gray squirrel (*Sciurus griseus*) and mule deer also consume oak mast in large quantities.

The tree and shrub canopies of oak woodlands slow the rate of evaporation by protecting soil moisture from the effects of the sun (Barbour and Major 1990). This permits wildlife species with higher moisture demands to survive in otherwise xeric conditions. For example, several salamander species that occur in the Unit, such as ensatina (*Ensatina eschscholtzii*), California newt (*Taricha torosa*) and slender salamander (*Batrachoseps attenuatus*), require the cooler, shaded conditions available in woodlands and forests.

The dense vegetation in oak woodlands provides concealment for predators. Large predators such as mountain lion (*Felis concolor*) and bobcat (*Felis rufus*) are able to conceal themselves behind trees or in the shadows of vegetation as they hunt. Raptors such as Cooper's hawk, red-tailed hawk, and western screech owl fly over and forage in woodland habitat, and nest in woodland trees. Great horned owl (*Bubo virginianus*) will make low, rapid flights from tree perches to capture rabbits, rodents and other prey that inhabit the woodland habitat (Zeiner *et al.* 1990a).

Associated Special Status Animal Species: Five special status wildlife species are associated with woodland habitat and are known to occur or have the potential to occur in the vicinity of the Unit (CDPR 1978b, Quinn *et al.* 1991, USFWS 2002, CNDDB 2003). These species are the following:

- Valley elderberry longhorn beetle - FT - This beetle may live in elderberry shrubs growing within oak woodlands or at the edges of woodlands along stream courses.

- Golden eagle - nesting - CSC - Golden eagles will build large stick nest platforms in very tall woodland trees.

- Bald eagle (*Haliaeetus leucocephalus*) – FT/FPD,[4] SE[5] - Bald eagles will perch and occasionally nest in tall woodland trees located near large waterbodies.

- Sharp-shinned hawk - nesting - CSC - Sharp shinned hawks will nest in woodland trees.

- Cooper's hawk (*Accipiter cooperii*) nesting - CSC - Cooper's hawks will nest in trees located in dense woodland vegetation.

- Long-eared owl (*Asio otus*) nesting - CSC – Long-eared owls have been observed in the fall and winter in dense woodlands in the vicinity of Avery's Pond and in the Peninsula.

The Special Status Wildlife section – page AL-30 provides a more detailed discussion of all special status wildlife species that occur or could potentially occur in oak woodland habitat.

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[4] FPD = Proposed for federal de-listing.
[5] SE = Species listed as endangered by the State of California.

Table AL-2 lists all potentially occurring special status species and their listing status, describes their habitat requirements and provides their nearest known occurrences to the Unit.

Non-native Species: A few introduced animal species are observed in woodlands. Non-native animals frequently observed in oak woodlands include the wild turkey and the Virginia opossum.

Riparian Woodlands

General Description: Within the Unit, riparian woodland habitat consists of Fremont cottonwood series and mixed willow series (see Plant Life section). Riparian woodlands occur along river, stream, and creek courses where the presence of water keeps soils moist for longer period than in the adjacent grassland, woodland or savanna habitats. The moist soils and the presence of a higher ground water table support plant and tree species different from those in the adjacent drier habitats. Riparian trees and shrubs are more tolerant of, or require, the longer periods of saturated soil conditions that occur along perennial or intermittent water features, and often have the ability to extend their roots for several feet downward to reach the dry season water table (Warner and Hendrix, 1984).

Within the Unit, the general appearance of riparian vegetation is in many ways similar to dense oak woodlands. Both vegetation types have extensive tree canopies and zones of dense understory growth. However, the plant composition of these two woodlands is different. Willow riparian habitat is dominated by dense patches of willow trees (*Salix* sp.) less than 30 feet (10 meters) in height. It supports a dense understory in locations where the smaller willow trees form dense thickets, and a sparse understory where more mature willow trees are found. In contrast, cottonwood riparian woodland is characterized by cottonwood trees that are up to 90 feet (30 meters) high and more widely spaced, forming an understory that can be dense or open underneath. Figures AL-1a and AL-1b show the location of riparian woodland in the Unit.

Many of the riparian habitat areas in the Unit have been disturbed and fragmented by roads and other infrastructure. This disturbance has facilitated the introduction of invasive exotic plant species, particularly Himalayan berry (*Rubus discolor*) which out-compete native species and form very dense thickets in the understory. These dense thickets may alter the riparian habitat in ways that affect its associated animal species. In particular, these thickets may inhibit or prevent access to water by larger animals (Warner and Hendrix, 1984).

Wildlife Composition and Characteristics: The structural diversity of riparian tree canopy, understory and groundstory and the availability of forage support wildlife assemblages similar to those of woodlands and forests (Mayer and Laudenslayer, 1988). Both habitat types provide similar food, shelter, cover, and nesting opportunities. However, an important difference between the oak woodlands and the riparian woodlands is the composition of insects. The softer cottonwoods and willows support different herbivorous and tree dependent insect species than the drier oak woodlands (Warner and Hendrix, 1984). Insect diversity, the moderately dense understory vegetation and the presence of a relatively mature canopy provide cover, roosting, foraging, and nesting for a variety of resident and migratory avifauna.

Insectivorous migratory birds take advantage of riparian feeding and nesting opportunities in the spring and fall. Species such as western kingbird, common yellowthroat (*Geothypis trichas*), blue-gray gnatcatcher (*Polioptila caerulea*) and tree swallow (*Tachycineta bicolor*) nest in riparian woodlands. The riparian woodland habitat also provides numerous feeding opportunities for birds that glean insects from foliage and branches. Bird species include Hutton's vireo (*Vireo huttoni*), yellow-rumped warbler (*Dendroica coronata*), and black-throated gray warbler (*Dendroica nigrescens*). Many common seed and insect-eating bird species are likely to use the riparian area on a year-round basis, including species such as lark sparrow (*Chondestes grammacus*), song sparrow, California towhee, spotted towhee, and house finch.

Several animal species, such as the red-shouldered hawk (*Buteo lineatus*) and the dusky-footed woodrat (*Neotoma fuscipes*), are adapted to live in the denser canopies and willow thickets of the riparian habitat. Yellow-breasted chat (*Icteria virens*) nests and feeds in dense riparian thickets. Within the Unit, they particularly frequent riparian areas with dense stands of Himalyan blackberry (Rodi Lee *pers. com*.). In locations where riparian woodlands pass through grassland or savanna habitats, the dense vegetation and taller riparian trees provide the only suitable retreat habitat for species such as mule deer and gray fox (*Urocyon cinereoargenteus*).

Raptors will forage over and in riparian woodland habitat. Common raptor species found in riparian woodlands include red-tailed hawk, Cooper's hawk and sharp-shinned hawk. Red-tailed hawk and red-shouldered hawk commonly nest in riparian habitat (Zeiner *et al.* 1990a).

Associated Special Status Animal Species: Nine special status wildlife species are associated with riparian habitat and are known to occur or have the potential to occur in the vicinity of the Unit (CDPR 1978b, Quinn *et al.* 1991, USFWS 2002, CNDDB 2003). These species are the following:

- Valley elderberry longhorn beetle - FT - This beetle may live in elderberry shrubs that are a common component of riparian woodlands.

- California red-legged frog (*Rana aurora draytonii*) - FT, CSC - Red-legged frogs use perennial and intermittent water features. They will also use riparian woodlands areas adjacent to such features for dispersal and movement.

- Western pond turtle (*Clemmys marmorata*) - CSC - Pond turtles reside in perennial and intermittent water features using adjacent riparian woodlands for nesting.

- Golden eagle - nesting - CSC - Golden eagles will build large stick nest platforms in very tall trees in riparian woodlands.

- Bald eagle - FPD, SE - Bald eagles will perch and occasionally nest in tall riparian woodland trees near located near large waterbodies.

- Sharp-shinned hawk - nesting - CSC - Sharp shinned hawks will nest in riparian woodland trees.

- Cooper's hawk - nesting - CSC - Cooper's hawks will nest in trees located in dense riparian woodland vegetation.

- Willow flycatcher (*Empidonax traillii*) nesting – FE, SE - This species migrates through the area in the spring and fall and has been observed in riparian habitats in the Unit (J. Webb *pers. com*.). The State of California lists all subspecies of willow flycatcher as endangered (E. *traillii brewsteri*, E. *traillii extimus*). The Federal listing is only for Southwestern willow flycatcher subspecies (E. *traillii extimus)*.

- Yellow warbler (*Dendroica petechia*) nesting - CSC - Yellow warbler will forage and nest in willow thickets and dense riparian brush.

- Yellow-breasted chat (*Icteria virens*) nesting - CSC - Yellow-breasted chats forage and nest in willow thickets and dense riparian brush, particularly where stands of Himalayan blackberry are found.

The Special Status Wildlife section – page AL-30 provides a more detailed discussion of all special status wildlife species that occur or could potentially occur in riparian woodland habitat. Table AL-2 lists all potentially occurring special status species and their listing status, describes their habitat requirements and provides their nearest known occurrences to the Unit.

Non-native Species: Introduced animal species observed in riparian woodlands are similar to those observed in oak woodlands. These species include bullfrog (*Rana catesbeiana*), wild turkey, and the Virginia opossum.

Lake Shoreline Drawdown Zone and Ruderal/Barren Habitat

General Description: As described in the Plant Life section, ruderal (disturbed, weedy) and barren areas are common in the Unit. Ruderal and barren habitat is most prominent along the Folsom Lake shoreline in the lake drawdown zone situated between ordinary high water elevation (466 feet NGVD) and annual mean low water. Following the recession of lake waters, the shoreline zone is seasonally vegetated with a mix of ruderal and grassland species, and has occasional patches of seasonal wetland and woody riparian vegetation, as well as large areas that remain mostly barren. Figures AL-1a and AL-1b depict the locations of ruderal and barren habitat in the Unit.

Ruderal/barren areas also occur along roadsides and boat-launch aprons, in camping and picnic areas, and other areas where human activity has compacted the soil or otherwise heavily impacted the vegetation. Areas of the Unit that have been converted to turf and lawn are also considered a part of this habitat (*e.g*., irrigated and mowed turf at Beal's Point, Negro Bar and Nimbus Flat).

Ruderal areas associated with park facilities and other terrestrial zones of disturbance are dominated by a mix of annual grassland and weedy plant species that often include extensive stands of invasive exotic plants such as yellow starthistle (*Centaurea solstitialis*), Italian thistle (*Carduus pycnocephalus*) and white sweet clover (*Melilotus albus*).

Wildlife Composition and Characteristics: Animals that use ruderal and barren areas are species associated with open habitats, such as grasslands and oak savannas. Several species of birds, such as rock wren (*Salpinctes obsoletus*) and rufous-crowned sparrow (*Aimophila*

ruficeps) are commonly seen foraging in these areas. Ground squirrels will commonly burrow into exposed soils of ruderal/barren areas. Shorebirds such as western sandpiper (*Calidris mauri*), spotted sandpiper (*Actitis macularia*) and killdeer (*Charadrius vociferus*) will forage in the shallow water along the barren shoreline. Rock wren (*Salpinctes obsoletus*) and killdeer nest in the drawdown zones around Folsom Lake (Sally Walters *pers. com.*). Canada geese (*Branta canadaensis*) commonly forage within areas of turf and lawn.

Larger mammals such as mule deer, mountain lion and black bear (*Ursus americanus*) have been observed using ruderal and barren habitat as movement corridors (Sally Walters *pers. com*). The Folsom Lake shoreline zone is the most significant example of this corridor function in the Unit. Along the western, southern and southeastern sides of the lake, shoreline movement corridors interconnect several oak woodland, grassland and riparian woodland habitats that are separated from one another by residential subdivisions (see Figures AL-2a and AL-2b). When lake waters are at or above ordinary high water elevation (usually late-winter until mid-late-spring), terrestrial connections between these habitats are few or none. The habitat areas remain isolated until Folsom Lake water levels recede, allowing for wildlife to resume movement along the exposed lake shoreline zones. (See the Wildlife Corridor section below for further discussion).

Associated Special Status Animal Species: In general, ruderal and barren areas are unlikely to provide habitat used by any of the special status species considered in the Unit area (CDPR 1978b, Quinn *et al.* 1991, USFWS 2002, CNDDB 2003). However, occasional elderberry shrubs are found at the landward limits of the shoreline in some locations. These provide potential habitat for Valley elderberry longhorn beetle, a federal Threatened species.

Non-native Species: Virginia opossum are likely to use barren and ruderal habitats.

Animal Life Associated with Existing Structures

General Description: Various buildings, dams, water control facilities, bridges and related facilities have been constructed within the boundaries of the Unit, both prior to and after the impoundment of the lakes. The lands surrounding these structures were often heavily disturbed during construction. After construction, surrounding lands have been actively maintained through continued maintenance and landscaping, or abandoned, allowing weedy vegetation to grow. These surrounding areas function as ruderal/disturbed habitats, as described above. The structures themselves may provide refuge for animal species that have adapted to survival in man-made landscapes and/or require the dark, cave-like recesses of bridges and abandoned buildings. In particular, attics, basements, undersides of eaves and bridges, and wall seams of buildings and other structures provide such habitat.

Wildlife Composition and Characteristics: Some wildlife species use man-made structures during the day to hide from detection. In heavily developed areas, these include species such as striped skunk, raccoon (*Procyon lotor*) and rock dove (*Columba livia*) that forage on human associated refuse, usually after dark when human disturbance is at a minimum. Other species, such as Brazilian free-tailed bats (*Tadarida brasilensis*), myotis bats (*Myotis* spp.), cliff swallows (*Petrochelidon pyrrhonota*), and deer mice, use man-made structures as refugia only when these structures are located well away from human activity for at least part

of the day. The historic Folsom Powerhouse and surrounding structures are known to provide such habitat.

Associated Special Status Animal Species: The following special status wildlife species are associated with man-made structures in the Unit (S. Walters *pers. com.*):

- Pallid bat (*Antrozous pallidus*) - CSC - Pallid bats will roost under bridges, in attic spaces, and within abandoned buildings as well as in other structures, and in tree hollows. It may be one of the bat species using the Folsom Powerhouse.

- Townsend's Western Big-eared Bat (*Corynorhinus townsendii*) - CSC - This bat species roosts in caves, buildings and other structures and may be found in the Folsom Powerhouse.

Non-native Species: Non-native species that are frequently associated with structures include Argentine ants (*Lipepithema humile*), starling (*Sternus vulgaris*), rock dove (*Columba livia*) and Virginia opossum.

Aquatic Habitats

Animal species occurring in aquatic habitats are usually dependent on water for all their life processes or for significant portions of their life histories (Hickman *et al.* 1990). These include fully aquatic species such as fish and crustaceans, as well as terrestrial animal species, such as pond turtles and waterfowl that require water for major portions of their life histories, such as feeding and refuge. Aquatic habitats are categorized into five major habitat types based on hydrology and vegetation, as summarized below:

- *Lake Habitat* – An artificially derived aquatic habitat resulting from impoundments of the American River to form Folsom Lake and Lake Natoma. This habitat is fully aquatic and has no related terrestrial vegetation community.

- *Pond Habitat* – An artificially derived aquatic habitat resulting from the impoundment of small creeks or drainages, and/or from mining activities. This habitat is also largely aquatic but may have freshwater marsh vegetation in its shallow shoreline littoral zone.

- *Creek and Stream Habitat* – A natural aquatic habitat that flows ephemerally, intermittently or perennially within a defined channel having a bed and bank. This habitat is largely aquatic but may have seasonal wetlands, freshwater marsh and/or riparian woodland vegetation types growing within or along its bed and banks.

- *Freshwater Marsh Habitat* – An aquatic habitat that occurs naturally along the margins of water features such as ponds and creeks. This habitat consists of the freshwater marsh vegetation community type described in the Plant Life section.

- *Seasonal Wetland Habitat* – A natural aquatic habitat consisting of the seasonal wetland, claypan vernal pool and northern hardpan vernal pool vegetation communities types described in the Plant Life section.

The following subsections summarize habitat characteristics and typical wildlife species in each of the five aquatic habitats in the Unit. Fish species are also discussed for all aquatic habitat types except the two lakes. A separate Fisheries Section, provided later in this document, deals with fish in Lake Natoma, Folsom Lake and the lower American River. Additionally, Table AL-1 provides a matrix listing all observed or potentially occurring wildlife species by habitat type in the Unit.

Lakes

General Description: Lake Natoma and Folsom Lake are artificial impoundments formed by the placement of dams across the American River. The resulting reservoirs consist of large expanses of open water habitat with aquatic and emergent vegetation and riparian woodland habitat growing along their edges in some shallow locations. Folsom Lake and Lake Natoma are large aquatic ecosystems that annually produce large numbers of aquatic insects and micro-invertebrates. This productivity supports an extensive aquatic fishery as well as large seasonal congregations of migratory water birds.

Wildlife Composition and Characteristics: The open water provides habitat for a number of waterfowl and shorebirds. Flocks containing hundreds or even thousands of ducks and geese, such as pintail (*Anas acuta*), canvasback (*Aythya valisineria*), and green-winged teal (*Anas crecca*) travelling along the Pacific flyway during spring and fall migrations will rest and feed on the lakes. Several species will over winter on the lakes. While thousands of Canada geese (*Branta canadensis*) and mallards (*Anas platyrhynchos*) stopover on the lakes during migration a few individuals will stay to reside on the lakes all year. The lakes also serve as habitat for oceanic species that move inland, such as white pelican (*Pelecanus erythrorhynchos*) and lesser scaup (*Aythya affinis*), and provide temporary refuge for accidental species such as black scoter (*Melanitta nigra*) and common tern (*Sterna hirundo*) (Audubon Society, 2003).

Audubon Society Christmas bird count data between the period 1990-2000 indicate the importance of the Unit to waterfowl along the Pacific flyway (Table AL-3). For example, a yearly average of 2,221 Canada geese, 1,085 mallards, and 686 northern pintails were observed in the Unit or in its vicinity during this period. Similarly, large numbers of shorebirds are observed in the vicinity of the two lakes. Christmas bird count data between 1990-2000 show an average of 4,892 California gulls (with as many as 27,000 gulls observed in a single year - 1996) and 854 herring gulls. Between 60,000 and 100,000 water birds have been observed roosting on Folsom Lake at night (Bruce Webb *pers. com.*).

Associated Special Status Animal Species: Three special status wildlife species are associated with the open water habitat of lakes and are known to occur or have the potential to occur in the vicinity of Lake Natoma and Folsom Lake (CDPR 1978b, Quinn *et al.* 1991, USFWS 2002, CNDDB 2003). These species are the following:

- Western pond turtle - CSC - Pond turtles reside in perennial and intermittent water features using adjacent upland areas for nesting. They may move into the lakes' shallower water areas particularly adjacent to creeks and ponds.

- Bald eagle - FPD, SE - Bald eagles will perch in tall trees located near large waterbodies such as lakes and will forage over the waterbodies.

- Osprey (*Pandion haliaetus*) nesting - CSC - Ospreys will nest in snags and trees near located near or in large waterbodies such as lakes and will forage over the waterbodies.

- Greater sandhill crane (*Grus canadensis*) winering, nesting - ST – Sandill cranes have been observed flying over Folsom Lake in the spring and fall (S. Walters *pers. com.*)

The Special Status Wildlife section – page AL_30 provides a more detailed discussion of all special status wildlife species that occur or could potentially occur in lake habitat. Table AL-2 lists all potentially occurring special status species and their listing status, describes their habitat requirements and provides their nearest known occurrences to the Unit.

Non-native Species: Many of the fish in the lakes, such as sunfish (*Lepomis* spp.), bass (*Micropterus* spp.) and catfish (*Ictalurus* spp.), are introduced species (see Fisheries Section). Other introduced animal species in the lake include red-swamp crayfish (*Procambarus clarkii*), bullfrog, red-eared slider (*Trachemys scripta*), and muskrat (*Ondatra zibethicus*).

Creeks and Streams

General Description: Creeks and streams consist of naturally-occurring water courses that are direct and/or indirect tributaries of Folsom Lake and Lake Natoma. They are characterized by having discernable beds and banks that have been formed by the flow of surface waters. Various reaches of creeks and streams in the Unit are associated with one of more of the following vegetation community types described in the Plant Life section: riparian woodland, freshwater marsh and seasonal wetlands.

As shown in Figures AL-1a and AL-1b, eight perennial creeks and 22 intermittent/ephemeral streams flow into Folsom Lake.[6] Three additional perennial/intermittent creeks enter Lake Natoma. An unknown number of small ephemeral streams (widths of 1-2 feet between the tops of banks) are likely tributaries to the mapped creeks and streams.

Intermittent streams provide zones of seasonally wet habitat (*i.e.*, "seasonal hydration habitat") that can provide water, forage, cover and movement corridors for both terrestrial and aquatic species. Intermittent streams typically begin drying toward the end of each year's rainy season and are usually dry by early/mid-summer. Along some intermittent stream reaches, zones of extended soil saturation and/or seasonal pools are found. These zones support freshwater marsh and/or seasonal wetland habitat types (see discussions below).

Ephemeral streams typically commence drying following the end of each storm event and do not contain seasonal pools. Therefore, they do not provide appreciable habitat for aquatic animals.

Perennial creeks contain water throughout the year. The presence of water in these features results in the development of wholly aquatic communities that support sparse to dense cover of aquatic and wetland plant species. Additionally, most perennial creeks systems support

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[6] Perennial creeks or streams flow year-round. Intermittent streams flow seasonally and may be supported by both surface runoff and ground water inflows. Ephemeral streams flow only for brief periods (a few days to a few weeks) following storms and are supported only by surface runoff.

riparian woodland habitat along their banks and occasionally emergent plant species such as cattail (*Typha* sp.) growing along their edges.

The construction of the Folsom and Nimbus Dams dramatically altered creek and stream habitat. Prior to the impoundment of the American River by Folsom Dam, creeks and streams were tributaries of the free-flowing American River. Aquatic species associated with the natural river system (*e.g*., native ranid frogs, California red-legged frog and foothill yellow-legged frog - *Rana boylii*) could also readily utilize the tributary creeks and streams. Similarly, creek and stream fauna could migrate through the river to other creek and stream habitat up- and downstream. Numerous native fish species, such as California roach (*Lavinia symmetricus*) and hardhead (M*ylopharodon conocephalu*s), likely occurred in the interconnected riverine and creek/stream systems. Anadramous fish, such as steelhead (*Oncorhynchus mykiss*), were able to move from the river into the creeks to spawn.

The two dams have eliminated or greatly reduced this habitat interconnectivity by replacing the free flowing riverine system with an artificial lake system containing major movement barriers. Many of the native animal species that were adapted to the free flowing river system are not adapted to the conditions caused by the impoundments. The dams act as movement barriers by preventing animals from moving up- and downstream. The lakes also act as movement barriers by preventing aquatic animals in the now isolated creeks behind the dams from reaching other creeks. The dams prevent movement of anadromous fish returning from the ocean to spawn. The artificial lakes also provide habitat for numerous introduced species such as bullfrogs and sunfish that will feed on the native creek and river fauna. Populations of native aquatic species remaining in the Unit's creeks are now likely isolated from each other and faunal movement is restricted by the lack of a riverine connection.

Wildlife Composition and Characteristics: Aquatic animals naturally occurring in the Unit's creeks and streams are species that can survive extreme fluctuations in water levels and currents during the year. The wet winter/dry summer cycle creates a situation of heavy high water flows during the winter and minimal to no flows during the summer and early fall, leaving drying isolated pools in many streambeds.

Creeks and stream pools in the Unit support an extensive aquatic invertebrate fauna that includes the aquatic life stages of both insects and amphibians. Numerous microscopic species serve as food for microscopic predators such as copepods (subclass C*opepoda*) and rotifers (phylum *Rotifera*), which form the food base for aquatic insects, such as water boatman (family *Corixidae*) and damselfly larvae (family *Coenagrionidae*). Aquatic insects, as well as nematodes (phylum *Nematoda*) and annelid worms (phylum *Annelida*) are, in turn, the prey base for frogs, turtles, and fish.

Many native fish species, such as California roach and Sacramento sucker (*Catostoma occidentalis*), that occur in the Unit's creeks can also survive in the small pools of intermittent streams. As the intermittent stream dry, the fish manage to survive the dry season by living in residual pools and then reproducing explosively during the spring. Non-native fish, such as sunfish (*Lepomis* sp.) and golden shinner (*Notemigonus crysoleucas*), introduced into the reservoirs, will occasionally move up creeks where they compete with native fish for insects and crustaceans. Native frogs (*e.g*., California red-legged frog and foothill yellow-legged frog) that are unlikely to occur in Folsom Lake and Lake Natoma, still occur in creeks and streams where they are able to successfully compete with non-native

species. Species such as the western pond turtle, have adapted to small residual pools during the dry months and can survive without any surface water for some time.

Creeks are also important to terrestrial species, providing a source of drinkable water throughout the year. This role as a reliable drinking water source played a more important function historically before the impoundment of ponds and lakes.

Native fish appear to be rare or absent in the perennial creeks of the Unit, while introduced fish such as sunfish, bass and catfish now predominate. Based on observations by LSA biologists, native ranid frogs also appear to have been extirpated and replaced in some creeks by the non-native bullfrog. During LSA site visits, only two creeks, Pilot Creek and Hancock Creek, appear to be dominated by native fish species. Nimbus Dam prevents the upstream movement of anadramous fish such as steelhead trout and Chinook salmon (*Oncorhynchus tshawytscha*) returning from the ocean to spawn.

Associated Special Status Animal Species: Three special status wildlife species are associated with creek and stream habitat and are known to occur or have the potential to occur in the vicinity of the Unit (CDPR 1978b, Quinn *et al.* 1991, USFWS 2002, CNDDB 2003). These species are the following:

- California red-legged frog – FT, CSC – Red-legged frogs use perennial and intermittent water features for breeding, rearing, foraging and cover.

- Foothill yellow-legged frog – CSC – Foothill yellow-legged frogs occur in long lived intermittent and perennial creeks and rivers with cobble and gravel bars.

- Western pond turtle – CSC – Pond turtles reside perennial and intermittent water features and use adjacent upland areas for nesting.

The Special Status Wildlife section – page AL-30 provides a more detailed discussion of all special status wildlife species that occur or could potentially occur in creek and stream habitat. Table AL-2 lists all potentially occurring special status species and their listing status, describes their habitat requirements and provides their nearest known occurrences to the Unit.

Non-native Species: Introduced animal species observed in creeks include red-swamp crayfish (*Procambaris clarki*), sunfish, (*Lepomis* sp.), bass (*Macropteris* sp.), catfish (*Ictalurus* sp.), bullfrog, red-eared slider, and muskrat. Muskrats are native to the lower Colorado River and the northeastern parts of California but were introduced by humans to areas west of the Sierra (Verner and Boss 1980).

Ponds

General Description: Ponds are small impoundments of water that are deep enough to provide open-water aquatic habitat. The edges of ponds may support the freshwater marsh vegetation type, as described in the Plant Life section. No naturally occurring ponds exist in the Unit. However, numerous small ponds have been constructed at Mississipi Bar for dredge tailing purposes. Avery's Pond is an approximate 2-3 acre pond adjacent to the northwest shoreline of Folsom Lake that may have been constructed as part of an unfinished canal in association with a PG& E Powerplant (B. Deason *pers. com.*). An additional small

pond is located just outside the Unit boundary at the end of the Los Lagos Trail. Figures AL-1a and AL-1b show the locations of ponds in the Unit.

The ponds in the Unit are all under ten feet in depth and most support an extensive growth of aquatic vegetation such as yellow pondweed (*Ludwigia peploides*), waterweed (*Elodea* sp.), and smartweed (*Polygonum* sp.). These aquatic plants provide cover, nesting and foraging habitat for the aquatic fauna occurring in ponds.

Wildlife Composition and Characteristics: Animal species currently residing in and along ponds are largely introduced species and aquatic natives that historically occurred in slack water conditions of creeks and freshwater marshes. Aquatic insects and their larvae feed on micro-invertebrates and vegetation and provide a food base for the other animals occurring in and along ponds.

Avery's Pond, located at Rattlesnake Bar, has been stocked with catfish, sunfish, and bass, all of which are non-native species. Other non-native species introduced into ponds include the red swamp crayfish, bullfrog, and mosquito fish (*Gambusia affinis*). Native species, including western pond turtles and waterfowl such as mallards, will move from creek systems into Unit ponds. Terrestrial birds and mammals will come to open water areas to drink.

Associated Special Status Animal Species: Two special status wildlife species are associated with pond habitat and are known to occur or have the potential to occur in the vicinity of the Unit (CDPR 1978b, Quinn *et al.* 1991, USFWS 2002, CNDDB 2003). These species are the following:

- California red-legged frog – FT, CSC – Red-legged frogs use ponds for breeding, rearing, foraging and cover and will also use the upland areas adjacent to such features.

- Western pond turtle – CSC – Pond turtles reside in ponds and use the adjacent upland areas for nesting. This species is regularly observed in Avery's Pond (David Muth *pers. obs.*).

The Special Status Wildlife section – page AL-30 provides a more detailed discussion of special status wildlife species that occur or could potentially occur in pond habitat. Table AL-2 lists all potentially occurring special status species and their listing status, describes their habitat requirements and provides their nearest known occurrences to the Unit.

Non-native Species: Introduced animal species observed in ponds include red-swamp crayfish, mosquito fish, sunfish, bass, catfish, bullfrog, red-eared slider, and muskrat.

Freshwater Marsh

General Description: Within the Unit, this habitat type is composed of the freshwater marsh vegetation community type, as described in the Plant Life section. Freshwater marsh habitat can be found in the Mormon Island Wetland Preserve, along the edges of Avery's Pond, in tailings ponds in Mississippi Bar and along the edges of various creeks (see Figures AL-1a and AL-1b). Freshwater marsh forms in locations where water is shallow enough to support stands of perennial, emergent marsh vegetation such as cattail and bulrush (*Scirpus* spp.). Along its edges, dense stands of shorter-statured marsh plants are found, while the interiors

may be broken by zones of open water that are often choked with smartweed and floating pond weeds.

Wildlife Composition and Characteristics: With the unique combination of land, shallow water, and dense vegetation, freshwater marsh provides habitat for many species of wildlife. The water in marsh habitats supports the micro-invertebrates that serve as the food base for most aquatic food chains while the presence of extensive vegetation supports many of the herbivorous species that begin the terrestrial food chain. The dense marsh vegetation provides cover and nesting habitat.

Most species that utilize freshwater marshes require water for part of their life cycles. Dragonflies and damselflies lay their eggs in water so their nymphs can feed on aquatic invertebrates until they are ready to metamorphose into aerial predators. Frogs such as Pacific treefrogs (*Pseudacris [= Hyla] regilla*) and western toad (*Bufo boreas*) lay eggs in water so their larvae can feed on micro-invertebrates and algae. These larvae become terrestrial predators after metamorphosis. Most ducks are terrestrial species that spend a majority of their life on or in the water where they find cover and food. Puddle or "dabbling" ducks (*e.g*. gadwall, northern pintail, green- and blue-winged teal, wigeon, and northern shoveler, mallard) feed largely on aquatic invertebrates and aquatic plants. Common garter snakes (*Thamnophis sirtalis*) crawl unnoticed through downed emergent vegetation feeding on frogs and fish.

Several species of birds, including American bittern (*Botaurus lentiginosus*) marsh wren (*Cistothorus palustris*), and red-winged blackbird (*Agelaius phoeniceus*), nest only in the dense vegetation of emergent marsh.

Associated Special Status Animal Species: Five special status wildlife species are associated with marsh habitat and are known to occur or have the potential to occur in the vicinity of the Unit (CDPR 1978b, Quinn *et al.* 1991, USFWS 2002, CNDDB 2003). These species are the following:

- California red-legged frog – FT, CSC – Red-legged frogs use marsh habitat for breeding, rearing, foraging and cover. They will also use the upland areas adjacent to such features.

- Western pond turtle – CSC – Pond turtles occur in marsh habitats, using adjacent upland areas for nesting.

- Tricolor blackbird (*Agelaius tricolor*)– CSC – Tricolor blackbird will nest and forage in the dense emergent vegetation of freshwater marshes.

- Northern harrier - nesting - CSC - Harriers will often nest at the edges of marshes and will forage over marsh habitats.

- White-tailed kite - FP - This kite species will nest in trees and tall shrubs at the edges of marsh habitat and will forage over the marsh.

The Special Status Wildlife section – page AL-30 provides a more detailed discussion of special status wildlife species that occur or could potentially occur in freshwater marsh habitat. Table AL-2 lists all potentially occurring special status species and their listing

status, describes their habitat requirements and provides their nearest known occurrences to the Unit.

Non-native Species: Introduced animal species observed in freshwater marshes include red-swamp crayfish, bullfrog, red-eared slider, muskrat and Virginia opossum.

Seasonal Wetlands and Vernal Pools

General Description: This habitat includes the seasonal wetlands and vernal pools vegetation community types described in the Plant Life section. These wetland features accumulate surface water during the rainy season, but are typically dry most of the year. In the Unit, they occur along various intermittent streams and in various other locations, such as the Mormon Island Wetland Preserve and the Snipes Pershing Preserve, where soil and topographic conditions allow water to seasonally accumulate (Figures AL-1a and AL-1b).

Seasonal wetlands provide limited habitat for most fauna (Bouder *et al.* 1998). When seasonal wetlands are hydrated (several months), they provide forage for terrestrial fauna. During the briefer periods that seasonal wetland have surface waters (usually 1-3 months), they provide a water source for wildlife and limited habitat for aquatic invertebrates. Seasonal wetlands that persist into the early summer can be particularly valuable habitat features, providing green forage in the midst of a surrounding desiccated landscape. Some species of invertebrates and amphibians have become well-adapted to these seasonal extremes, and are typically associated with vernal pool habitats. Most species of terrestrial animal use seasonal wetlands as watering sites. Grazing herbivores may feed on the vegetation in vernal pools in late spring as the upland vegetation dries up.

Wildlife Composition and Characteristics: Because seasonal wetlands typically do not contain fish, several amphibians, such as western spadefoot and Pacific treefrog, as well as several insect species with aquatic larval stages such as predaceous diving beetles (Dyticid), use vernal pools for egg laying and larval habitat. Herbivores, such as mule deer and California vole that feed on grassland forage will take advantage of the greener vegetation growing in seasonal wetlands as the grass and other forage in upland areas dries and becomes less palatable.

A few species of crustacean such as fairy shrimp (Order *Anostraca*) and the copepod *Diaptomis* spp. have become specialized to survive the extreme conditions in seasonal wetland habitat, primarily vernal pools. These species have an accelerated life cycle that is completed within the short period of time water persists in the pools. These vernal pool endemics lay encysted eggs that can survive the hot, dry summer by lying in the dried clay soil at the bottoms of vernal pools. Several species of solitary bees, such as *Diandrena blennospermatis*, that excavate burrows along the edge of vernal pools, are specialized to pollinate only vernal pool flowers during their blooming periods.

Associated Special Status Animal Species: Two special status wildlife species are associated with seasonal wetland habitat are known to occur or have the potential to occur in the vicinity of the Unit (CDPR 1978b, Quinn *et al.* 1991, USFWS 2002, CNDDB 2003). These species are the following:

- Vernal pool fairy shrimp (*Branchinecta lynchi*) - FT - This shrimp species usually occurs in vernal pools for the first six to eight weeks after the pools fill.

- Western spadefoot toad - CSC - This species will breed in vernal pools and other seasonal water features. The adults live in the surrounding grasslands.

Non-native Species: The same non-native species that use freshwater marsh may use seasonal wetland habitat during the periods when surface water is present.

Historical Influences on Animal Life

Human activities have significantly modified California's native ecosystems over the past 150 years (Wilson, 1988; Ricklefs and Schluter, 1993). Land-altering activities such as farming, grazing, mining, drainage, damming rivers, road building, introductions of non-native biota, residential development and urbanization have fundamentally changed the state's native landscape. The history of human activities in and around the Unit mirrors the greater California experience (see *Cultural Resources* Section). All of the land-altering activities mentioned above have taken place in or around the Unit and have almost certainly caused fundamental changes to the Units's native ecosystems. The specific effects of these changes on the wildlife species in the Unit have not been documented. Nevertheless, the probable impacts can be reasonably conjectured based on the greater California experience and general pattern of such changes on the types of habitat present in the Unit (Wilson, 1988; Ricklefs and Schluter, 1993).

Humans have caused significant changes to the structure and composition of vegetation communities in the Unit. These changes have also significantly altered the habitat characteristic of these communities (Barbour and Major 1977; Wagner 1989). For example, changes in the fire regime of chaparral areas in the Unit have reduced their utility as foraging habitat (see discussion in Plant Life section). Similarly, long-term changes in the composition and structure of native grasslands have fundamentally altered the grassland food chain. Introduction of livestock to California was accompanied by the introduction of European annual grasses and forbs, resulting in a rapid conversion of native perennial grasslands and oak savanna understory to mostly annual grasses and forbs of European origin (Heady *et. al.* 1991; Edwards 1992, Kinney 1996). Disturbance associated with livestock aided the invasion and helped maintain suitable conditions for persistence of the non-native opportunist plants (McClintock 1987). These changes made grasslands, such as those in the Unit, less suitable foraging habitat for native fauna such as deer and rodents (Lidisker 1989, Wagner 1989).

Changes to grassland probably depleted or altered populations of native foragers and native plant pollinators (Wagner 1989, Murphy and Ehrlich 1989). For example, populations of native wildflowers such as tarplant (*Hemizonia fichii*) and buttercups (*Ranunculus* spp.) have been reduced to small isolated patches in the Unit. These small patches probably provide sufficient forage and pollen to support only a fraction of the historic numbers of native bees, butterflies, and beetles that are dependent on these plants. Declines in these insect species populations may have had consequences further up the food chain. For example, many insectivorous species in the Unit, such as black phoebe (*Sayornis nigricans*) or tree swallow, have probably adjusted to these changes in prey species diversity by moving to other prey species, such as the introduced honey bee (*Apis mellifera*). What effect such shifts in prey have had on insectivorous species in the Unit is unknown.

Confounding the change in the natural ecosystems in the Unit has been the introduction of non-native species, such as wild turkey, feral cats and Virginia opossum. Wild pigs have appeared outside the Unit in the Auburn vicinity but were removed (R. Lee *pers. com.*). Additionally, some common native species, like raccoon, coyote, striped skunk, and raven (*Corvus corax*), may have increased in number due to their ability to adapt to alterations caused by humans. Many of these exotic and native species may have significantly altered the population structures of other native species because they out-compete or disproportionately prey upon certain wildlife species (Wilson, 1988; Ricklefs and Schluter, 1993). Feral cats can cause significant impacts to native bird populations, particularly where the cats are fed by people (Hawkins 1998). This problem may be occurring in the Lake Natoma vicinity of the Unit where feral cats are being fed.

The impoundment of the American River is a good example of how California's natural creek and river systems have been fundamentally altered, which has in turn changed the habitat characteristic of these systems. The historic natural water system consisted of heavy flows of cold water during the winter rains and spring snow melt followed by a steady decrease in water flows, that became warmer, during the summer. The animal species that naturally occurred in California's river systems were adapted to these normal seasonal changes in water flow and temperature for their life cycles (Moyle 1976).

Since the influx of Europeans into California, these systems have been diverted, impounded, and channelized. Winter flows are now reduced. Cold water at the bottom of impoundments is slowly released all year, never warming, and water levels rise and fall abruptly based on societal needs (ACOE 2001b). These alterations in the environment have resulted in damage to the populations of native aquatic species, particularly fish and amphibians (Moyle *et al.* 1996). In the Unit, this damage is illustrated by the current status of steelhead. Historically, steelhead moved up the American River to spawn in the numerous creek systems throughout the watershed. This species can no longer travel past Nimbus Dam. The species survives in the system largely due to the presence of a CDFG hatchery below Lake Natoma (see Fisheries Section – pages AL-26 to AL-30).

Native aquatic plant populations have been altered and/or replaced by non-natives. Native herbivorous fish and aquatic insect populations have respnded to changes in aquatic plant life and these changes continue up the food chain. Numerous non-native fish and invertebrates, such as carp, bass, catfish, crayfish, and clams have also been introduced into aquatic systems. Other introductions into Unit waterways are the bullfrog and a species of watersnake (*Nerodia* sp.). These introduced species out-compete and unnaturally prey upon natives. For example red-legged frog were once common in the Sierra foothills. The introduced bullfrog feeds on tadpoles and young frogs, is larger and able to eat more food. Today, California red-legged frog is considered all but extirpated in the Sierra Nevada, while bullfrog is considered common (USFWS 1996).

Runoff from urban and agricultural land uses has probably changed the hydrology of many streams that flow to Folsom Lake and Lake Natoma. Streams that were once intermittent may now be perennial due to year-round runoff from irrigation, car washing and other water use activities (RWQCB 1998). These changes to stream hydrology often favor non-native species such as bullfrogs and introduced fish in aquatic systems (USFWS 2000). Urban and agricultural runoff is often polluted with chemicals, nutrients, and sediments. Changes to water quality, particularly decreases in clarity and enrichment from nutrients, often favor

non-native species in aquatic systems (Lee 1998). This process is likely to continue in the Unit as urban development continues to encroach upon the watershed.

Wildlife Corridors

The ability of wildlife to move between habitat areas within semi-urbanized areas like the Unit, is dependent, in part, on the existence of suitable corridors (Beier and Noss 1998). The extent of connectivity provided by such corridors play an important role in the ability of partially or fully isolated patches of habitat to support wildlife populations. Species that have low vagility (*i.e.* the ability of an animal to move about and disperse within its environment), such as most reptiles, amphibians and small mammals, are negatively impacted by the presence of few widely spaced corridors.

As shown in Figures AL-2a and AL-2b, most of the developed land adjacent to the Unit fails to provide any suitable corridor for wildlife passage. Wildlife movement is generally restricted to the remaining corridors of undeveloped land between developed parcels. The continued development of private lands in and around the Unit will further restrict the ability for wildlife located in natural areas to move into, out of, or across the Unit. These corridor restrictions will have particular impact on mammals that require large areas for foraging and hunting prey such as mountain lion, black bear and bobcat.

Wildlife movement corridors within the Unit are also limited. In several locations along Folsom Lake, park facilities or adjacent development lie in close proximity to the ordinary high water line of the lake (466 feet NGVD). Examples of these areas include South of Iron Mountain, Granite Bay, Mooney Ridge, and the dam area (Figures AL-2a and AL-2b). The ability for larger mammals to move between habitats in these locations is largely limited to the lake shoreline corridors. Movement by wildlife in these corridors becomes restricted when the lake waters are at or above 466 feet. Even when the water level is below 466 feet, wildlife movement in these areas is limited to narrow corridors of barren or poorly vegetated ground, less than 100 feet wide, and often heavily used by humans for recreation. These corridors become wider as the lake draws down, but the barren or sparsely vegetated zones that remain have little value as wildlife corridors because they provide poor cover for animals moving between more suitable habitat areas.

The Unit connects the open space along the American River Parkway to undeveloped lands upstream of Folsom Lake. However, the private lands on either side of the American River corridor and to the south, east and west of the Unit are very heavily developed and the habitat value of these open space areas is marginal. For example the community of Granite Bay now separates the Unit from open space areas in Miners Ravine that are, at least for now, contiguous with undeveloped lands to the west.

Nuisance Wildlife

Activities in the Unit sometimes bring people into close proximity with wildlife and the habitats they inhabit. In some of these situations, the animals residing in human use areas often become a nuisance to Unit users (S. Walters *pers. com.*). In these cases, there are

increased risks associated with interactions between people and animals. For example, the ground squirrels in the Beals Point campground and picnic areas regularly multiply in such large numbers that they pose a health risk to the campers using the area (J. Micheaels *pers. com.*). The squirrels actively move among people seeking food remnants and handouts. Some users exacerbate the problem by feeding the squirrels. Squirrels that are used to being fed become aggressive and will readily approach people, increasing the potential for people to be bitten or scratched. Squirrels in campgrounds have been known to chew through tents, backpacks and styrafoam coolers to get to food (S. Walters pers. com.).

The presence and behavior of wildlife in close association with people can result in harmful interactions in several ways. Yellow jackets (*Vespula* sp.) will attempt to forage among the food stuffs of day visitors in picnic areas. Raccoons and skunks become accustomed to the presence of people and can carry rabies. Bears will raid campgrounds and can injure campers. In situations where wildlife becomes an interference to human use of the Unit and its resources, it may be necessary to determine methods to control the nuisance species.

Fisheries

Folsom Lake

Completed in 1955, Folsom Lake has a maximum depth of 266 feet and inundates portions of both the North and South Forks of the American River. The maximum depth occurs near Folsom Dam. Because most of the reservoir is relatively shallow, the lake has a mean depth of 66 feet. The lake surface area is approximately 12,000 acres and has a total shoreline length of approximately 85 miles (CDPR 1979).

Thermal stratification of Folsom Lake allows it to support a "two-story fishery" of both warm water and cold water fish species. The lake begins thermally stratifying in April and the stratification holds through November when winter rains and high inflows mix the waters. Thermal stratification during the summer results in an upper layer of warm water, a narrow zone of rapid temperature transition called the "thermocline," and a lower layer of cold water.

Warm water sport fishes present in the lake include: largemouth bass (*Micropterus salmoides*), smallmouth bass (M. *dolomieui*), spotted bass (M. *punctulatus*), bluegill (*Lepomis macrochirus*), red-ear sunfish (L. *microlophus*), green sunfish (L. *cyanellus*), black and white crappie (*Promoxis nigromaculatus* and P. *annularis*), threadfin shad (Dorosoma pretenense), white catfish (*Ictalurus catus*), channel catfish (I. *punctatus*), and brown bullhead (I. nebulosus), all of which are non-native fishes. Native fishes present in the warmer waters of the lake are limited to Sacramento pikeminnow (*Ptychocheilus grandis*), hardhead (*Mylopharadon conocephalus*), California roach (*Hesperoleucus symmetricus*), and Sacramento sucker (*Catostomus occidentalis*).

The cold water sport fish species include rainbow trout (*Oncorhynchus mykiss*), brown trout (*Salmo trutta*), and chinook salmon (O. *tshawytscha*) (ACOE 2001a & b). Of these four cold water fishes, only the rainbow trout and the chinook salmon are native species. Since 1989, the cold waters of Folsom Lake have also contained wakasagi smelt, a Japanese subspecies of the native Delta smelt (*Hypomesus transpacificus*). It is believed that they originated from

Sly Park Reservoir and entered the Folsom Lake/South Fork American River drainage during a drought year inter-basin transfer of water from Sly Park Reservoir (Aasen *et al.* 1998; Dennis Lee, CDFG *pers. com.*). A list of all fish species known to occur in the Unit is provided in Table AL-4.

The California Department of Fish and Game (CDFG) stocks multiple sizes of rainbow trout into Folsom Lake, including fingerlings, catchable size (two fish/pound), and trophy fish. The annual stocking of catchable size rainbow trout is typically 14,000 fish (Mike Healy, CDFG *pers. com.*). They also stock chinook salmon as part of the CDFG's Inland Chinook Salmon Program (ACOE 2001a). The chinook salmon stocked into Folsom Lake originate from the Nimbus Hatchery where they are screened for disease prior to release (Terry West, CDFG *pers. com.*). During most years, 100,000 fingerling chinook salmon are released to Folsom Lake during the spring. Occasionally, 40,000 to 50,000 yearling salmon are released in the fall. These fish are first caught by anglers when 12-14 inches in length and continue to be caught up to 3 years of age when they are 3.5 to 4 pounds in size. The return to anglers has been determined by CDFG to be 20 percent of the number stocked (Dennis Lee, CDFG *pers. com.*).

In the past, Kokanee salmon (*Oncorhynchus nerka*) have been stocked as fingerlings but this practice has since been discontinued (Mike Healy, CDFG *pers. com.*). Folsom Lake's pond smelt population has replaced the kokanee salmon through competition for the same forage (zooplankton), and there appears to be no Kokanee salmon remaining in the lake (Kyle Murphy, CDFG *pers. com.*). Brown trout (*Salmo trutta*) are also no longer stocked in the lake but reproduce in the tributaries. Natural reproduction of rainbow trout also occur in the north and south forks of the American River, but it is rare for CDFG to see a non-hatchery rainbow trout in its Folsom Lake creel census (Dennis Lee CDFG *pers. com.*).

Although there have been no quantitative studies on spawning success for Folsom Lake's inland chinook salmon population, CDFG manages the Inland Chinook Salmon Program on the assumption that there will be no significant recruitment contribution from these salmon spawning in the tributaries to Folsom Lake. Creel census data for Folsom Lake indicates that all inland chinook salmon occurring in Folsom Lake are products of the hatchery (Dennis Lee, CDFG *pers. com.*). These inland salmon ascend tributaries and spawn, but none of their progeny have been found in the lake by CDFG. Reasons for this may be the lack of suitable spawning substrates in the tributaries, predation of young by stream and reservoir fishes, and stress mortality when the smolts are unable to enter salt water (Dennis Lee, CDFG *pers. com.*).

The substantial reduction in in water surface elveation that begins in late spring affects the reproduction of a number of Folsom Lake's warm water sport fishes. Both egg and juvenile survival of bass, sunfish, and catfish are affected by the water level fluctuations. Dropping water levels can lead to nest abandonment as bass spawning occurs primarily in April and May, and sunfish and catfish spawning generally occurs in late-May and June (ACOE 2001a). For average warm water fish populations in California reservoirs, a nest survival rate of at least 20 percent is necessary to maintain long-term population levels (PCWA 2002). The Folsom Lake bass fishery falls below the state reservoir average in both size and catch rate. Of the three black bass species present, spotted bass dominate the catch (Dennis Lee, CDFG *pers. com.*).

The management of the cold water pool in Folsom Lake is also critical to the populations of fall-run chinook salmon and steelhead in the Lower American River below Nimbus Dam. Summer releases of cold water from Folsom Lake are needed to maintain juvenile steelhead rearing habitat in the Lower American River. October and November releases of cold water are needed for adult chinook salmon immigration, spawning, and egg incubation (M. Healy, *pers. com*).

The Unit includes the lower reaches of several small tributary streams that drain into Folsom Lake. It also includes a small amount of riverine habitat where the North and South Forks of the American River enter the reservoir's inundation zone. Avery's Pond, located adjacent to the north side of the upper North Fork of the American River, is generally less than 5 feet deep and is reported to contain bluegill and other non-native sunfishes. No water quality data is presently available for this small pond.

Lake Natoma

Located immediately downstream of Folsom Lake, Lake Natoma serves as a regulating afterbay to stabilize flow releases to the Lower American River. Flows entering Lake Natoma from Folsom Lake can fluctuate widely as Folsom Dam responds to power generation needs. However, daily water surface elevations in Lake Natoma typically fluctuate between four and seven feet (ACOE 2001a). During summer months, water released from Folsom Lake may increase in temperature by 3 to 7 degrees F as it travels through Lake Natoma, depending on flow rate and air temperature.

Lake Natoma was created by Nimbus Dam, an 87-foot high concrete structure. In addition to its role as a regulating facility for Folsom Dam releases, it also is the point of diversion for waters into the Folsom South Canal. The completed portion of the Folsom South Canal extends from Nimbus Dam 27 miles south. It was the main conveyance of water to the Rancho Secho Nuclear Power Plant when it was in operation, but is presently unused.

Lake Natoma generally provides a very mediocre fishery due to the rapid turnover of water associated with its function as a regulating afterbay (Dennis Lee, CDFG *pers. com.*). Fish species occurring in Lake Natoma are generally the same as those found in Folsom Lake. Although the CDFG annually stocks 1,500 catchable size rainbow trout into Lake Natoma, the lake's water temperatures favor warm water fishes.

Several additional waters that support fish populations are found in the vicinity of Lake Natoma and within the Unit boundaries. Small tailings ponds on the former Teichert property portion of Mississipi Bar are reported to contain bass, bluegill, green sunfish, and catfish (Mike Healy *pers. com.*). Nimbus Shoals, a 0.7-mile reach of the Lower American River immediately below Nimbus Dam seasonally contains adult and juvenile steelhead, chinook salmon, American shad, and Pacific lamprey, all of which are anadromous fishes. Alder Pond is the inundated portion of Alder Creek located on the south side of Hwy 50. Based on observations by LSA biologists, Alder Pond is typically choked each summer with aquatic weeds and algae that likely result in low levels of dissolved oxygen. For this reason, the most prevalent fish species occurring in Lake Natoma during the summer months are warmwater fish species common to Lake Natoma and tolerant of low oxygen conditions (*e.g.* catfish and carp). The lower several hundred feet of Willow Creek upstream of its confluence with Lake Natoma is surrounded by an auto mall. It is likely to contain limited numbers of many of the warm water fish species found in Lake Natoma. An October 1996

sampling of Willow Creek about 450 feet upstream of its mouth found the most common fish species to be Sacramento squawfish, prickly sculpin, and mosquito fish. Other species captured during this sampling included smallmouth bass, rainbow trout, and Sacramento sucker (Davis, 1996).

Nimbus Hatchery, located approximately 0.25 miles downstream of Lake Natoma, is operated and maintained by CDFG and funded by the BOR. The hatchery spawns and rears both chinook salmon and steelhead. The BOR designed and built Nimbus Hatchery to mitigate for the impacts of Folsom Dam that eliminated approximately 100 miles of upstream spawning and rearing habitat for chinook salmon and steelhead. Nimbus Hatchery draws its water supply from Lake Natoma through a 60-inch pipe in Nimbus Dam. While hatchery water temperatures of less than 55 degrees F (13 degrees C) are desirable for spawning chinook salmon, temperatures this low are often not available from Lake Natoma in September and October. The hatchery will not open its gates to allow upstream migrating chinook salmon into the hatchery for spawning until its water supply from Lake Natoma maintains a water temperature of of 60 degree F (15.5 degrees C) for five consecutive days (Terry West, Nimbus Hatchery Manager *pers. com.*).

Lower American River

Flow releases from Folsom Lake and Lake Natoma are critical to the anadromous salmonid fisheries found in the Lower American River. The construction of Folsom and Nimbus dams obstructed the historic migrations of chinook salmon and steelhead to over 100 miles of upstream spawning and rearing habitat. Based on counts of the salmon run in the American River made since 1944, approximately 72.5 percent of the annual run of 26,000 chinook salmon originally spawned upstream of Nimbus Dam (CDFG 2002). These two native anadromous fish species are now limited to the 23 miles of the Lower American River between Nimbus Dam and the Sacramento River. Only 0.7 miles of the Lower American River below Nimbus Dam lies within the Unit.

The Lower American River is designated as Essential Fish Habitat for Chinook salmon by the Pacific Fishery Management Council in Amendment 14 to the Pacific Coast Salmon Plan (ACOE 2001b). Adult fall-run chinook salmon may enter the Lower American River between August and January, with peak migration occurring October through December. Since 1995, at least 50,000 adult fall-run chinook salmon return to the Lower American River annually (ACOE 2001a), with 80 percent of these fish spawning naturally in the river. Peak spawning activity occurs in November and early December, and 98 percent of spawning occurs in the river upstream of Watt Avenue (PCWA 2002). Within a few months after hatching, the juvenile chinook salmon migrate downstream (April through June) (ACOE 2001b).

Adult steelhead migrate up the Lower American River from January through April. The majority of these fish return to the Nimbus fish hatchery located approximately a mile downstream of Nimbus Dam. Juvenile steelhead spend at least a year rearing in the river before migrating downstream during spring high flows. The adult steelhead usually return after 2 years in the ocean.

At certain times of the year, high water temperatures seriously limit the reproduction, growth, and survival of anadromous salmonids in the Lower American River. An adequate regime of flows and water temperatures from Folsom Lake and Lake Natoma is essential to creating

favorable conditions for downstream populations of chinook salmon and steelhead. Various government agencies have formed working groups to set goals for preferred flow and temperature conditions in the Lower American River. Some of these working groups meet monthly to determine how best to meet these goals given the constraints of available water and the demands for power generation and water supply deliveries. The following goals have been established by the FISH Working Group for the management and restoration of water temperature to the river below Nimbus Dam (ACOE 2001b):

- *Goal #1*. Reduce water temperature in the Lower American River during critical stages in the life cycles of Sacramento River fall/late fall-run Chinook salmon and Central Valley steelhead so as to increase the number of these fish spawning naturally in the river.
- *Goal #2*. To the greatest extent possible, reach those temperatures recommended by the CDFG for Central Valley steelhead and Sacramento River fall/late fall-run chinook salmon (i.e. 56 degrees F between October 1 and June 30 and between 56 and 60 degrees F for July 1-September 30). Temperatures are measured at Watt Avenue (River Mile 9.5).
- *Goal #3*. Significantly increase the Central Valley steelhead and Sacramento River fall/late fall-run chinook salmon natural production fish populations in the Lower American River.

In addition to the chinook salmon and steelhead, American shad (*Alosa sapidissima*) and Pacific lamprey (*Lampetra tridentata*) are two other anadromous fish species that migrate up the Lower American River to within the Unit at Nimbus Shoals. A native species, the adult Pacific lamprey moves into its spawning streams between April and late July, builds a rock nest in the river gravels, and then dies after spawning (Moyle 1976). The larval young are known as ammocoetes. They move downstream to burrow into mud or sand and live as filter feeders for 3 to 7 years before migrating to the ocean to begin the predatory phase of their lives.

American shad are an introduced sport fish whose spawning run peaks in late May and June. Most shad die after spawning but a few do survive to return to the ocean and spawn again the following year (Moyle 1976). Shad eggs are broadcast spawned and drift suspended in the current. Hatching takes place 3 to 6 days after spawning and the young fish move gradually down through the Delta and out to sea.

Adult striped bass (Morones saxitilis), a non-native sport fish, occur in the Lower American River year-round. Striped bass spawning appears not to occur in the Lower American River (SWRI 2001). Striped bass do not inhabit the upstream reaches of the river within the Unit at Nimbus Shoals (Mike Healy, CDFG *pers. com.*).

Sacramento splittail *(Pogonichthys macrolepidotus)*, a native minnow with federal status as threatened, has potential spawning habitat in the lowermost 5 miles of the Lower American River. This habitat would be available during particularly wet years of high spring flows. Splittail are not found in the upper reaches of the Lower American River near Nimbus Shoals (SWRI 2001).

Special Status Fish Species

While no special status fish species are known to occur in Folsom Lake or Lake Natoma, the flow releases from these reservoirs are critical to creating favorable flow and temperature conditions for two special status anadramous salmonids that are found in the Lower American River below Nimbus Dam. These two fishes, fall/late fall-run chinook salmon (Federal Candidate Species) and Central Valley steelhead (Federal Threatened), both occur seasonally throughout the length of the Lower American River including Nimbus Shoals, a 0.7-mile reach that lies within the Unit (Table AL-2). The cold water flow releases from Folsom Lake are managed to meet temperature goals suitable for these species in the Lower American River as measured at Watt Avenue.

In addition to the Central Valley steelhead and chinook salmon, the lower end of the 23-mile Lower American River below Nimbus Dam provides spawning habitat to the Federally listed (threatened) Sacramento splittail. Low numbers of this native minnow have been found spawning within the lowermost 6.5 miles of the Lower American River. Even though this special status species does not occur within the boundaries of the Unit, it can nevertheless be affected by water released from Folsom Lake and Nimbus Dam.

Central Valley Spring-Run Steelhead

The Central Valley spring-run steelhead Evolutionary Significant Unit or "ESU" (*Oncorhynchus mykiss irideus*) has been Federally listed as threatened since 1998. The ESU for this species occurs in the Sacramento and San Joaquin Rivers and their tributaries. The Lower American River has been designated as part of its critical habitat.

The Central Valley spring-run steelhead once occurred in great numbers throughout the Sacramento and San Joaquin drainages, however, the construction of dams associated with large water supply and hydroelectric projects has eliminated hundreds of miles of steelhead spawning and rearing habitat. High temperatures and habitat degradation from reduced flows and habitat loss from excessive sedimentation in remaining accessible stream reaches, has steadily reduced the numbers of steelhead produced naturally. Because steelhead young spend a year or two rearing in stream of origin before migrating to the ocean, adequate water temperatures and flows during the hot months of summer and early fall are critical to their survival.

The release of cold water from the deeper portions of Folsom Lake is managed to maintain 56 to 60 degree F water temperatures in the Lower American River as measured at Watt Avenue during the period of July 1 through September 30. This temperature goal is primarily to provide favorable conditions for juvenile steelhead rearing in the Lower American River.

The majority of steelhead in the Lower American River are produced in the Nimbus Hatchery located about a mile below Nimbus Dam. Steelhead habitat within the boundaries of the Unit is limited to Nimbus Shoals, an approximately 0.7 mile reach of the Lower American River below Nimbus Dam.

Sacramento Fall/Late Fall-Run Chinook Salmon

The fall-run chinook salmon (*Oncorhynchus tshawytscha)* was proposed and evaluated for Federal listing as threatened. A listing as threatened was determined to be unwarranted. However, the fall/late fall-run chinook salmon remains a candidate species for listing under the Federal Endangered Species Act (ESA).

The runs of chinook salmon in California are differentiated by the maturity of fish entering fresh water, time of spawning migrations, spawning areas, incubation times and temperatures, and migration of juveniles. The great majority of the Sacramento late-fall run chinook salmon appear to spawn in the mainstem of the Sacramento River. These fish range in age from 2 to 5 years, with the majority being 3 and 4 year old fish. Fall-run chinook salmon spawning in the Lower American River occurs primarily in November and early December, with eggs being laid in a depression (redd) hollowed out in gravel beds. The embryos hatch after 3 to 4 months of incubation. The alevins (sac-fry) remain in the gravel for another 2 to 3 weeks. Although downstream movement may occur within a few weeks of emergence, juvenile chinook salmon rear in the Lower American River only a few months until they leave the river with the spring high flows.

The majority of Sacramento late-fall run salmon are found in the Sacramento River. The run of fall-run chinook salmon in the Lower American River extends up to Nimbus Dam and includes Nimbus Shoals. The principle causes of the decline of the late fall-run chinook salmon appear to be: 1) inability to pass over dams, 2) loss of habitat, 3) introgression with other runs, and 4) other factors such as disease and pollutants. In the Lower American River, water temperatures can be sufficiently warm to impede upstream migration of adults and to stress juvenile fish. For this reason, the cold water releases from Folsom Lake are managed for Lower American River chinook salmon to provide river temperatures at Watt Avenue of 56 degrees F from October 1 through June 30.

Sacramento Splittail

The Sacramento splittail (*Pogonichthys macrolepidotus*) was Federally listed as threatened in March 1999 and is a native minnow historically distributed throughout the lakes and rivers of the Central Valley. This fish is now confined to the Delta and the lower reaches of the Sacramento River. Splittail numbers declined as dams, diversions and development eliminated or drastically altered much of the lowland habitat once used by this species for spawning and rearing.

From February through April, adult splittail migrate upstream from brackish water to fresh water to spawn. Spawning occurs on submerged vegetation in temporarily flooded upland and riparian habitat. Lower reaches of rivers, bypasses used for flood management, dead-end sloughs, and some of the larger sloughs are favored for spawning. The larval splittail remain in the shallow weedy inshore areas near the spawning sites and move into deeper waters as they mature. Low numbers of splittail are known to use the lowermost 6.5 miles of the Lower American River for spawning (ACOE 2001a).

Special Status Wildlife Species

Special status wildlife and fish species are defined here as follows:

- Species that are listed, formally proposed or designated as candidates for listing as threatened or endangered under the Federal Endangered Species Act.

- Species that are listed, or designated as candidates for listing, as rare, threatened, or endangered under the California Endangered Species Act.

- Wildlife species listed by the California Department of Fish and Game (CDFG) as species of special concern, or as fully protected species.

- Species that meet the definition of rare, threatened, or endangered under the *California Environmental Quality Act* (CEQA). (Under Section 15380 of the *CEQA Guidelines,* a species not included on any formal list "shall nevertheless be considered to be endangered, rare or threatened if the species can be shown to meet the criteria for listing.")

Thirty-five special status wildlife species reported from the Folsom area will use habitat types that occur in the Unit (USFWS 2002, CNDDB 2003). Table AL-2 lists these special status wildlife species and summarizes their preferred habitats. Four of the species on the list, have ranges that do not extend into the Unit. These species are included on the Folsom list because they are included on the special status species list provided by the USFWS (USFWS 2002).

The following sections provide brief descriptions of special status animal species known to occur in the Unit or for which the presumed range includes the Unit. Key management and protection concerns are also summarized for each species.

Vernal Pool Fairy Shrimp

The USFWS listed vernal pool fairy shrimp as a threatened species in 1994. Vernal pool fairy shrimp is a small crustacean that lives in the vernal pools of California's Central Valley. Fairy shrimp hatch out of encysted eggs soon after vernal pools fill with winter rainfall. They reach maturity, breed and begin to lay eggs within two to four weeks. Vernal pool fairy shrimp die within three months of hatching, leaving their encysted eggs to survive the hot dry season in the soil at the bottom of dried seasonal wetlands. The vernal pool habitats of the vernal pool fairy shrimp in the Central Valley have been severely reduced in number by agriculture and development (Eriksen and Belk, 1999).

Vernal pool fairy shrimp have been observed in pools located on the Empire Ranch development site immediately (less than one mile) south of the Mormon Island Wetland Preserve (David Muth *pers. obs.*). Vernal pool fairy shrimp could occur in the vernal pools in the Mormon Island Wetland Preserve. Based on observations by LSA Biologists, the remaining vernal pools and seasonal wetlands in the Unit probably contain less water than is

typical of seasonal wetlands that support this species of fairy shrimp. However, the presence of vernal pool fairy shrimp in these features cannot be ruled out (see Figure AL-2).

Valley Elderberry Longhorn Beetle

The valley elderberry longhorn beetle is listed as a federally threatened species. The species is found in the Central Valley of California and lower elevations of the Sierran foothills and is only associated with blue elderberry (*Sambucus mexicana*), which is the obligate host for the larvae of the valley elderberry longhorn beetle. Adult beetles can be found on or flying between elderberry plants. The flight season for the beetle is between mid-March and early June (USFWS, 1999).

The USFWS determined that a threatened listing was warranted due to the extensive historical conversion of riparian habitats that supported large numbers of elderberry plants, for agriculture and development. The USFWS considers any elderberry plants within the presumed range of the valley elderberry longhorn beetle to support the species (USFWS 1999).

Blue elderberry can be found in a variety of habitats occurring in the Unit including grasslands, chaparral, and woodlands. The locations of elderberries in the Unit have been mapped (Jones and Stokes, 2001). The valley elderberry longhorn beetle should be presumed present at each of these locations. (see wildlife map). Surveys for valley elderberry longhorn beetle can be conducted year round and consist of searching the stems of each clump for the presence of exit holes of elderberry beetle larvae (USFWS, 1999).

California Red-legged Frog

The California red-legged frog is listed as a threatened species by the federal government, and as a species of special concern by the State of California. Historically, California red-legged frogs occurred in and along perennial and intermittent water features throughout most of California. The species is considered extirpated from California's Central Valley, and all but extirpated from the Sierra Nevada (USFWS 1996). Three known populations remain in the Sierra Foothills. One of these is a population in the Weber Creek drainage near Camino in El Dorado County, over 15 miles east of the Unit. Isolated individuals are also occasionally observed in the Sierra and a single female was observed in the American River drainage in 2001. The frog was observed where the Middle Fork of the American River and the Rubicon River intersect, approximately 15 miles upstream of Folsom Lake (David Muth, LSA *pers. obs*.).

Loss of habitat, fragmentation of habitat, and the presence of introduced fish and crayfish species, that prey on frog larvae and eggs, are considered the primary threats to the California red-legged frog. The presence of the introduced bullfrog (*Rana catesbeiana*) that may feed on larvae and adults and interfere with breeding is also important. In locations where red-legged frogs have been extirpated, such as in the Central Valley and Sierra foothills, bullfrog are present and may prevent red-legged frog reestablishment (USFWS 2000).

As California red-legged frogs are all but extirpated from most of the Sierra foothills, they are very unlikely to occupy any potential habitat areas available in the Unit. However, ponds, such as Avery's Pond, and the perennial and intermittent creeks feeding into the lakes, provide marginally suitable habitat that could support this species.

Foothill Yellow-legged Frog

The foothill yellow-legged frog is a California Species of Special Concern. Foothill yellow-legged frogs occur along permanent streams and creeks in the Coast Ranges from Oregon to San Luis Obispo County and along the western foothills of the Sierra Nevada above the valley floor (Stebbins 1985). The species is found in association with flowing perennial waterways such as streams, creeks, and smaller rivers with cobble and gravel bars. Foothill yellow-legged frogs occur in the American River just above the City of Auburn, approximately 6 miles upstream of Folsom Lake.

Foothill yellow-legged frogs are threatened by degradation of stream channels due to incision of channels, mining, and dam construction. The frogs are also susceptible to predation by introduced fish, bullfrogs, and crayfish.

Foothill yellow-legged frogs are likely to have been extirpated from the Unit. The flooding of the American River by Folsom Lake inundated most of the foothill yellow-legged frog habitat in the Unit and the bullfrogs that now occur in the lake are likely to prevent re-establishment of a population. The perennial and intermittent creeks that feed into Folsom Lake provide potential habitat, but appear to be too small to sustain a viable population.

Western Spadefoot

The western spadefoot is a California Species of Special Concern occurring in grasslands and alkali plains, where they breed in ephemeral pools, stockponds, and slow moving ephemeral streams. The species has been found from the central Sacramento Valley south through the San Joaquin Valley and west to Santa Barbara County. In California's Central Valley the species is typically found on the valley floor and at the base of the Sierra foothills. Adult western spadefoot toads are terrestrial and spend the majority of their life below ground in rodent burrows, natural crevices, or buried in dried mud. Spadefoot toads have been observed in Roseville near Fiddyment Road, and in Sacramento near the intersection of Grantline and Douglas Roads (CNDDB 2003). Both locations are about 10 miles from the Unit.

Western spadefoot is considered threatened by the conversion of grasslands and prairies into agricultural fields and development lands. Breeding locations are also being lost to agricultural practices and channelization of drainages.

While most of the grassland/savanna communities in the Unit appear suitable for adult western spadefoot toad, there is little suitable aquatic habitat for reproduction. Most of the seasonal wetlands in the Unit are too small to hold water long enough for spadefoot larvae to reach metamorphosis.

Western Pond Turtle

The western pond turtle is a California Species of Special Concern. Western pond turtles occur in perennial and intermittent lakes, ponds, rivers, and creeks throughout the State of California, except for desert habitats and the Sierra Nevada above 3,000 feet elevation. The species can often be observed basking on logs, banks, and downed emergent vegetation during the spring and early summer. Western pond turtles have been regularly observed in the Unit at Avery's Pond since the late 1970s (David Muth *pers. obs.*).

The loss and degradation of riparian and wetland habitats, as well as the loss of upland nesting sites are considered the primary threats to the western pond turtle. Hatchlings are also susceptible to predation by introduced fish and bullfrogs.

Most of the creeks, ponds, and lake backwaters in the Units are suitable for, and likely occupied by, western pond turtles. Western pond turtles have been regularly observed in Avery's Pond since the 1970s (David Muth *pers. obs.*) where they now occur with the introduced red-eared slider. The effects of the introduced turtle population on western pond turtles in the Unit are unknown, however, the population of red-eared sliders appears to have increased since the late 1980s (David Muth *pers. obs.*).

California Horned Lizard

The California horned lizard is a California Species of Special Concern. The California horned lizard inhabits open, sparsely vegetated areas in a variety of habitats, including scrubland, grassland, and woodlands. Horned lizards are often associated with areas containing loose sand and soil, where it feeds mainly on native ants such as *Pogonmyrmex*. Records indicate the species occurred in the Sierra Foothills and at the edge of the Central Valley from about Butte County to Los Angles County. The species was observed near Pilot Hill, less than 3 miles from the Unit, during the 1970s (David Muth *pers. obs.*). Recent observations have been made on Pine Hill, 4 miles east of the Unit.

The California horned lizard has been little studied and data on population trends is based mainly on conjecture. At present, the species is seldom observed in the Sierra foothills (David Muth *pers. obs.*). While the exact causes of the disappearance of the California horned lizard are unknown, the conversion of sparse native bunchgrass grassland to dense non-native grassland, development, or agriculture is suspected (CDFG 2003). The invasion of California by the introduced Argentine ant, which is inedible to horned lizards, is also considered a serious threat (Jennings and Hayes, 1994).

California horned lizards have been observed in Pilot Hill and on Pine Hill within the last 20 years (CNDDB 2002). Habitats similar to those used by California horned lizard occur in the vicinity of Folsom Lake on the east side of the Unit. This species may still occur in the sparsely vegetated grassland and chaparral habitats of the site.

Bald Eagle and Golden Eagle

The bald eagle was formerly listed by the federal government as threatened but is currently proposed for de-listing. A decision on whether to de-list will occur within the next few years. The State of California designated the bald eagle as an endangered species. Golden eagle are considered a State of California Species of Special Concern. Both eagle species are protected under the federal Bald Eagle Protection Act of 1940. Bald eagles winter and occasionally nest in the vicinity of large bodies of water such as Folsom Lake and Lake Natoma, throughout California. Golden eagles will nest on stick platforms built in tall trees adjacent to open space areas. Audubon Society Christmas bird count data show an average of 6 bald eagles and 2 golden eagles observed in the Unit vicinity each year (Audubon Society 2003). No confirmed records of nesting eagles exist from any locations within 15 miles of the Unit. One bald eagle record indicates possible nesting at Bass Lake, four miles east of the Unit (CNDDB 2003).

The bald eagle was protected after it was discovered that the pesticide DDT contaminated the fish upon which it fed. The DDT contamination resulted in thin eggshells and prevented successful reproduction in this species. Both birds were also protected because of indiscriminate historic hunting to control predators of livestock. Golden and bald eagles are reported from the Unit area during Audubon Society sponsored Christmas bird counts each year (Audubon Society, 2003). Both species could nest in tall trees located within the Unit. The tallest trees in the Unit are mature foothill pines.

Peregrine Falcon and Prairie Falcon

The peregrine falcon is a California state endangered species but was de-listed by the federal government from endangered status. Prairie falcon is a protected Species of Special Concern by the State of California. Both species occur throughout the State of California nesting on the ledges of rocky cliffs and tall structures. No records of nesting by these species exist from any locations within 15 miles of the Unit. However, Audubon Society Christmas bird count data shows an average of one peregrine falcon and four prairie falcons observed in the Unit vicinity each year (Audubon Society 2003)

Peregrine falcons were protected after it was discovered that the pesticide DDT passed through the food chain to the birds upon which falcons feed. The DDT contamination resulted in thin eggshells and prevented successful reproduction in this species. Both falcons were also protected because of indiscriminate historical hunting to control predators. Very few peregrine falcons have been reported within the Unit (Audubon Society, 2003). Rocky ledges located adjacent to the Unit may provide suitable nesting locations for these birds.

Burrowing Owl

The burrowing owl is a California Species of Special Concern that nests in abandoned rodent burrows of open grasslands and arid areas. Burrowing owls occur in the Central Valley of California from Redding to the base of the Tehachapi's and in the desert regions to the east and south of the Sierra Nevada. In California, burrowing owls are typically associated with ground squirrel burrow complexes although other type of burrows and abandoned pipes may be used (CDFG 2003). The closest records are from the vicinity of Keifer and Grant Line Roads in Sacramento, 7 miles south of the Unit and burrowing owl are regularly observed during the Audubon Society Christmas bird counts (Audubon Society 2003).

Burrowing owls are of concern due to the extensive loss of grasslands in California to agriculture and urban development (CDFG 2003). In grazed lands, ground squirrels are often considered a pest and heavily managed. Ground squirrel management has a direct impact on animals such as burrowing owl that use ground squirrel burrows. Burrowing owls nested in the Unit at Nimbus Flat 20-25 years age (R. Lee *pers. com.*). However, suitable habitat exists and burrowing owls could take up residence in grasslands or ruderal habitats of the Unit where suitable burrows are present.

Other Raptors

In addition to the raptor species discussed above, a number of other raptors with suitable habitat in the Unit are designated as California Species of Concern if they are nesting. These species are: osprey, northern harrier, sharp-shinned hawk, Cooper's hawk, ferruginous hawk,

merlin (*Falco columbarius*), long-eared owl, and short-eared owl. Nesting white-tailed kite is listed by California as a Fully Protected Species.

Many of these raptor species forage over a wide variety of habitats including those in the Unit. Nesting is usually restricted to high perches although the northern harrier and the short-eared owl nest on the ground in high grasses (Zeiner *et al.* 1988). There are nesting records of white-tailed kite in Snipes-Perishing Ravine less than one mile from the Unit and Cooper's hawk nesting on Mississippi Bar (CNDDB, 2002). Long-eared owl are known to winter in the vicinity of Avery's Pond and the Peninsula (S. Walters and R. Lee *pers. com.*). With the exception of long-eared and short-eared owl, all of the raptor species mentioned above are routinely observed in the Unit area during Audubon Society Christmas bird counts (Audubon Society 2003).

There has been as general loss of potential nesting sites for these raptor species. Tall trees and snags have historically been removed for fire wood and lumber while grasslands are typically grazed to a short height. Protecting nesting sites is expected to encourage recovery of these species. Any of the tall trees and snags in the Unit could potentially serve as nesting locations for many species of nesting raptor. Grassland habitats with stands of tall grass could also provide nesting locations for short-eared owls and northern harriers.

Loggerhead Shrike

Nesting locations of the loggerhead shrike are designated as California Species of Special Concern. Shrikes are associated with grassland habitats in California's Central Valley, although they nest in shrubs and small trees. CDPR staff report that they have not observed loggerhead shrike anywhere within the Unit boundaries in recent years (R. Lee *pers. com.*). However, suitable nesting habitat is located in and along the grassland habitats on the site and the species could take up nesting in these locations. Additionally, Audubon Society Christmas bird counts recorded an average of 6 loggerhead shrikes in the Unit vicinity between 1990 and 2000 (Audubon Society 2003).

Tricolor blackbird

Tricolor blackbird nesting colonies are designated as California Species of Special Concern. Tricolor blackbirds range throughout the Central Valley of California nesting in dense marsh vegetation along creeks, pond, and lakes. The species typically nests in colonies of up to several hundred birds. Nesting colonies have been observed in numerous locations within one mile of the Unit (CNDDB 2002).

The species is of concern due to the loss of suitable breeding habitat areas resulting from the conversion of the Central Valley to agriculture (CDFG 2003). Suitable nesting locations for tricolor blackbird are located in the dense emergent marsh vegetation located in the Mormon Island Wetland Preserve and possibly in other dense marsh stands such as those at the mouth of Alder Creek. Any densely vegetated marsh areas should be searched for the presence of this species during the spring and early summer breeding season.

Yellow-breasted Chat and Yellow Warbler

The nesting locations of yellow-breasted chat (*Ictaria virens*) and yellow warbler (*Dendroica petechia*) are designated as California Species of Special Concern. These two species nest in

riparian thickets and dense patches of willow usually adjacent to a creek or stream. CDPR staff report yellow-breasted chat nesting in Himalayan berry (*Rubus discolor*) thickets just outside of the Unit boundaries along Sweetwater Creek (R. Lee and S. Walters *pers. com.*).

The nesting locations of yellow-breasted chat and yellow warbler are declining because of the extensive historic loss of riparian habitat in California. As riparian habitats disappeared, so did the potential breeding locations for riparian bird species. Both yellow-breasted chat and yellow warbler are known to occur in the Unit and suitable nesting habitat occurs in the riparian corridors along creeks and adjacent to the river.

Greater Sandhill Crane

Nesting and wintering greater sandhill crane are designated as Threatened by the State of California because of habitat loss due to agricultural and residential habitat conversion (CDFG 2003). Sandhill cranes establish territories in wet meadows that are often interspersed with emergent marsh. Cranes will typically feed in rice and corn field and will use irrigated pastures as resting sites. They are known to breed in marshes in Northeastern California. Sandhill cranes are unlikely to use the Unit for feeding or resting habitat but have been observed flying over Folsom Lake in the spring and fall (S. Walters *pers. com.*), and could occasionally rest along the lake shoreline or in marsh areas.

Willow Flycatcher

The willow flycatcher was historically a common summer resident throughout California and bred wherever extensive willow thickets occurred. The species has now been eliminated as a breeding bird from most of its former range in California. Willow flycatcher populations have declined primarily due to loss and degradation of riparian habitat (CDFG 2003). Livestock grazing impacts and nest parasitism by brown-headed cowbirds have also caused population declines (Zeiner 1990a). Only the southwestern willow flycatcher subspecies, which has a range that does not include the Unit, is federally listed as Endangered. However the State of California lists both subspecies of willow flycatcher as Endangered.

This species is a summer migrant to wet meadows and montane riparian forests in the Sierra Nevada. During the spring and fall it can be found in lower elevation riparian areas in the eastern Central Valley where it feeds on flying insects by making brief flights from exposed patched of willow thickets (Zeiner 1990a). It has been observed in willow riparian habitats in the Unit (J. Webb *pers. com*.).

Purple Martin

Purple martin is an uncommon to rare summer resident in low elevation woodlands, riparian habitats and coniferous forests in California. Nesting locations are designated as California Species of Special Concern. These occur primarily in abandoned woodpecker cavities in old, tall, isolated trees or occasionally underneath human-made structures such as bridges (Zeiner 1990a). During its spring and fall migration periods, the species may be found in open habitats near water such as wet meadows and grasslands. Purple martin populations have declined due to loss of riparian habitat, loss of snags and competition for nest cavities from European starlings and house sparrows (Zeiner 1990a). Purple martins may be rarely observed within woodlands and riparian habitats in the Unit.

Bats

Three species of bat, pallid bat (*Androzous pallidus*), Townsends big-eared bat (*Corynorhinus townsendii*) and California mastiff bat (*Eumops perotis californicus*), and their roosting sites, are protected by the State of California as Species of Special Concern. Pallid bats and Townsend's bats roost in a wide variety of locations including bridges, tree hollows, buildings, caves, and mines, while mastiff bats tend to roost in rock outcroppings and rocky ledges. Both species range widely throughout California. Two colonies of bats that do not have special status, including the Brazilian or Mexican free-tailed bat (*Tadarida brazilensis)* and a species of myotis (*Myotis* sp.) have a maternity colony in the Folsom Powerhouse and gates (S. Walters *pers. com.*). Additionally the western red bat (*Lasiurus blossevillii*), also a non-special status species, has been observed in the general vicinity of the Unit (D. Schmoldt *pers. com.*).

Bats have been the subject of intentional destruction. Because they have a low fecundity rate and frequently refuse to re-use disturbed roosting sites their numbers appear to be significantly decreasing. Bats may roost in Unit buildings as well as in trees and rock crevices in many of the habitats throughout the park.

Recommendations

Management of Invertebrates, Amphibians and Reptiles

Vernal Pool Fairy Shrimp; Western Spadefoot Toad

Vernal pool fairy shrimp and western spadefoot toad habitat can best be promoted by protecting all Unit vernal pools from direct and indirect impacts. In particular, the remaining watershed areas of vernal pools should not have any further intrusions such as filling, grading or infrastructure that would reduce or alter the quantity or quality of runoff into the pools. More specific vernal pool protection measures are discussed earlier in this document under "Vegetation Management Recommendations." (Plant Life section pg.) Surveys for fairy shrimp involve dipnetting of pools in accordance with USFES protocols (USFWS, 1996). Surveys for spadefoot toad include listening for calling males during the winter and searching for larvae with nets during the spring (Heyer, et al, 1994).

Valley Elderberry Longhorn Beetle

A unit-wide management protocol should be enacted for any future infrastructure, operational or management plans that could occur in the vicinity of elderberry plants. These protocols need to include: (1) site specific mapping and counts of individual elderberries clumps or shrubs, as well as analysis for exit holes; (2) protection of elderberry stands and associated riparian vegetation with suitable buffer zones of at least 20-25 feet from the edge of driplines; and (3) identification of one or more suitable mitigation areas within which elderberries can be relocated or planted as compensation for unavoidable impacts where elderberries cannot be adequately protected (USFWS, 1999). CDPR should attempt to conduct informal consultation with U.S. Fish and Wildlife Service as part of the protocol development process with an ultimate goal of enacting a unit-wide Habitat Conservation Plan (HCP).

California Red-legged Frog; Foothill Yellow-legged Frog

Potential red-legged frog and foothill yellow-legged frog habitat areas should be adequately protected. Any proposed park infrastructure improvements in the vicinity of the Unit's ponds and various perennial and intermittent creeks should take into account the potential presence of these frog species. Prior to design of such improvements, surveys for the presence of the species should be conducted in accordance with USFWS and CDFG protocols. If the surveys establish the presence or potential presence of red-legged or yellow-legged frogs, every effort should be made to avoid impacting the habitat and to establish an adequate buffer zone (usually 300 feet). Habitat mitigation would likely be required for any unavoidable direct or indirect impacts. Such mitigation could include habitat enhancement through such measures as bullfrog control and habitat creation in suitable areas of the Unit. Informal consultation with the USFWS would also be required as part of this process if red-legged frogs are present (USFWS 1996). The CDFG should be consulted with respect to foothill yellow-legged frogs.

Western Pond Turtle

Potential habitat areas for western pond turtle should be protected in essentially the same manner as discussed above for red-legged frog. Surveys for pond turtles should include searching banks, shorelines, and surface objects, such as rocks and logs, with binoculars for basking turtles. The water surface should also be searched for turtles coming to surface for air (Holland, 1991).

California Horned Lizard

Remaining populations of California horned lizard in the Unit should be located and protected. Habitat where this species still resides should be managed to encourage sparse vegetation and to promote the life history of native ants. Areas most likely to support horned lizards occur on the Peninsula. Surveys for this species usually include searches for active lizards during spring and summer mornings. The presence of these lizards can also be determined by the presence of their scat in the form of oval shaped pellets consisting of ants.

Management of Birds

Heron and Egret Rookeries

Great egrets (*Ardea alba*) and great blue herons (*Ardea herodias*) feed in the wet meadows, marshes, lake margins (draw-down zones), creeks and ponds of the Unit. These birds typically nest in large trees adjacent to larger bodies of water. In the Unit, nesting occurs on Anderson Island and at Mississippi Bar in mature foothill pines and in cottonwoods near Folsom State Prison. The Mississippi Bar rookery formerly occurred on the eastside of Lake Natoma at the Willow Creek area (S. Lee, *pers. comm.*) (CDPR 1978a, 1979). The Mississippi Bar rookery has been established within the last 25 years. Additional rookeries could be located in other isolated locations within the Unit, where large trees are present.

Active or potential rookery locations should be protected from disturbance during the nesting season. Tall mature foothill pines adjacent to or near open water should also be considered potential roosting and/or nesting sites.

Any proposed park infrastructure improvements in the vicinity of roosting or nesting sites should take into account the potential presence of nesting egrets, herons and/or cormorants. Double-crested cormorants (*Phalacrocorax auritus*) nested with the Mississippi Bar rookery in 2003 (S. Waters, *pers. comm.*). Sacramento County Audubon mapped these locations in the late 70's and early 80's and submitted them to the California Natural Diversity Database. If active rookeries are found, improvement plans should be designed to avoid these sites until the young have fledged. Any construction work in the vicinity should be done outside of the breeding season. The Unit should consider establishing exclusion zones around potential rookery sites for watercraft and other active recreational uses during the nesting season.

Burrowing Owl

There are no known occupied burrows in the Unit and foraging habitat is limited due to the surrounding urban development that has occurred consistently around the Unit. Nevertheless, there is the potential for habitat to occur or to be re-established. Any proposed park

infrastructure improvements in the vicinity of grasslands should take into account the potential presence of burrowing owls, which will require that surveys be conducted for burrow sites. Surveys for burrowing owl require searching the entrance of suitable burrows and pipes for evidence of burrowing owl use, such as feathers, white-wash, and/or scat. Surveys should be conducted for both winter residents and during the breeding season. If evidence of burrowing owls is found, improvement plans should be designed to avoid the burrow areas to the extent feasible. If impacts are unavoidable, then passive relocation protocols should be implemented, as established by CDFG. All relocation efforts must be coordinated with CDFG. If occupied habitat cannot be feasibly avoided, then mitigation for loss of habitat will be required.

Loggerhead Shrike

Loggerhead shrike is believed extirpated from the Mormon Island Wetland preserve, which was the only habitat known to be occupied in the Unit (R. Lee *pers. com.*). Nevertheless, there is the potential for species to occur in the Unit. Any proposed park infrastructure improvements in the vicinity of grasslands or shrubs near open areas should take into account the potential presence of nesting loggerhead shrike. Surveys should be conducted for active nesting sites in the vicinity of proposed improvements. No construction work should be conducted in the vicinity of nesting sites during the nesting season, which will require that surveys be conducted to detect active nests during the nesting season. If active nests are found, improvement plans should be designed to avoid these locations until the young have fledged. Surveys for these species should include searching grassland areas for nesting birds during the nesting season in spring and early summer.

Tri-colored Blackbird

There is no known occupied habitat in the Unit. However, areas such as cattail marshes need to be adequately protected. Unit infrastructure improvement should avoid occupied vegetation to the greatest extent feasible. If impacts are unavoidable, then mitigation measures to establish new marsh habitat will need to be designed and implemented.

Yellow-breasted Chat; Yellow Warbler

The primary concern regarding yellow-breasted chat and yellow warbler in the Unit is to locate and protect active nesting locations from disturbance during the nesting season. Any proposed park infrastructure improvements in the vicinity of riparian habitats should take into account the potential presence of nesting yellow-breasted chat and yellow warbler, which will require that surveys be conducted to detect active nests during the nesting season. Yellow-breasted chat territories have been observed near the Beal's Point campground by the sewage treatment plant (B. Webb, *pers. comm.)* and in the Unit near Sweetwater Creek. If active nests are found, improvement plans should be timed to avoid these locations until after the breeding season. Surveys should include searching willow thickets and dense riparian vegetation, including areas with dense stands of Himalayan blackberry, for nesting birds during the nesting season (spring and early summer).

Any areas proposed for Himalayan blackberry management should first be surveyed for nesting activity. No such management work should be conducted until the nesting season is completed, all young have been fledged and the nests have been abandoned.

Fisheries Management

Central Valley Spring-run Steelhead; Fall-run Chinook Salmon; Sacramento Splittail

CDPR should seek to continue coordination of actions and policies relating to these species with the Lower American River FISH working group, the BOR and other stakeholders.

Avery Pond Fishery Enhancement

Avery Pond has the potential to be deepened and managed as one of three possible options relating to fisheries. One option is to remove all existing fish from the pond and to manage it for native warmwater fishes. The long-term difficulty with this approach is that eventually someone will introduce non-native sunfish and bass into the pond from the adjacent Folsom Lake. A second option is to establish a bass and bluegill, or bass and redear sunfish fishery in the pond to provide anglers with a warmwater sport fishery. A third option is to put only mosquitofish in the pond for vector control and manage the pond for non-angling beneficial uses.

To properly evaluate Avery Pond's restoration options and determine the fish species best suited to the pond, it will first be necessary to collect monthly water quality data for the pond. Water temperature and dissolved oxygen profiles, specific electrical conductivity, total alkalinity, pH, and turbidity data should be collected monthly for one year to characterize water quality conditions in Avery Pond. At a minimum, water temperature and dissolved oxygen profiles in the pond should be determined for the months of April through November. A depth profile of the pond should also be developed across its length and width.

Management of Mammals

Bats

The primary bat management concerns for the Unit are to locate and protect roost sites from disturbance, and to keep roost sites separate from people. Any proposed infrastructure improvements in the vicinity of barns, buildings, bridges, caves, rock outcrops or ledges, and hollow trees should take into account the potential presence of roosting bats, which will require that surveys be conducted to detect any roosting locations and to determine whether the site is used as a day roost, night roost, or nursery roost. Foraging areas may also need to be identified and protected. If day/ night or nursery roosts are found, improvement plans should be designed to avoid these sites. If impacts are unavoidable, night roosts should be altered to discourage use and nursery roosts avoided until the young have matured enough to fly, then altered to discourage use. Suitable alternative roosts may be necessary. Consultation with CDFG will be necessary.

Enhancement of Forage

Restoration of a more natural fire regime to chaparral would probably improve its habitat value for foraging animals. This effort should be integrated into prescribed fire plans to be developed under the Unit-wide Burn Plan. Where extensive stands of yellow star thistle have invaded grassland habitat, the vegetation management recommendations in the Plant Life section should ultimately improve forage in these area as well.

Control of Nuisance Wildlife

A nuisance wildlife management plan should be developed in close consultation with the California Department of Fish and Game. Management actions should address such issues as: (1) controlling California ground squirrels within picnic areas and campgrounds in order to reduce the heath and safety risks to park users, and (2) preventing the feeding of geese and ducks at Nimbus Flat in order to reduce bacteriological contamination. Management actions should take into account the effects on other interdependent organisms at higher or lower trophic levels. For example, wild turkey, a non-native species, is preyed upon by coyotes in the Unit. Control of wild turkeys could encourage coyotes to shift to greater predation upon ground squirrels. However it could also increase predation on native mammals such as cottontail rabbits (Wilson, 1988; Ricklefs and Schluter, 1993).

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Avery's Pond

Dotons Point Seasonal Wetland

Mormon Island Preserve

UNIT BOUNDARY

HABITAT

- CHAMISE CHAPARRAL
- GRASSLAND & OAK SAVANNA
- LAKE
- MARSH
- OAK WOODLAND
- POND
- RIPARIAN WOODLAND
- RUDERAL/BARREN/LANDSCAPED
- CREEK & STREAM HABITAT

SPECIAL STATUS WILDLIFE OCCURRENCES

- WESTERN POND TURTLE

OTHER POTENTIAL SPECIAL STATUS WILDLIFE HABITAT

- BAT ROOSTS
- HERON/EGRET ROOKERY/ROOSTING AREA
- SALMONID HATCHERY
- SEASONAL WETLANDS
- UNDISTURBED RIPARIAN
- VERNAL POOL HABITAT
- ELDERBERRY STANDS

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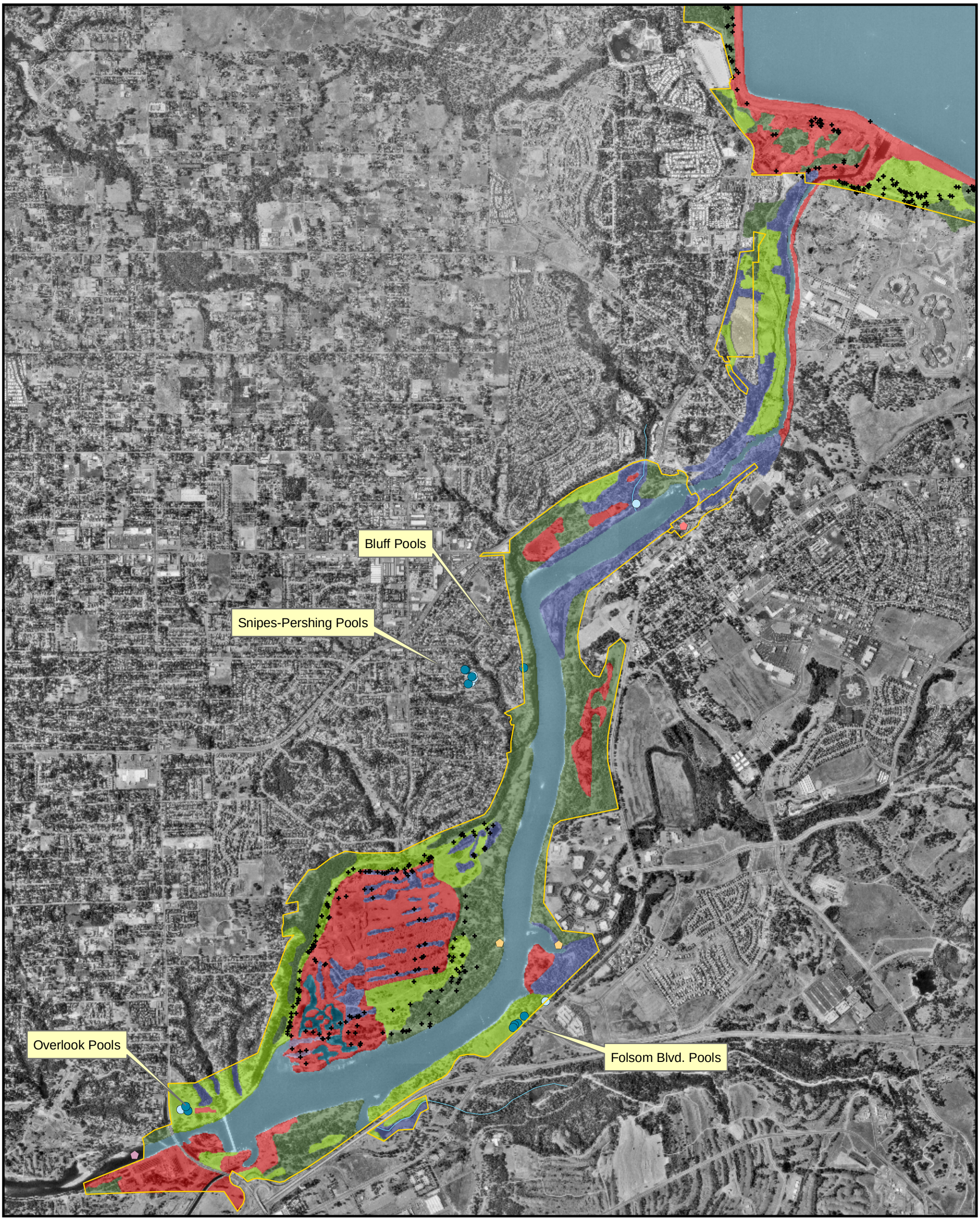
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FOLSOM LAKE STATE RECREATION AREA RESOURCE INVENTORY

FIGURE AL-1a

Wildlife Habitat and Occurrences

Prepared by LSA Associates, Inc.
Source: LSA Associates, Jones & Stokes, USGS, CDPR



UNIT BOUNDARY

HABITAT

- CHAMISE CHAPARRAL
- GRASSLAND & OAK SAVANNA
- LAKE
- MARSH
- OAK WOODLAND
- POND
- RIPARIAN WOODLAND
- RUDERAL/BARREN/LANDSCAPED
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- VERNAL POOL HABITAT
- ELDERBERRY STANDS

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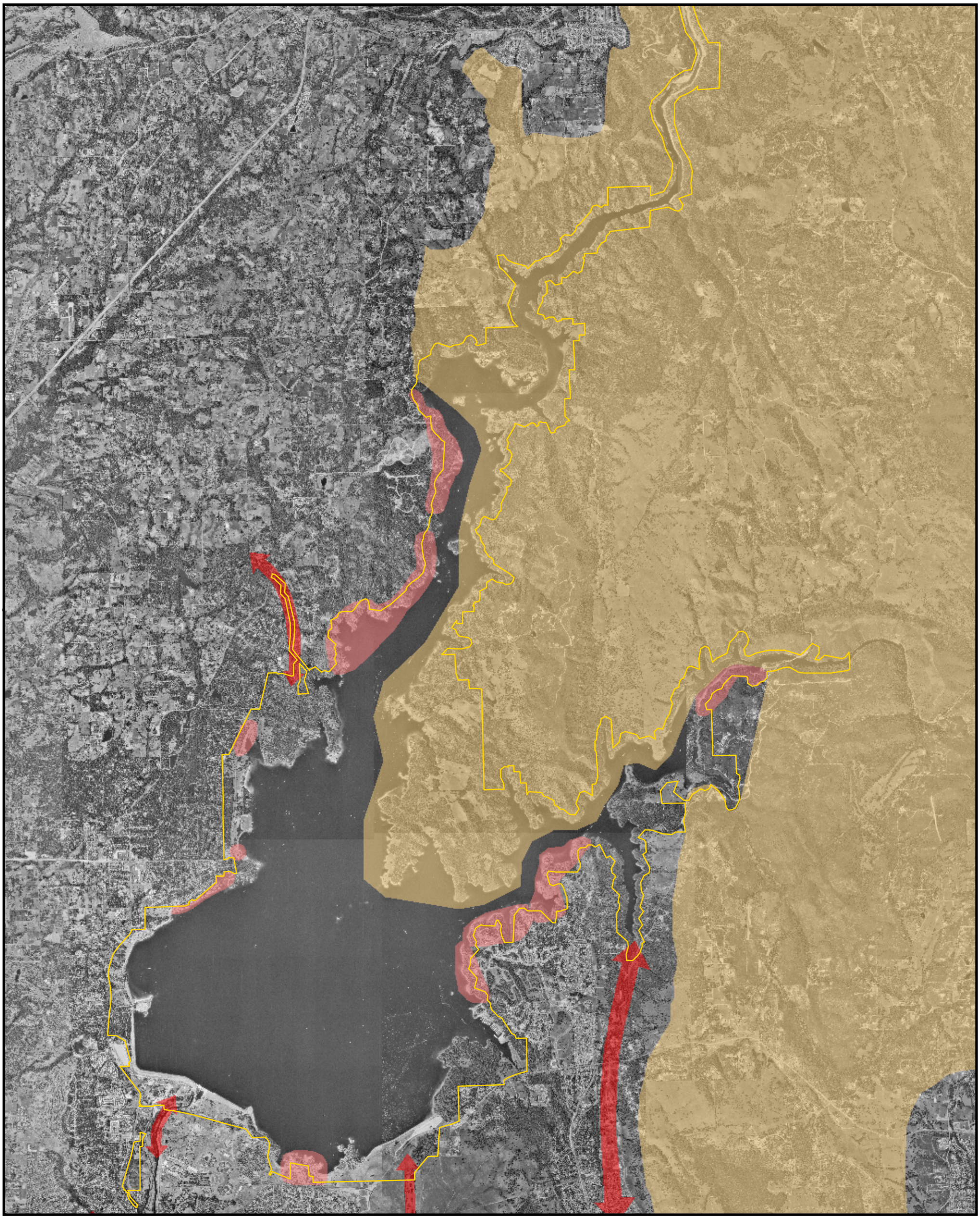
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FOLSOM LAKE STATE RECREATION AREA RESOURCE INVENTORY

FIGURE AL-1b

Wildlife Habitat and Occurrences

Prepared by LSA Associates, Inc.
Source: LSA Associates, Jones & Stokes, USGS, CDPR



UNIT BOUNDARY
OPEN MOVEMENT AREAS
MOVEMENT CORRIDOR
SEASONAL CORRIDOR

FOLSOM LAKE STATE RECREATION AREA RESOURCE INVENTORY

FIGURE AL-2a

Movement Corridors

N

0 0.25 0.5 1 1.5 2 Miles

Prepared by LSA Associates, Inc.
Source: LSA Associates, Jones & Stokes, USGS, CDPR

UNIT BOUNDARY
OPEN MOVEMENT AREAS
MOVEMENT CORRIDOR
SEASONAL CORRIDOR

FOLSOM LAKE STATE
RECREATION AREA
RESOURCE INVENTORY

FIGURE
AL-2b

Movement Corridors

N

0 0.125 0.25 0.5 0.75 1 Miles

Prepared by LSA Associates, Inc.
Source: LSA Associates, Jones & Stokes, USGS, CDPR

RECREATION, SCENIC AND CULTURAL RESOURCES

RECREATION RESOURCES

Folsom Lake State Recreation Area

April 2003

by

Wallace Roberts & Todd, LLC

1328 Mission Street, 4th Floor

San Francisco, CA 94103

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RECREATION RESOURCES

Introduction

Folsom Lake State Recreation Area (the Unit) is a significant local, regional, and state recreation resource. The two primary physical features of the Unit—Folsom Lake and Lake Natoma—are also its principal recreational attractions. While aquatic activities such as boating, water skiing, sailing, and swimming are the most popular activities in the Unit, land-based activities such as hiking, biking, picnicking, camping, and horseback riding also attract visitors. With more than 1.5 million visitors in 2000, the Unit is one of the most popular in the California Department of Parks and Recreation (CDPR) system.[1] Recreational activities in the Unit have changed significantly since the first facilities were opened to the public in 1958, and even since the first General Plan for the Unit was adopted in 1979. The popularity of personal watercraft (jetskis) and sailing has transformed the boating environment on Folsom Lake. Likewise, kayaking and other paddling sports have become favorite activities on Lake Natoma. The popularity of rowing on Lake Natoma is witnessed by the increase in the number of annual competitions on the Lake and by annual increases in attendance at these events. Land-based recreational activities have also changed over the years. When the Unit first opened, the trails were used primarily by equestrians and hikers. The popularity of running in the 1970s, mountain biking in the 1980s, and in-line skating in the 1990s, have greatly increased trail use. With urban development surrounding the southern half of the Unit, paved trails now play an important part in the region's growing transportation network as more people commute via bicycles. These changes affect the character and level of use in the Unit, how existing facilities are used, and what future facilities may be needed.

Characteristics and Levels of Use

Visitor Attendance

CDPR tracks visitor attendance for each unit in the parks system for the purposes comparing attendance with capacity and for identifying visitor and recreational use trends. Four categories are used to track visitor attendance at Folsom Lake, including paid day use, free day use, overnight (camping), and boats (launching). For each category, a conversion factor is used to calculate the number of visitors per entrance regardless of whether the entrance is paid or free. It is important to note that estimates of visitor attendance are used to supplement actual counts since not all entrances to a park unit offer attended or monitored checkpoints.

Use Characteristics

As noted, the Unit accommodated more than 1.5 million visitors in 2000. And although the Unit accommodates year-round recreation 75 percent of all visits occur during the warmer spring and summer months. This concentrated period of seasonal activity reflects the fact that water-dependent activities account for about 85 percent of all recreation visits to the Unit.[2]

---

[1] California Department of Parks and Recreation (CDPR), Gold Fields District 2000 Visitor Counts.

[2] US Army Corps of Engineers, *Final Environmental Assessment/Initial Study: American River Watershed, California Folsom Dam Modification Project,* August 2001, pg. 58.

Water-dependent activities on Folsom Lake include boating, personal watercraft use (jetskis), windsurfing, water skiing, rafting, swimming, and fishing. On Lake Natoma, water-dependent activities include paddling (kayaking, rowing, canoeing, outriggers, etc.), swimming, and fishing. Unitwide, boating is the most popular water-dependent activity accounting for approximately 30 percent of recreation demand. The remaining 15 percent of all recreation visits to the Unit are for land-based activities such as picnicking, camping, and trail use (walking, hiking, cycling, mountain biking, horseback riding, etc.).[3]

It is interesting to note the distribution of visitors across major facilities in the Unit. In 2000, approximately 70 percent of all visitors to the Unit were accommodated by just eight major facilities, as shown in Table RR-1 below. Of these facilities, Granite Bay is by far the most heavily used in the Unit, followed by Beals Point, Folsom Point, and Negro Bar. An analysis of the distribution of visitors across facilities in the Unit over the past five years seems to vary little over time.

Table RR-1: Distribution of Visitors (2000)

Facility	*Attendance*	*Percent of Total Attendance*
Granite Bay	507,712	32.0
Beals Point	219,986	14.0
Folsom Point	112,120	7.1
Brown's Ravine	66,856	4.3
Peninsula Area	19,303	1.2
Negro Bar	84,481	5.4
Nimbus Flat	38,801	2.5
Rattlesnake Bar	62,001	3.9
Total Facility Attendance	**1,111,260**	**70.7**
Total Park Attendance	**1,571,074**	

Source: CDPR; Wallace Roberts & Todd, 2003.

Recreation use and quality in the Unit are closely related to the function of Folsom Lake as a reservoir that serves the regional needs for flood control, irrigation, and water supply, particularly as it relates to water surface elevations of Folsom Lake. Water surface elevations directly affect the availability of boat ramps, beaches, berth sites, and other facilities that depend largely on water depth or surface area. These elevations can vary greatly (as much as 70 feet in normal years). The highest surface elevations occur during the rainy season and spring run-off in late winter and early spring; the lowest elevations in late fall or early winter before the rains. As a result, the elevations drop continuously from the start of the peak recreation season around Memorial Day through the season's end at Labor Day. Recreation use on Lake Natoma is less dramatically affected, since water surface levels vary minimally and tend to fluctuate on a daily basis.

[3] Ibid., pg. 58.

Park Entrance Fees

Visitor attendance is generally affected by changes in park entrance fees. In July 2000, park entrance fees in California were essentially cut in half reducing them to early 1980s levels. In addition, several add-on fees, such as for dogs, boat launching, and extra vehicles, were eliminated. As a result, CDPR reported a subsequent increase in visitor attendance of about 30 percent system wide. According to CDPR staff, no similar increase in visitor attendance occurred at Folsom Lake. On January 1, 2003, CDPR entrance fees were increased in response to the State's budget crisis. The increased fees remain below pre-2000 levels.

Recreation Facilities and Activities in the Unit

The following provides an inventory of the existing facilities and activities within the Unit. This inventory is arranged by type of facility. Recreation facilities and activities proximate to the Unit are summarized in the section that follows.

The Lakes

Folsom Lake and Lake Natoma are the primary physical features of the Unit and its main attractions. Folsom Lake measures about 11,500 surface acres in area and is the result of the damming of the American River at Folsom in the 1950s as part of the Central Valley Project. The focus of the Project is flood control, water supply, and power generation. For CDPR, the Lake provides the focus for water-dependent recreation activities and supporting facilities in the Unit along some 75 miles of shoreline. Due to the size of the Lake, and the nature of the aquatic facilities present, it is ideal for a wide range of aquatic recreation activities, including boating, sailing, fishing, swimming, etc. The upper (easternmost) arms of the lake are designated slow zones for quiet cruising, fishing, and nature appreciation. Major facilities on the Lake include five developed boat launching areas, one marina, and two formal beach areas (these facilities are described in detail later in this chapter). The use of the Lake and its shoreline facilities are affected by fluctuating water levels due to releases at Folsom Dam to the Central Valley during the dry summer months. Lake levels in a normal year will generally fall from an elevation of 466 feet at the beginning of the peak summer season to a low of 405 feet in late autumn long after the season has ended.[4] As a result, boat launch facilities are designed to maintain some level of service throughout the boating season as water levels fall. For further information, refer to the Aquatic Facilities section below.

Lake Natoma is the afterbay of Folsom Dam and is located about one mile below the dam at the foot of a steep river gorge. The lake measures approximately 500 surface acres in area and 4 miles in length from the foot of the gorge at Rainbow Bridge in Folsom to Nimbus Dam in Orangevale. The Lake is narrow, linear, and highly scenic with 14 miles of dense riparian shoreline and the Lake Natoma Bluffs stretching from Negro Bar to Mississippi Bar. The quiet and sheltered waters of the Lake make it an ideal location for paddling and rowing, swimming, and fishing. Major facilities on the Lake include 3 boat launching areas, formal beaches at Negro Bar and Nimbus Flat, and the California State University, Sacramento (CSUS) Aquatic Center just above Nimbus Dam (these facilities are described in detail later in this chapter).

---

[4] California Department of Water Resources, *Comparative Inventory of Recreation Facilities at California's Largest Reservoirs, 2000*, pg. 27.

Aquatic Facilities

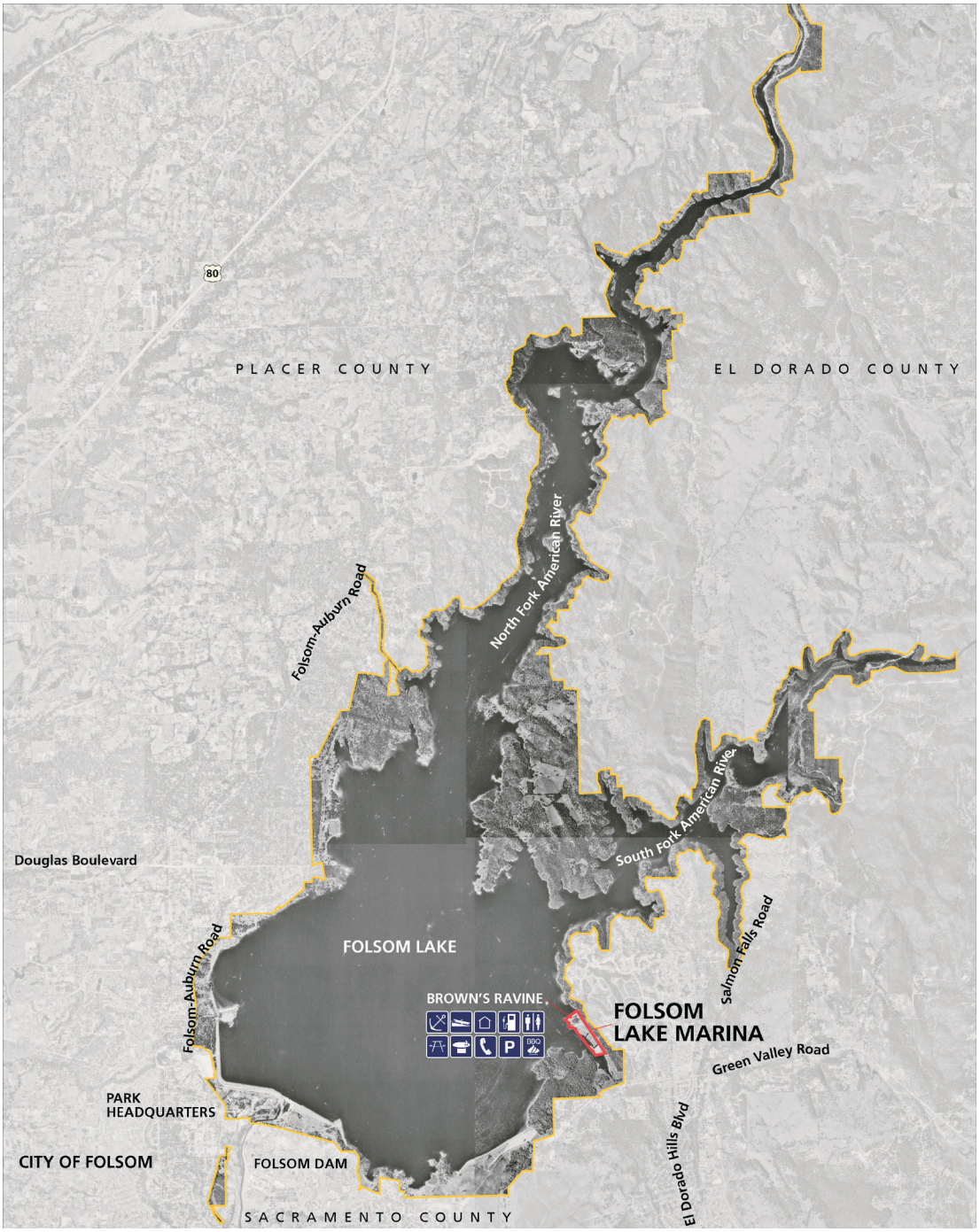
Marinas

The Folsom Lake Marina is the only marina facility in the Unit (refer to Figure RR-1). Located at Brown's Ravine, the facility includes 685 wet slips and 175 dry storage slips. Currently, there is a 5-year waiting list for one of the 72 sixteen-foot slips and 368 twenty-foot slips. A 9-year wait currently exists for one of the 245 twenty-four-foot slips. Other facilities provided at the marina are outlined in Table RR-2 below. In recent years, interest in slip rentals has increased significantly due to the difficulty in launching here on peak season weekends due to the lack of ramp and parking capacity at the main launch area. The alternative boat launch at Hobie Cove provides no relief during the peak season since it only becomes available in the fall when lake levels have dropped sufficiently to make this facility operational.

Table RR-2: Folsom Lake Marina Facilities

Boat Slips	*Total*	*16-foot Slips*	*20-foot Slips*	*24-foot Slips*	*Waiting List (years) 16 and 20-foot/24-foot*
Wet	685	72	368	245	5/9
Dry	175	N/A	N/A	N/A	5/9
Launch Ramps	*Lanes*	*Slope (%)*	*Length (ft.)*	*Construction*	*Minimum Lake Level (ft.)*
Main Ramp	4	15	420	Asphalt/ concrete	395
Hobie Cove	3	15	323	Concrete	375
Concessions	*Services Provided*				
Snack Bar	Yes				
Supply Sales	Yes				
Fuel Station	Yes				
Boat Equipment Rentals	Yes				
Parking	*Vehicle Spaces*	*Vehicle/Trailer Spaces*	*Disabled Spaces*	*Construction*	
Main Ramp		404	5	Asphalt	
Hobie Cove	41	150	3	Asphalt	
Day Use		122		Asphalt	
Restrooms/Other Facilities	*Total*				
Restrooms	2				
Information Kiosks	1				
Picnic Tables	38				
Barbeques	16				
Drinking Water	Yes				

Source: CDPR; Folsom Lake Marina Concessionaire; Wallace Roberts & Todd, 2003.



FOLSOM LAKE STATE RECREATION AREA RESOURCE INVENTORY

- Barbeques
- Boat Launch
- Toilets
- Concession
- Drinking Water
- Fueling Station
- Marina
- Picnic Area
- Public Telephone
- Vehicle Parking

FIGURE

RR-1

Marina Facilities in the Unit

Prepared by
Wallace Roberts & Todd

N

Not to Scale

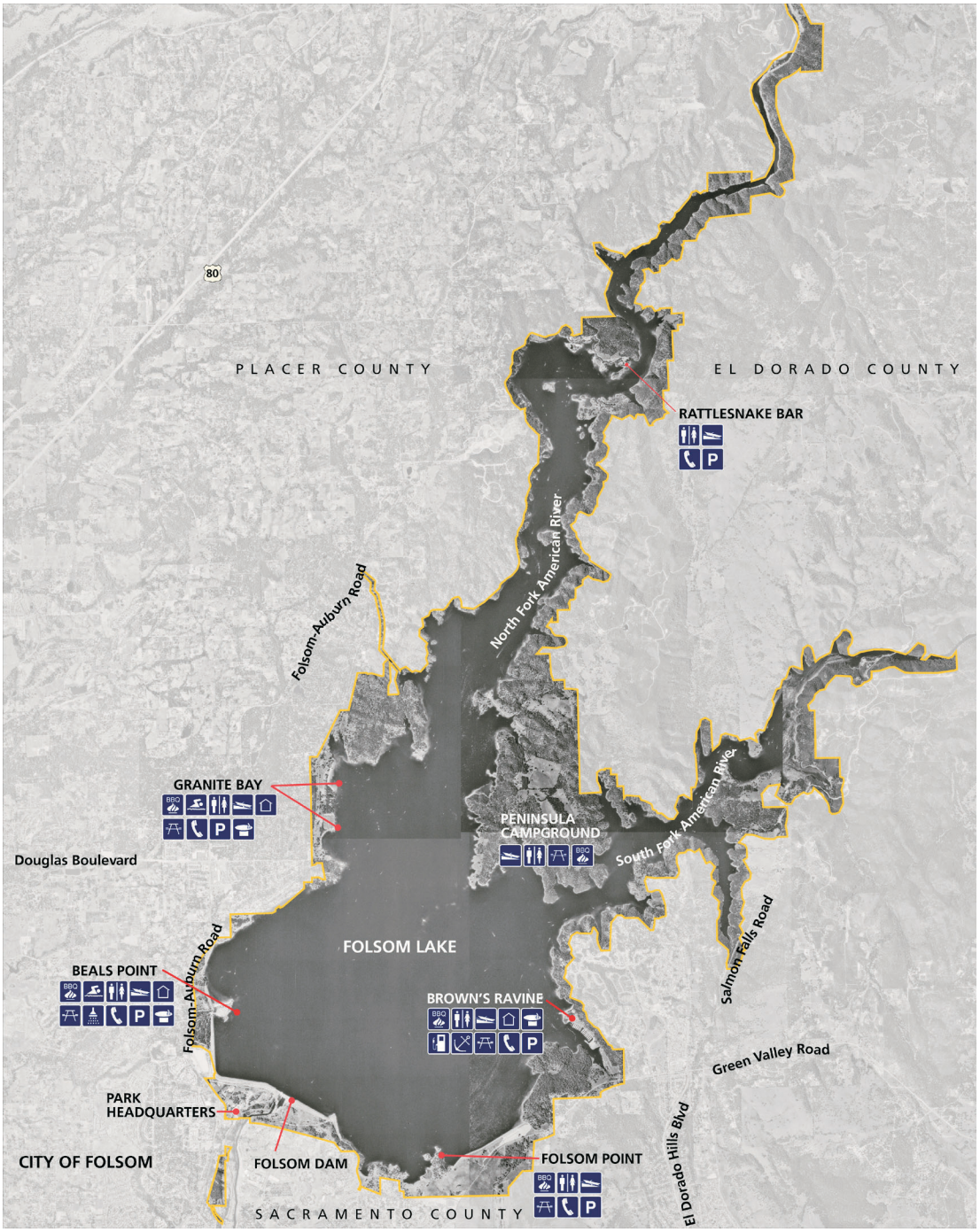
Boat Launch Facilities

There are nine distinct boat launch facilities in the Unit, six on Folsom Lake and three on Lake Natoma (refer to Figures RR-2 and RR-3). The main launch facilities on Folsom Lake are located at Granite Bay, with secondary facilities at Folsom Point, Brown's Ravine, and Rattlesnake Bar. These facilities are designed for powerboat, personal watercraft (jetski), and sailboat launching. They are fully hard surfaced, have demarcated lanes and turnaround areas, as well as adjacent parking areas. Folsom Point and Rattlesnake Bar are popular launch areas for fisherman – bass fishing tournaments are often held at Folsom Point. The waters off Dike 8 also make Folsom Point an ideal location for staging sailing regattas, and California State University Sacramento (CSUS) offers waterskiing classes here. Refer to Table RR-3 for a list and description of the existing launch facilities.

Table RR-3: Boat Launch Facilities

Folsom Lake	*Lanes*	*Slope (%)*	*Length (ft.)*	*Width (ft.)*	*Construction*	*Minimum Lake Level (ft.)*
Granite Bay						
Stage 1	2	15	300	60	Concrete	395
Stage 2	10	10	250	700	Asphalt/concrete	426
Stage 3	10	10	250	700	Asphalt/concrete	435
Stage 4	14	15	180/250	330	Asphalt/concrete	425
5 Percent	4	5	1,200	60	Asphalt	408
Low Water	2	15	60	45	Concrete	360
Folsom Point	4	11	900	80	Asphalt	406
Brown's Ravine						
Main Ramp	4	15	420	60	Asphalt/concrete	395
Hobie Cove	3	15	323	60	Concrete	375
Rattlesnake Bar	2	2	300	40	Asphalt	425
Peninsula						
Day Use	1	15	260	30	Concrete	434
South Ramp	1	10	750	25	Asphalt/concrete	410
Beals Point	1	5	400	40	Gravel	420
Lake Natoma	*Lanes*	*Slope (%)*	*Length (ft.)*	*Width (ft.)*	*Construction*	*Minimum Lake Level (ft.)*
Negro Bar	2	5	200	60	Concrete	200
Nimbus Flat						
Main Ramp	2	1	60	30	Concrete	115
Alternate	1	1	30	30	Gravel	120
Willow Creek	1	1	35	12	Gravel	35

Source: CDPR; Wallace Roberts & Todd, 2003.



FOLSOM LAKE STATE RECREATION AREA RESOURCE INVENTORY

- Barbeques
- Beach
- Boat Launch
- Comfort Station
- Concession
- Drinking Water
- Fueling Station
- Marina
- Picnic Area
- Shower
- Public Telephone
- Vehicle Parking

FIGURE

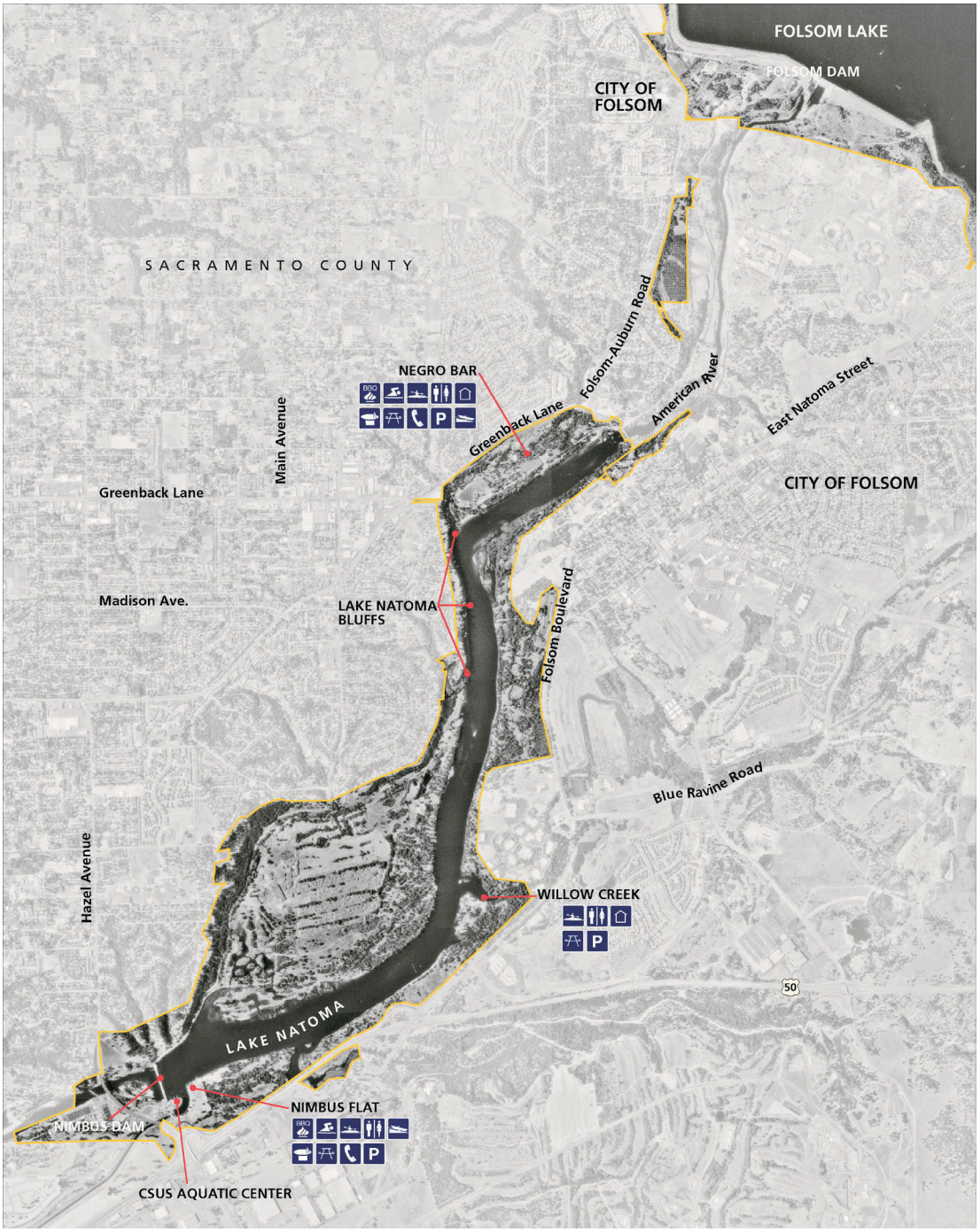
RR-2

Boat Launch Facilities at Folsom Lake

Prepared by
Wallace Roberts & Todd

N

Not to Scale



FOLSOM LAKE STATE RECREATION AREA RESOURCE INVENTORY

- Barbeques
- Beach
- Boat Launch
- Toilets
- Concession
- Drinking Water
- Picnic Area
- Public Telephone
- Vehicle Parking
- Cartop Boat Launch

FIGURE

RR-3

Boat Launch Facilities at Lake Natoma

Prepared by
Wallace Roberts & Todd

N

Not to Scale

An informal boat launch at Beals Point is also popular with fisherman and other small craft owners. Due to their remote location, the two ramps at the Peninsula are used more as mooring points to access this isolated area. On Lake Natoma, the 5 mph speed limit for motorized watercraft means that launch facilities on the Lake are used primarily by paddlers, rowers, and fisherman. The Negro Bar launch is popular with fisherman, as is the launch at Willow Creek, which is largely unimproved. The docks at Nimbus Flat are primarily for non-motorized boat users, such as kayakers, paddlers, and rowers.

Table RR-4: Parking Capacity of Boat Launch Facilities

Folsom Lake	*Vehicle Spaces*	*Vehicle/Trailer Spaces*	*Disabled Spaces*
Granite Bay			
Stage 1[1]	100		
Stage 2[1]	250		
Stage 3[1]	300		
Stage 4	391		9
5 Percent	43	48	
Low Water[1]	27		
Folsom Point	25	100	4
Brown's Ravine[2]	41	554	8
Rattlesnake Bar	25	64	5
Peninsula			
Day Use[1]		60	
South Ramp[1]	50		
Beals Point[3]	370	9	8
Lake Natoma	*Vehicle Spaces*	*Trailer Spaces*	*Disabled Spaces*
Negro Bar[1]	300		
Nimbus Flat[3]	101	122	8
Willow Creek[3]	19		1

[1] Estimated capacity as vehicle spaces are not striped.
[2] Includes Main Ramp and Hobie Cove.
[3] Separate launch area parking not provided.

Source: CDPR; Wallace Roberts & Todd, 2003.

Boat launch capacity in the Unit is a concern, particularly during peak season weekends at Granite Bay, Folsom Point, and Brown's Ravine, when ramps become congested. A preliminary review of boat launch capacity using Department of Boating and Waterways (DBW) guidelines found that many of the ramps are not being used to their full design capacity. The results of this review are summarized in Table RR-9. While new ramps, additional ramp lanes, and expanded turnaround areas could put more boats in the water, the difficulty is that after launching there is not adequate area to park, particularly at Brown's Ravine and Folsom Point. It should be noted that in day use facilities where boat launching is clearly a secondary activity—such as at Beals Point, Nimbus Flat, and Willow Creek—separate launch area parking is not provided and that the day use parking area must serve all users. The DBW guidelines for launch area parking is between 20 and 30 vehicle/ trailer

spaces per launch lane. Table RR-4 above summarizes the parking capacity at boat launch facilities in the Unit.

Whitewater Rafting Facilities

Commercial and private whitewater rafting are popular activities on the South Fork of the American River. The 21-mile run between Chili Bar Dam near Highway 193 and Salmon Falls Road at the upper extent of Folsom Lake is the highest use river segment in the West. The river offers a diversity of rafting experiences—with Class I through Class III rapids—along with classic scenery and narrow rocky gorges all within relatively easy reach of Sacramento. Several agencies have jurisdiction in this run of the American River: the U.S. Bureau of Land Management (BLM) owns 12.5 miles of river frontage; CDPR owns 1.5 miles of river frontage between Hospital Bar and Salmon Falls Road; and El Dorado County is responsible for permitting river use by commercial outfitters.

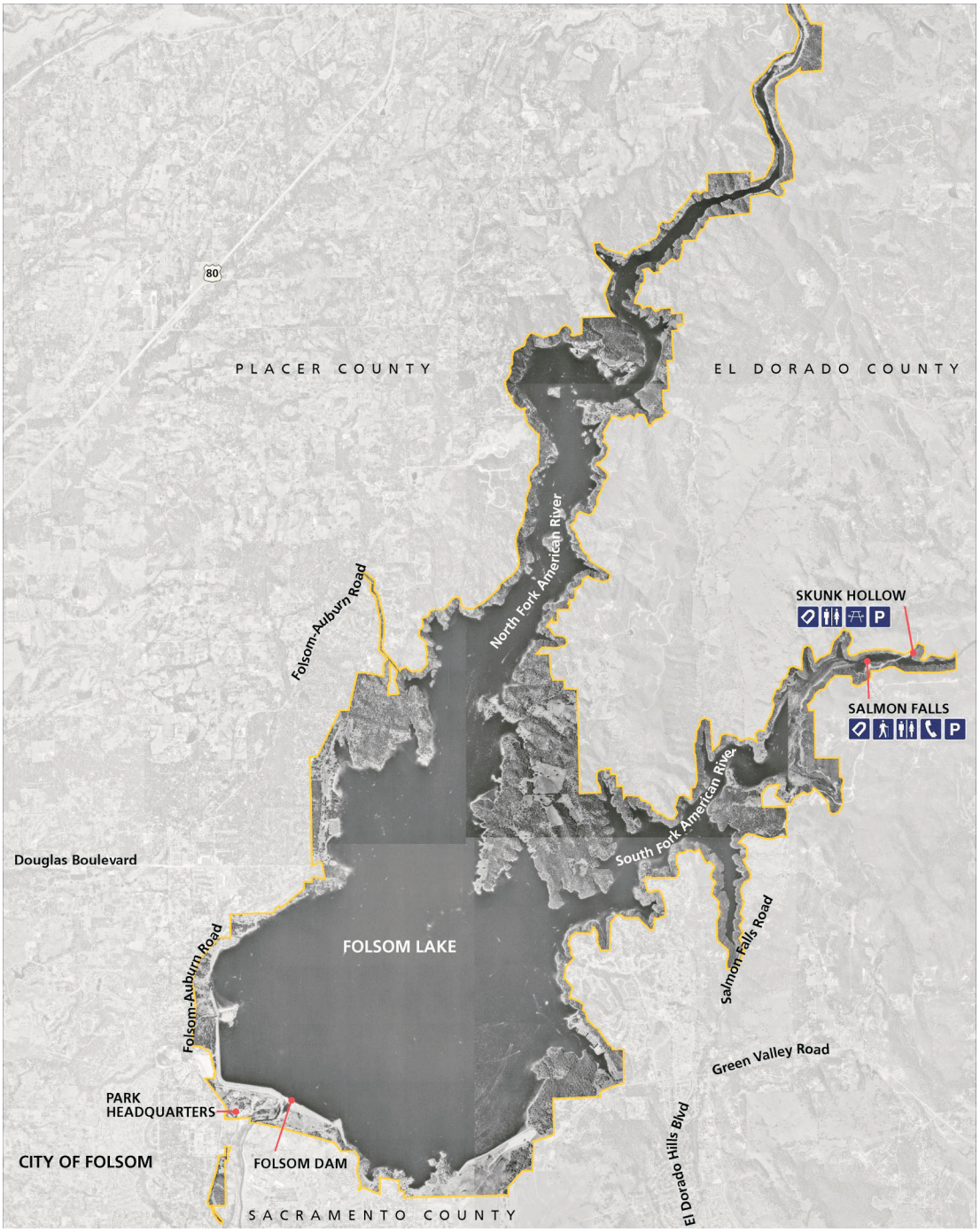
There are currently about 40 commercial rafting outfitters on the South Fork with 67 permits in existence. These outfitters must obtain river use permits from El Dorado County which specify, among other things, the number of weekday and weekend trips permitted, the number of rafts and rafters per group, and insurance requirements.[5] Permits are not required for private boats. The current daily boater total threshold is 3,200 boaters on two days during any one season.[6]

Table RR-5: Whitewater Rafting Facilities

Skunk Hollow				
Parking	*Vehicle Spaces*	*Disabled Spaces*	*Loading Area*	*Construction*
Day Use	35	2	Yes	Asphalt
Restrooms/Other Facilities	*Total/Description*			
Vault Toilets	2			
Picnic Tables	3			
Drinking Water	No			
Raft Drying Rails	Yes			
Salmon Falls				
Parking	*Vehicle Spaces*	*Vehicle/Trailer Spaces*	*Disabled Spaces*	*Construction*
Day Use	32	12	1	Asphalt
Restrooms/Other Facilities	*Total/Description*			
Vault Toilets	2			
Picnic Tables	No			
Drinking Water	Yes			
Raft Drying Rails	No			

Source: CDPR; Wallace Roberts & Todd, 2003.

[5] County of El Dorado, *El Dorado County River Management Plan*, November 2001, pg. E-6.
[6] Ibid., pg. D-2.



FOLSOM LAKE STATE RECREATION AREA RESOURCE INVENTORY

- Toilets
- Picnic Area
- Raft Take- Out
- Public Telephone
- Vehicle Parking
- Trail Access

FIGURE

RR-4

Whitewater Rafting Facilties in the Unit

Prepared by
Wallace Roberts & Todd

N

Not to Scale

The Unit facilities at Salmon Falls and Skunk Hollow—located where Salmon Falls Road in El Dorado County crosses the South Fork—are specifically intended to accommodate rafting activity on the river (refer to Figure RR-4 above). According to CDPR staff, approximately 9,000 commercial boats take-out at the Salmon Falls facility (they are prohibited to do so at Skunk Hollow), or between 50,000 and 60,000 boaters. Facilities here include a large area for bus parking and queuing, informal take-out area, four vault toilets, and drinking water. It is estimated that as many as 4,000 additional private boats (roughly 24,000 boaters) take-out at the Skunk Hollow facility. Facilities here include a small paved parking area for 35 vehicles, a raft loading zone with drying rails, two vault toilets, a paved path from the river up to the parking area, and several picnic tables. Table RR-5 above summarizes the improvements at these facilities. Both the Skunk Hollow and Salmon Falls facilities receive heavy use during peak season weekends. Both facilities are often used as a parking area for the nearby Darrington and Sweetwater trails.

Terrestrial Facilities

Campgrounds

There are a total of 176 campsites in the Unit that accommodate tent, trailer, RV, and group campers (refer to Figures RR-4 and RR-5). Table RR-6 provides a summary list of the features at each facility.

Peninsula Campground

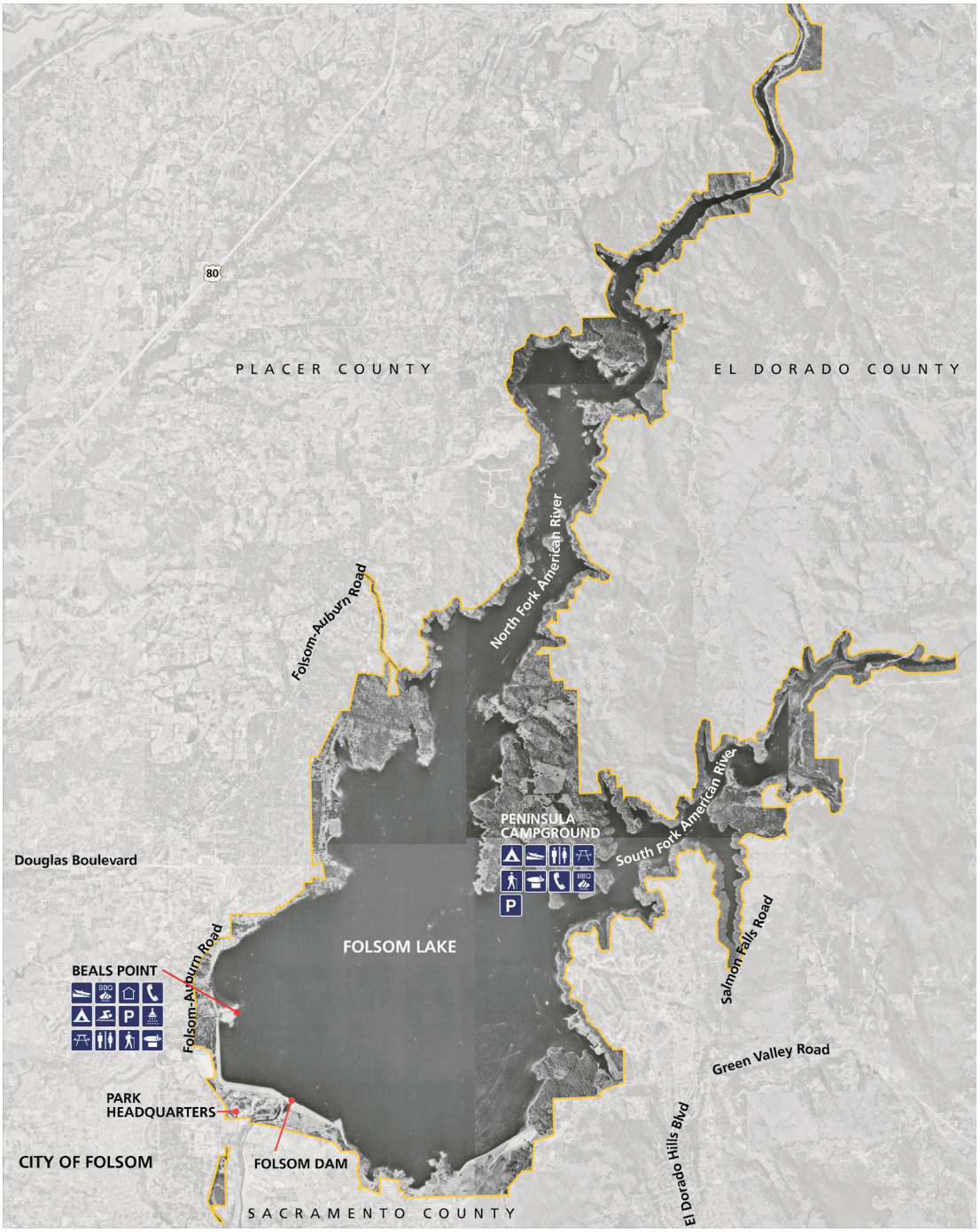
The Peninsula Campground is located at the tip of the peninsula that separates the North and South Forks of the American River. This facility is located in what is the most natural and least disturbed portion of the Unit, an area characterized by rolling hills, open grasslands, and scattered oak and pine groves. Access to the site is provided by Rattlesnake Bar Road which connects to Highway 49 at Pilot Hill about 9 miles away. The campground includes 104 sites that can accommodate a maximum trailer length of 18 feet and RV length of 24 feet. The facility also includes five restrooms (no showers), one boat ramp, and a small amphitheater suitable for group use. Located nearby is temporary seasonal housing for four Park employees, a permanent park ranger residence, and a small maintenance yard.

Beals Point Campground

The Beals Point Campground is located adjacent to the popular Beals Point day use area. The facility includes 49 single campsites, 20 RV sites, a sanitary dump station, two restrooms, and showers. The RV sites were constructed with electrical hookup, however this service is no longer provided since the costs of providing the service are not recoverable under the current fee structure. The RV sites were constructed as mitigation for the loss of the family campsites at Negro Bar that were removed for the construction of the Lake Natoma crossing. Campers have easy access to all of the day use facilities provided at Beals Point, including trails, the beach, boat launch, picnic area and snack bar.

Negro Bar Group Campground

The campground at Negro Bar is comprised of 3 reservation only group campsites designed to accommodate approximately 50 people each. A restroom is also provided. The group campground is located in the northeastern portion of Negro Bar near the boat launch just downstream from the Rainbow Bridge. A family campsite was once also located in this area



FOLSOM LAKE STATE RECREATION AREA RESOURCE INVENTORY

- Barbeques
- Beach
- Boat Launch
- Camping
- Toilets
- Concession
- Drinking Water
- Picnic Area
- Shower
- Public Telephone
- Trail Access
- Vehicle Parking

FIGURE

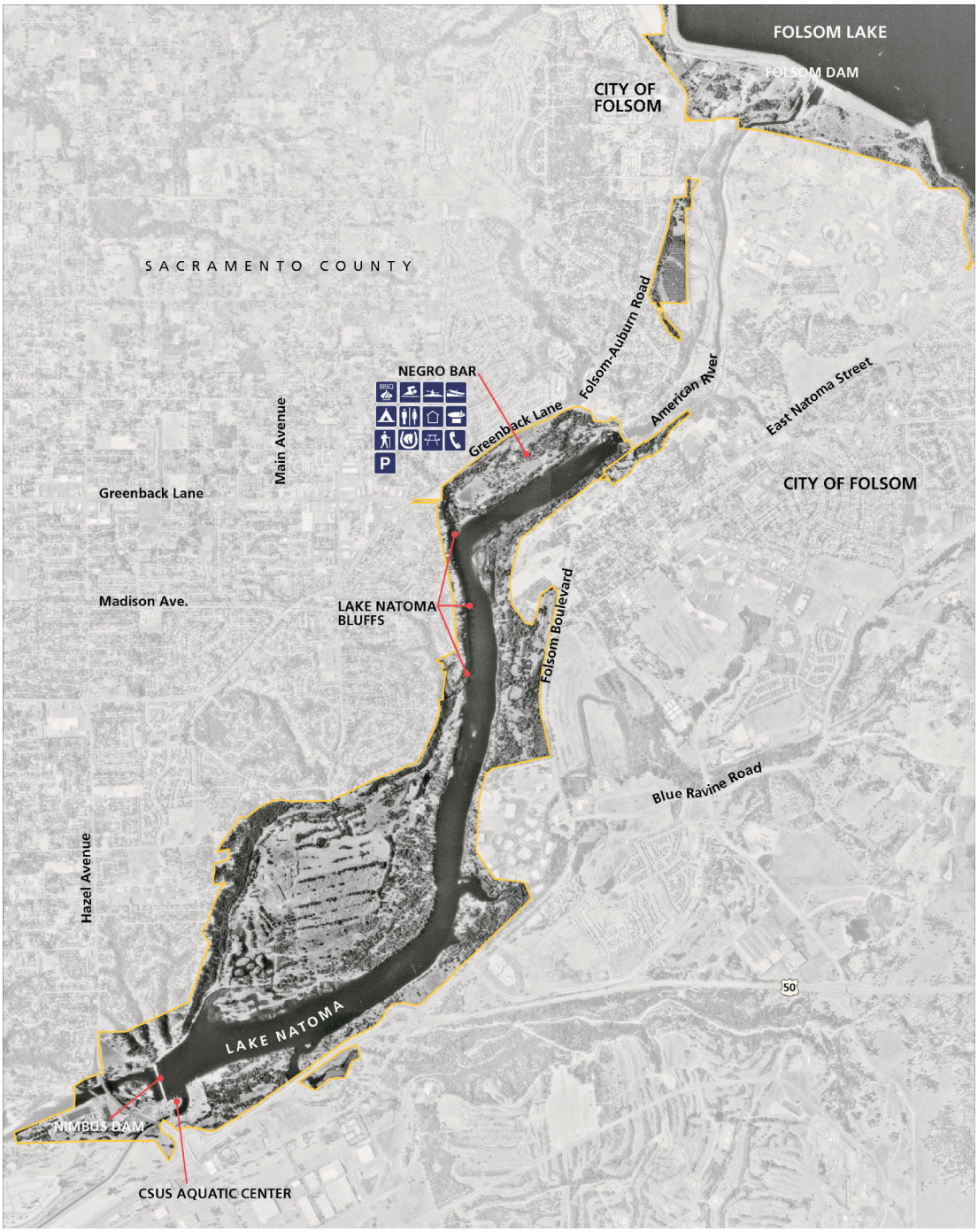
RR-5

Campgrounds at Folsom Lake

Prepared by
Wallace Roberts & Todd

N

Not to Scale



FOLSOM LAKE STATE RECREATION AREA RESOURCE INVENTORY

- Barbeques
- Beach
- Boat Launch
- Camping
- Toilets
- Concession
- Drinking Water
- Horse Assembly
- Picnic Area
- Public Telephone
- Trail Access
- Vehicle Parking
- Cartop Boat Launch

FIGURE

RR-6

Campgrounds at Lake Natoma

Prepared by
Wallace Roberts & Todd

N

Not to Scale

of Negro Bar but was removed to make way for the Lake Natoma crossing in the late 1990s. Campers here have easy access to all of the day use facilities provided at Negro Bar, including hiking, cycling, and equestrian trails, the beach, boat launch and rentals and picnic area.

Table RR-6: Campground Facilities

Peninsula Campground	*Total/Description*
Campsites	104 single
Restrooms	5
Showers	No
Hookups	No
Picnic Tables	104
Fire Pits	104
Drinking Water	Yes
Boat Ramps	1
Beals Point Campground	*Total/Description*
Campsites	49 single/20 RV
Restrooms	2
Showers	Yes
Hookups	Sanitary for RV sites
Picnic Tables	69
Fire Pits	69
Drinking Water	Yes
Negro Bar Group Area	*Total/Description*
Campsites	3 group
Restrooms	1
Hookups	No
Picnic Tables	17
Barbeques	15
Fire Pits	5
Drinking Water	Yes

Source: CDPR; Wallace Roberts & Todd, 2003.

Day Use Facilities

Day use facilities are the primary gateways to the Unit and all it has to offer (refer to Figures RR-7 and RR-8). These facilities are also the busiest in the Unit and accommodate the majority of total visitors. Table RR-7 provides a summary list of the features at each facility.

Beals Point

Beals Point is second only to Granite Bay as the busiest day use facility in the Unit. This facility provides a 1,000–foot long guarded swim beach (summer season only) and concessions facility with a snack bar, beach equipment rentals, restrooms, and paved parking for 500 vehicles. A large grassy area along the lake includes picnic tables, barbeques, and

restroom facilities. The paved multi-use Lake Natoma Trail begins here and heads west along both lakes to Nimbus Dam and the unpaved multi-use Granite Bay Trail connects Beals Point to other facilities along Folsom Lake. The aquatic facilities at Beals Point are outlined in the Boat Launch Facilities section above. There are two primary issues with respect to this facility. The first is capacity, as the parking area generally fills by midday during peak season weekends causing traffic to backup onto Auburn-Folsom Road and surrounding neighborhood streets. This also makes it difficult for campers with reservations to enter the Unit. The second is unrestricted shoreline access to the shoreline area. When lake levels fall, the shoreline becomes exposed allowing motorized vehicles to access the shoreline. Unrestricted access along the shoreline means that day users and boaters often drive on the shoreline to the water's edge causing erosion damage, impacting cultural resource sites located below the high water line and potentially impacting water quality. A secondary issue and an ongoing is a problem with ground squirrels that are habituated to the presence of humans. According to CDPR staff, day users complain that the animals are aggressive.

Granite Bay

The most popular day use facility in the Unit is Granite Bay with a series of facilities spread over three distinct subareas. The Main Beach area includes a 1,200-foot long guarded swim beach (summer season only), snack bar and beach equipment concessions, restrooms, a grassy picnic area, tot lot, and a paved parking area for vehicles. The North Granite area is popular for fishing, horseback riding, and hiking. This area includes an informal beach area at Oak Point, equestrian staging area, Dotons Point, and Beeks Bight. An activity center located just north of the Main Beach is available by reservation for group use and includes a small picnic area. Trail facilities at Granite Bay include the equestrian and pedestrian Pioneer Express Trail running north to Auburn SRA, 8 miles of dirt multi-use trails running through the area, and a dirt pedestrian and ADA only trail in the Beeks Bight area. The boat launch area and its associated facilities are outlined in the Boat Launch and Ramp Facilities section above. As with Beals Point, capacity is a major concern at Granite Bay, particularly during peak season weekends when the day use parking area at Main Beach and the parking area and launch ramps at the launch area fill by midday. Access is another concern: there is only one entrance to Granite Bay at Douglas Boulevard and significant backups occur along the roadway and onto Auburn-Folsom Road when the parking areas fill. In addition, there is no external access to the sprawling and relatively remote North Granite area. A second access here could relieve some pressure on Douglas Boulevard and make the area easier to monitor and patrol. Unrestricted vehicle access along the shoreline at low water is also a concern in the North Granite area. Unrestricted vehicle access causes erosion, potentially impacts water quality, damages vegetation and threatens cultural resources located below the high water line.

Old Salmon Falls

Old Salmon Falls is located on Salmon Falls Road in El Dorado County between Brown's Ravine and the whitewater rafting facilities at the South Fork of the American River. The upper portion of the facility just off Salmon Falls Road—commonly referred to as Falcon Crest—includes an informal parking area used as an equestrian staging area, and access to a hiking and horseback riding trail that drops down to the site of the old Monte Vista campground about one mile to the west. From Falcon Crest a narrow road drops down to a lower area on the shore of Folsom Lake. Facilities here include a small unpaved parking area and portable toilet. This area is used for fishing, swimming, and as a trailhead for Brown's Ravine and Sweetwater trails. Issues related to the Old Salmon Falls area include unrestricted

vehicle access to the shoreline, particularly when lake levels are low, that could lead to damage and erosion, and possible erosion problems on State land and trails resulting from the country-estate residential subdivision currently under construction on the nearby hills above the lake. Finally, the old Monte Vista campground site appears to offer opportunities for enhanced visitor facilities. The area has been discussed as a possible site on which to establish an environmental camping area (no services), but nearby residential development could pose a constraint to public use of the area.

Sweetwater Creek

Sweetwater Creek is located midway between Old Salmon Falls and the Salmon Falls Bridge. A widened shoulder just off Salmon Falls Road doubles as an informal parking area where a gate marks the trailhead for the Sweetwater Trail. This dirt multi-use trail runs east about 2 miles to the Salmon Falls Bridge and the Darrington Trail. An informal trail runs west from here to Old Salmon Falls and the Brown's Ravine Trail.

Peninsula

The Peninsula day use facility is located about 1 mile north of the Peninsula Campground on the eastern shore of Folsom Lake. Due to its remote location, this facility is used primarily by boat-in users. The site consists of a small concrete boat ramp, two portable toilets, picnic tables with ramadas and barbeques, and a small informal beach area. The provision of drinking water and vault toilets at this site would make it more enjoyable for users. The extension of the Darrington Trail from the Peninsula Campground to the day use area is also a possibility.

Folsom Point

Folsom Point, located off East Natoma Street between Folsom Dam Road and Green Valley Road, is the most popular day use area on the eastern shore of Folsom Lake. Facilities here include a shaded picnic area with tables and barbeques, two vault toilets, and parking for 77 vehicles. As noted in the Boat Launch Facilities section, Folsom Point also includes the largest formal boat launch facilities on this side of the Lake, and restrooms are being built here. The popularity of Folsom Point for the staging of special aquatic events causes both the aquatic and day uses facilities reach capacity quickly during peak season weekends. Another issue here is the fact that the picnic area appears eroded and worn due to heavy foot traffic and informal parking off paved surfaces. Access to the shoreline is also informal. Possible improvements here could include additional picnic capacity, formalized parking area, and formalized water access and shoreline area, such as a beach. The suitability of the Dike 8 area of Folsom Point for a multi-use facility or an aquatic facility for various boat clubs—California State University Sacramento (CSUS) uses this area of Folsom Lake for waterskiing lessons—should be explored. Finally, there is an opportunity here for a trail linking Folsom Point to nearby neighborhoods in the City of Folsom.

Observation Point

Observation Point is located on Folsom Dam Road at the eastern end of the Dam and offers sweeping views of Folsom Lake. In the past, Observation Point was a popular place for meeting and fishing and swimming. When lake levels are low, Observation Point also provides a good starting place for hiking the informal trail along the eastern shoreline to Brown's Ravine. However, this facility is now closed to public access and has been since

Table RR-7: Day Use Facilities

Beals Point	*Total/Description*
Beach	Yes (guarded)
Concession	Snack bar/beach equipment
Restrooms	3
Picnic Tables	53
Barbeques	31
Drinking Water	Yes
Trail Access	Lake Natoma/Granite Bay
Parking	387(including 8 disabled)
Granite Bay	*Total/Notes*
Beach	Yes (guarded)
Concession	Snack bar/beach equipment/boating equipment
Restrooms	5
Picnic Tables	100
Barbeques	42
Activity Center	Group use by reservation
Drinking Water	Yes
Equestrian Staging Area	Yes
Trail Access	Pioneer Express/Granite Bay/Beeks Bight-to Dotons/Beeks Bight ADA
Parking	677
Old Salmon Falls	*Total/Notes*
Chemical Toilets	2
Drinking Water	No
Equestrian Staging Area	Yes
Trail Access	Brown's Ravine/Sweetwater Creek
Parking[1]	15
Peninsula	*Total/Notes*
Boat Ramp	Yes
Chemical Toilets	2
Picnic Tables	6 with ramadas
Drinking Water	No
Trail Access	No
Parking[1]	60
Folsom Point	*Total/Notes*
Vault Toilets	2
Picnic Tables	50
Barbeques	46
Drinking Water	No
Trail Access	Brown's Ravine
Parking	77 (including 2 disabled)

Table RR-7: Day Use Facilities

Observation Point	*Total/Notes*
Picnic Tables	No
Restrooms/Toilets	No
Drinking Water	No
Trail Access	No
Parking	77 (including 2 disabled)
Folsom Powerhouse	*Total/Notes*
Main Powerhouse	Museum
Concessions	Gift shop
Restrooms	1
Picnic Tables	10
Drinking Water	Yes
Trail Access	Powerhouse Loop
Parking[1]	35
Willow Creek	*Total/Notes*
Concessions	Boating equipment
Boat Ramp	Yes
Vault Toilets	2
Picnic Tables	4
Barbeques	No
Drinking Water	No
Trail Access	Lake Natoma
Parking[1]	20 (including 1 disabled)
Nimbus Flat	*Total/Notes*
Beach	Yes (unguarded)
Restrooms	2
Picnic Tables	37
Barbeques	11
Boat Ramp	2 small docks
Drinking Water	Yes
Trail Access	Lake Natoma
Parking	231 (including 8 disabled)
Lake Overlook	*Total/Notes*
Restrooms/Toilets	No
Picnic Tables	No
Drinking Water	No
Equestrian Staging Area	Yes
Trail Access	Lake Natoma
Parking[1]	150

Table RR-7: Day Use Facilities

Negro Bar	*Total/Notes*
Beach	Yes (unguarded)
Concessions	Boating equipment
Restrooms	2
Picnic Tables	32
Barbeques	4
Boat Ramp	Yes
Drinking Water	Yes
Trail Access	Lake Natoma
Parking	96 (including 4 disabled)

[1] Estimated capacity as vehicle spaces are not striped.

Source: CDPR; Wallace Roberts & Todd, 2003.

September 11, 2001, due to security concerns associated with Folsom Dam, past illegal activity at the site (drinking and partying), and CDPR staffing levels. The near-term future of Observation Point is an issue as the area provides an ideal staging area for construction vehicles and equipment associated with the Folsom Dam Modification Project and the proposed Folsom Dam Raise Project. The site is currently being used as a staging area for the installation of a temperature control intake device. Beginning in late 2003, the site will be used as a staging area for the outlet modifications phase of the Folsom Dam Modification Project. This three-year project will enlarge eight existing river outlets to increase water releases from Folsom Lake during flood events.[7] In order to complete this work, approximately 30,000 cubic yards of sediment that has accumulated upstream from the dam will have to be removed. Later phases of the dam raise project may also involve this area with construction expected to begin in 2006 or 2007 and last about 5 years. With the completion of construction, this area could serve several possible roles, assuming it remains accessible after the dam raise and associated security issues are resolved. Possible uses suggested include a view restaurant or a multi-use activity center, both of which would require that sewer and water services be extended to the site. A multi-use trail link to Folsom Point in the east and the bicycle trail and hiking and horseback trails in the west would improve non-vehicular access to Observation Point.

Folsom Powerhouse State Historic Park

The Folsom Powerhouse is the most important historic and interpretive facility in the Unit and is located in the City of Folsom at the intersection of Riley and Scott Streets above the Lake Natoma shoreline. It is one of the oldest hydroelectric facilities in the world and was the nation's first power system to provide high-voltage alternative current over long distance transmission lines for major municipal and industrial use.[8] The Powerhouse was operated by Pacific Gas and Electric Company until 1952 when the old dam associated with the powerhouse was destroyed during the construction of the new Folsom Dam. The powerhouse, which is listed on the National Register of Historic Places, includes the main

[7] U.S. Army Corps of Engineers, American River Watershed, California, Folsom Dam Modification Project, August 2001, pg. 9.

[8] California State Parks, *Folsom Powerhouse State Historic Park Brochure*, 2002.

powerhouse museum, lower powerhouse, associated forebay and wooden flumes, blacksmith shop (gift shop), picnic area, a comfort station, and a small parking area. Significant improvements are already planned for this day use facility, including seismic upgrades, a larger parking area with room for buses, and a new visitor center to be located on the north side of the Powerhouse entrance. These improvements are likely to increase attendance to the Powerhouse, particularly if the American River Water Education Center moves from it's current location at Park headquarters to this new visitor center. The new visitor center will address the primary concern at this facility, which to date has been the lack of appropriate facilities to accommodate attendance. However, another concern, one that will not be addressed by the visitor center, is the lack of a formal bicycle path/multi-use trail along the shoreline between the Lake Natoma Crossing and the Rainbow Bridge at Greenback Lane. Cyclists and pedestrians using the east Lake Natoma bike path must use Riley and Leidesdorff Streets along this stretch. This portion of the shoreline below the Powerhouse is accessed by a combination of informal trails. Finally, there are problems at the Powerhouse with vandalism, including graffiti, which has necessitated the installation of security fencing on all but the shoreline side of the site.

Willow Creek

This secluded day-use area is located on the Willow Creek inlet to Lake Natoma off Folsom Boulevard between Blue Ravine Road and Natoma Station Drive. The site is popular for fishing, canoeing, picnicking, bird watching, and accessing the paved Lake Natoma Trail and multi-use trail along the shoreline. Facilities here include a small picnic area, canoe and kayak concession, gravel parking and turnaround area, small boat ramp, and vault toilets. Due to the popularity of this site, the development of additional facilities may be necessary to minimize the wear and tear and erosion caused by informal parking in the picnic area. Other ideas suggested for the area include an environmental camping area and enhanced interpretive opportunities of the heron and egret rookery located just across the lake. The storage containers used by the concessionaire are unsightly and diminish the natural scenery.

Nimbus Flat

Nimbus Flat is located on a broad, flat area of shoreline just upstream from Nimbus Dam and adjacent to the CSUS Aquatic Center. A wide range of facilities are offered here, including two small unguarded beaches, observation area, grassy picnic area with tables, two small boat docks, boat ramp, two restrooms, and a large paved parking area for 231 vehicles. Access to the paved Lake Natoma Trail and dirt multi-use trail is also available. Nimbus Flat provides the ideal location for watching the various rowing competitions and events hosted by the neighboring CSUS Aquatic Center on Lake Natoma. The Aquatic Center, which hosts between eight and ten major events each year, obtains permits from CDPR to use Nimbus Flat to stage these events. These events include collegiate and intercollegiate rowing championships, regional and national masters-level rowing regattas, and other events. The use of Nimbus Flat by the Aquatic Center for major competitions and events, particularly during peak season weekends, results in capacity conditions early in the day and complaints that access to the area for non-competition related activities is difficult. . The popularity of these events and of Nimbus Flat as a day use area spurred the significant improvements to the area made in recent years, including the redesigned shoreline and parking area and the new observation area. While there is room for expansion of the area, the capacity of Lake Natoma to handle further recreational use should be carefully considered.

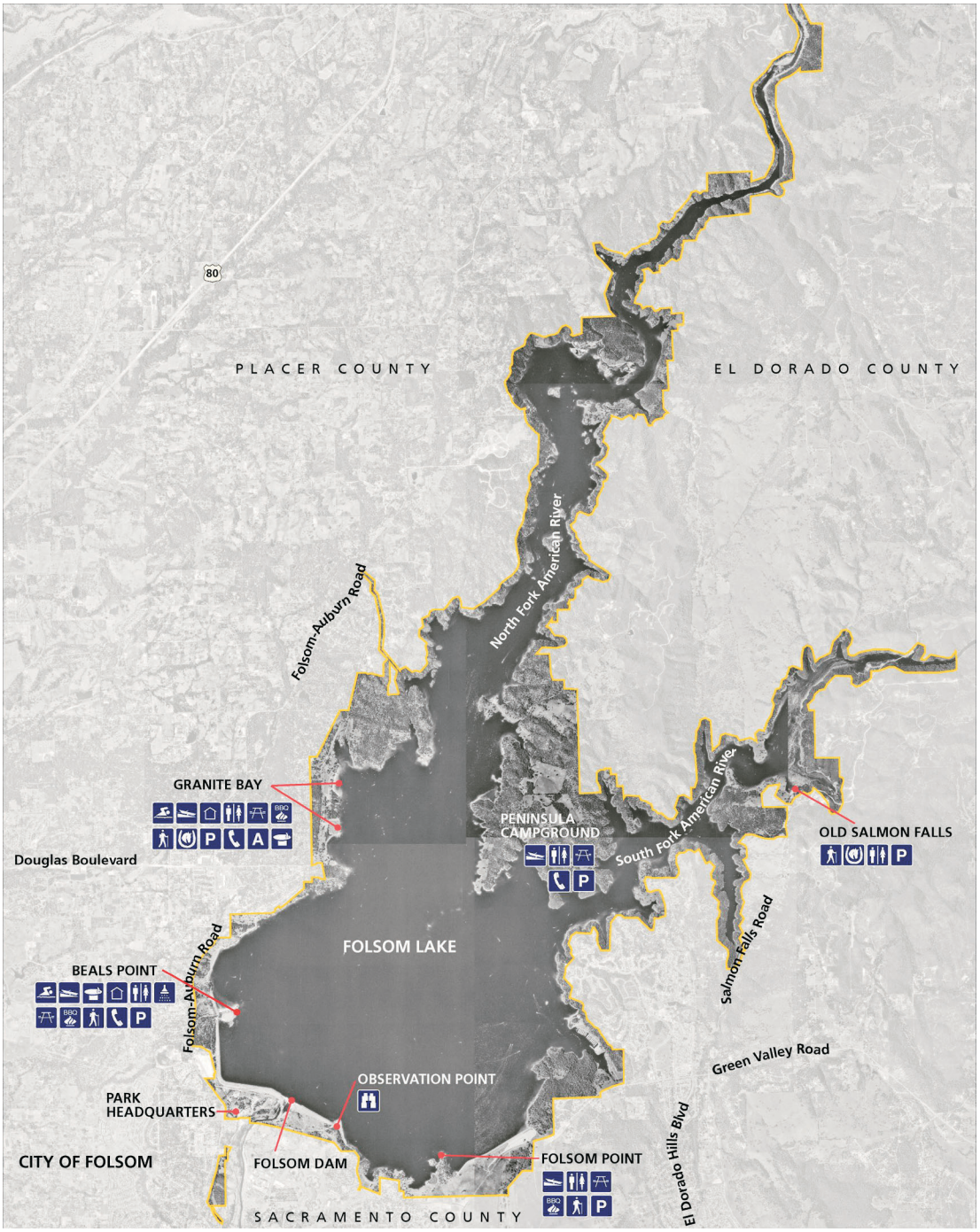
Lake Overlook

Lake Overlook is located above the north end of Nimbus Dam in Orangevale, just north of the Hazel Avenue Bridge. The site offers sweeping views north up Lake Natoma toward the Sierra Foothills and south across Nimbus Dam toward the Sacramento Valley and Mount Diablo. The site is comprised of a large paved parking area and an unpaved parking area—the site of an informal trailhead—with access to the unpaved area limited by a recently-installed guard rail along the entrance road. No other facilities are provided. A chain-link fence along the southern boundary of the site restricts access to a very steep hillside that slopes down toward the dam. A wooden fence along the northern boundary of the site separates State land from a neighboring residential development. At this time, the physical and aesthetic conditions of the overlook are not consistent with the high quality views available from this site. The chain-link fence interrupts views to the south and a guardrail intended to restrict off-road vehicle access has a negative impact on views to the north. Access difficulties should improve with the widening of Hazel Avenue to six lanes and realignment of the entrance road. The area offers significant potential as an interpretive resource.

Negro Bar

Negro Bar is a popular day-use area that includes a full range of facilities and easy access from Greenback Lane. Negro Bar extends along 1 mile of the Lake Natoma shoreline between the Lake Natoma Bluffs to the south and the Old Rainbow Bridge to the north. The main day use area includes an upper area with a large grassy picnic area with tables and shade ramadas, one restroom, and a paved parking area with space for 100 vehicles. An equestrian staging area is located just north of the parking area. The lower area on the Lake Natoma shoreline includes a shaded picnic area with tables and barbecues, one restroom, a small, unguarded beach with views of the lake and bluffs, and a concessionaire renting canoes and kayaks. The northeastern portion of Negro Bar along the shoreline between the Old Rainbow Bridge and the Lake Natoma Crossing is the location of the group campsites described in Campgrounds section above, and the boat launch facility described in the Boat Launch and Facilities section above. This area of Negro Bar is popular with local fishermen and paddlers and with swimmers and sunbathers who use the Rainbow Rocks just below the Old Rainbow Bridge. One chemical toilet here serves the boat ramp users. Finally, the area surrounding a one-time residence for park rangers (the “cottage”) is the site of the annual Juneteenth celebration organized by the Sacramento African American Cultural and Historical Society.

The demand for facilities at Negro Bar is great and often competing. There is interest from outside groups to develop additional recreational and cultural facilities at Negro Bar, including a boathouse and dock facility for the Masters Rowing Club in the area of the existing boat launch and a cultural center for the Sacramento African American Cultural and Historical Society in the area of the “cottage.” The “cottage” area may also be suitable for an environmental camping area (no services) and there are potential interpretive opportunities related to African American history in the area and the Lake Natoma Bluffs.



FOLSOM LAKE STATE RECREATION AREA RESOURCE INVENTORY

- Activity Center
- Barbeques
- Beach
- Boat Launch
- Comfort Station
- Concession
- Drinking Water
- Horse Assembly
- Picnic Area
- Shower
- Public Telephone
- Trail Access
- Vehicle Parking

FIGURE

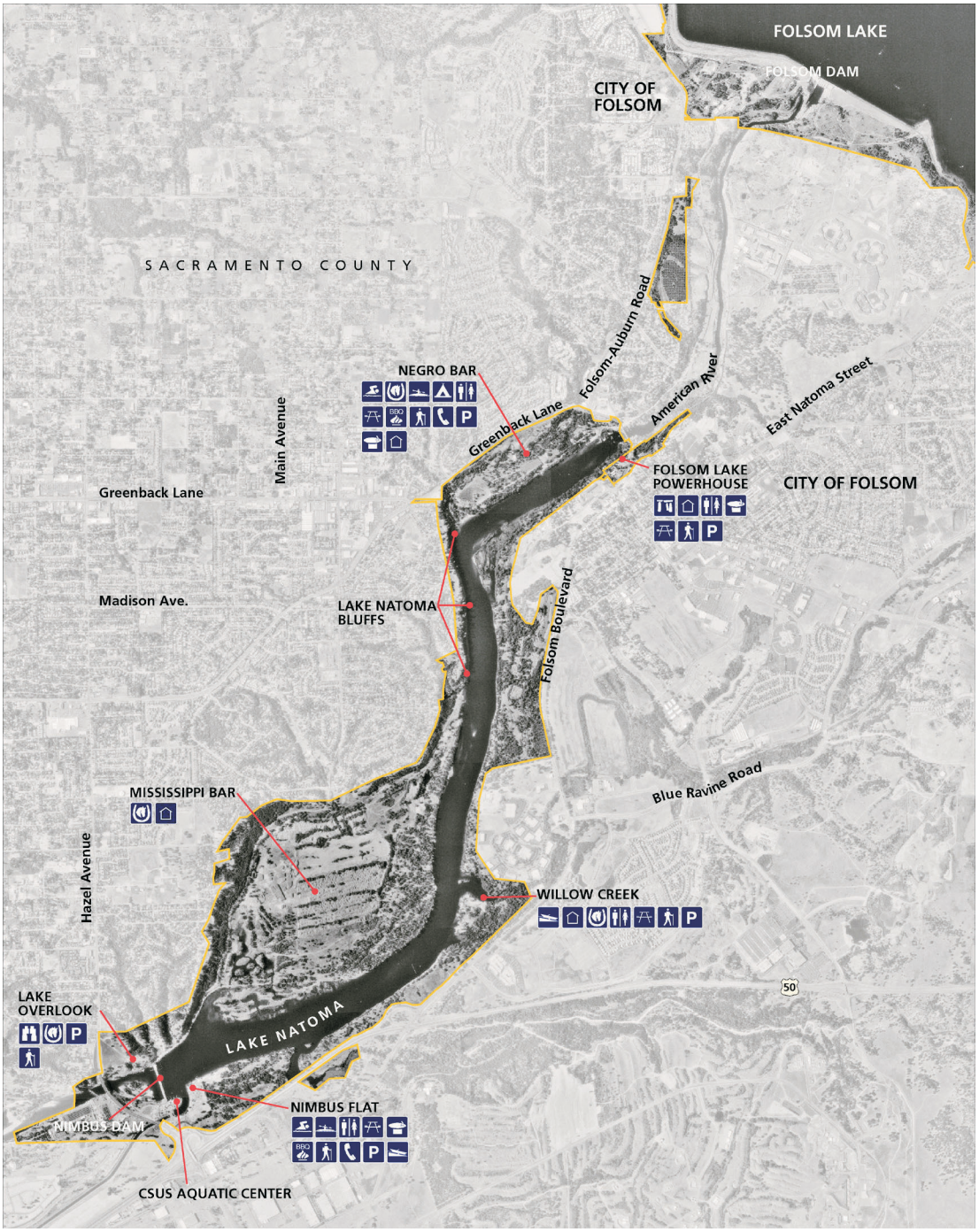
RR-7

Day Use Facilities at Folsom Lake

Prepared by
Wallace Roberts & Todd

N

Not to Scale



FOLSOM LAKE STATE RECREATION AREA RESOURCE INVENTORY

- Barbeques
- Beach
- Boat Launch
- Camping
- Comfort Station
- Concession
- Drinking Water
- Historic Attraction
- Horse Assembly
- Marina
- Observation Point
- Picnic Area
- Public Telephone
- Trail Access
- Vehicle Parking

FIGURE

RR-8

Day Use Facilities at Lake Natoma

Prepared by
Wallace Roberts & Todd

N

Not to Scale

Other Facilities

Folsom Dam

Completed in 1956, Folsom Dam is 1,400 feet long and 340 feet high and serves the purposes of flood control, water storage, and power generation. The dam includes three generators with a combined capacity of just under 199,000 kilowatts of electrical power, or about 10 percent of the electrical needs of the City of Sacramento. Daily walking tours of Folsom Dam, once provided free of charge to the public by BOR staff, are no longer offered due to security concerns in the wake of September 11, 2001. The planned project to raise the height of Folsom Dam by seven feet to provide additional flood control capacity, is expected to begin construction in 2006 or 2007 and last about 5 years, assuming Congress approves funding.

At this time, it appears that the raised Folsom Dam will not include a public access roadway across it. Prior to the security concerns of September 11, 2001, the Bureau sought to close Folsom Dam Road to public traffic due to increasingly heavy traffic (4 million vehicles cross the road each year) that creates the potential for accidents that could damage dam facilities and endanger the public.[9] As such, a new bridge and roadway will need to be constructed to replace the current roadway. Preliminary designs call for a new temporary two-lane highway and bridge located 1,600 feet downstream from the dam. The alignment would extend from Folsom-Auburn and Folsom Dam Roads in the west to near the eastern end of the dam on Folsom Dam Road.[10] Instead of building a temporary bridge, the City of Folsom and other interests would like to see a new four-lane permanent bridge constructed downstream of the dam. Folsom Dam Road is currently closed to the public.

American River Water Education Center

Managed by the BOR and the CDPR, the American River Water Education Center provides tours, exhibits and interactive activities that explore the watershed of the American River and water conservation. Exhibits describe the physical and biological characteristics of the watershed as well as the history of human use, including the diverse interests in American River water today. Flooding and droughts, dam construction, and hydro-electric power production are illustrated in physical displays. A compelling display challenges the visitor to divide available fresh water to satisfy the needs of three main water users: farmers, cities, and wildlife. An outdoor exhibit features water-efficient irrigation systems and plants that do well in the semi-arid climate of California. The Center was also the starting point for public tours of Folsom Dam, but this program has been cancelled due to security concerns in the wake of September 11, 2001. The Center, which is located within the compound that houses the district offices for CDPR and the BOR, is visited by roughly 20,000 children annually. The Center may be moved to the visitor center planned for the Folsom Powerhouse State Historic Park.

CSUS Aquatic Center

The California State University Sacramento (CSUS) Aquatic Center is located on Lake Natoma, within the unit, at the south end of Nimbus Dam. The Center is a cooperative

[9] U.S. Department of the Interior, Bureau of Reclamation, *Folsom Dam Bridge Appraisal Report*, March 2000, pg. i.
[10] Ibid., pg. 15.

operation of the Associated Students of California State University Sacramento, the University Union of CSUS, California Department of Boating and Waterways (DBW), and CDPR. The land for the Center is leased to CSUS by CDPR and serves as one of several DBW Boating Instruction Safety Centers (BISC) in the state providing on-the-water and in-the-classroom boating safety education. The Center also serves as the base for Sac State's water ski and rowing teams and aquatic courses. Also offered are a full range of public courses in sailing, windsurfing, jet skiing, kayaking, rowing, canoeing, etc., as well as youth programs and summer camps. Public kayak and canoe rentals are also available. Facilities at the Center include an administrative building with offices and classrooms, several equipment storage buildings, three launch docks with mooring areas, a small beach area, and a large paved parking area with access off Hazel Avenue. The Center is currently undergoing an expansion project assisted by DBW that will include a new administrative building with locker rooms, classrooms, and storage, and a new boathouse and dock.

Trails

The trail system in the Unit is extensive, linking most of the Unit's facilities, and accommodating a variety of users including walkers and hikers, horseback riders, cyclists, and mountain bikers (Refer to Figures RR-9 and RR-10). Although there are over 90 miles of existing trails within the Unit, there are many areas that are not accessible by trail and there is not a continuous trail connection around the lake. Due to the narrow land base and steep topography around both Folsom Lake and Lake Natoma, the opportunities to develop new trail facilities are limited. Within this context, the demand for trail access continues to increase for all types of trail uses, including pedestrian, equestrian, mountain bikes, and hard-surface bicycling. The increased demand also results in a growing concern about conflicts between the different kinds of trail users, particularly on multi-use trails which are open to all users. The following is a description of trails in the Unit and Table RR-8 provides a summary of these facilities.

Pioneer Express Trail

The Pioneer Express Trail connects the cities of Auburn and Sacramento and passes through the Unit. This segment of the Pioneer Express Trail is also part of the American Discovery Trail, the nation's first coast-to-coast non-motorized recreation trail. The trail enters the northeastern corner of the Unit at Cardiac Hill and follows the western shoreline of the North Fork of the American River through Rattlesnake Bar and Granite Bay to Beal's Point. This 21-mile segment of dedicated dirt trail is for equestrian and pedestrian users only. From Beal's Point west, the Pioneer Express Trail follows the American River Bike Trail along the western shore of Lake Natoma to Nimbus Dam (10 miles), and continues west along the American River Parkway 23 miles to Discovery Park in Downtown Sacramento.

Los Lagos Trail

This 1.5-mile equestrian and pedestrian trail is located on a 200-foot wide strip of land that extends through the residential subdivision of Los Lagos. The trail begins at Auburn-Folsom Road and runs south into the Unit connecting with the Pioneer Express Trail just north of Granite Bay at Beeks Bight.

Doton's Point ADA Trail

This pedestrian-only trail is a scenic 1-mile spur that extends from a trailhead near the Granite Bay equestrian staging area at Beeks Bight to the end of Doton's Point on Folsom Lake.

Granite Bay Multi-Use Trails

There are 8 miles of dirt multi-use trails in the sprawling Granite Bay area of the Unit. The 2-mile Granite Bay/Beals Point Trail connects Granite Bay and the day use area at Beals Point. The Granite Bay Trail extends 5 miles from the main entrance to Granite Bay at Douglas Boulevard to Beeks Bight in the northern area of the facility. The 1-mile Center Trail is essentially a shortcut across Oak Point instead of following the Granite Bay Trail along the shoreline.

Lake Natoma Bike Paths

Paved and signed bike paths extend along both the eastern and western shorelines of Lake Natoma. The East Trail runs from Nimbus Dam to the historic truss bridge in Folsom – a distance of about 6 miles. The West Trail runs east from Nimbus Dam about 10 miles to Beals Point on Folsom Lake. The West Trail doubles as a segment of the American River Bike Trail that begins 23 miles to the south at Discovery Park in Downtown Sacramento at the confluence of the American and Sacramento Rivers The American River Bike Trail is part of the American River Parkway which is a continuous open space greenbelt that extends from Discovery Park to Folsom Dam. Below Nimbus Dam, the American River Bike Trail is operated and maintained by Sacramento County; above Nimbus Dam it is the responsibility of CDPR. The East and West trails around Lake Natoma effectively create a loop around the Lake.

Lake Natoma Dirt Trails

In addition to the paved bike paths along Lake Natoma, dirt trails on both sides of the lake provide additional mileage as well as different experiences. Along the east side of Lake Natoma, 6 miles of multi-use trails wind through and provide access to Nimbus Flat and Willow Creek. Along the west side of the lake, an equestrian/pedestrian trail extends from an informal trailhead at Lake Overlook above Nimbus Dam north to Beals Point – a distance of about 9 miles. Portions of this trail form part of the Pioneer Express Trail.

Middle Ridge Trail

This 1-mile equestrian/pedestrian trail extends through Mississippi Bar from the Main/Sunset Avenues trailhead south to the Lake Natoma equestrian/pedestrian trail just north of Nimbus Dam. The trail provides access to Shadow Glen Stables, an equestrian concessionaire.

Snowberry Trail

Snowberry is an equestrian/pedestrian trail that extends 1.5 miles from the Main/Sunset Avenues trailhead north to the Lake Natoma equestrian/pedestrian trail between Mississippi and Negro Bars.

Folsom Point/Brown's Ravine Trail

This dirt multi-use trail extends 4 miles between Folsom Point and Brown's Ravine. The trail begins in the day use area at Folsom Point and ends at the Brown's Ravine/Old Salmon Falls trailhead at Brown's Ravine.

Brown's Ravine/Old Salmon Falls Trail

This dirt equestrian and pedestrian trail begins at the Brown's Ravine equestrian staging area and trends north along the eastern shoreline of Folsom Lake to the trailhead parking area at Old Salmon Falls about 12 miles away. In 2002, CDPR planned to implement a one-year pilot project to designate this trail as multi-use which would add mountain biking as a permitted use. The purpose of the pilot is to increase trail access for users while reducing potential conflicts between users.[11] The pilot would include a variety of trail improvements, public education and outreach, patrol and enforcement, and monitoring and evaluation.[12] However, since funding shortfalls delayed the pilot project, the actual designation of this trail will be determined in Trail Management Plan that will be prepared at the completion of the General Plan update for the Unit.

Sweetwater Creek Trail

A widened shoulder just off Salmon Falls Road between Old Salmon Falls and Salmon Falls Bridge doubles as an informal parking area where a gate marks the trailhead for the Sweetwater Trail. This dirt multi-use trail extends east about 2 miles to the commercial raft take-out facility at Salmon Falls Bridge and the Darrington Trail. An informal trail extends west from here to Old Salmon Falls and the Brown's Ravine Trail.

Darrington Trail

The trailhead for this popular trail is located at a small dirt parking area at the north end of the Salmon Fall Road bridge over the American River just above the whitewater rafting facility at Skunk Hollow. This rugged 9-mile trail for mountain bikers and pedestrians follows the western shoreline of the South Fork high above the waterline, rounds the peninsula that separates the North and South Forks, and terminates at the Peninsula Campground.

Peninsula ADA Trail

This pedestrian-only trail is located at the Peninsula Campground and extends from the south boat launch here south along the Folsom Lake shoreline about 1 mile.

Powerhouse Loop Trail

This pedestrian-only trail runs along the canal north of the Folsom Powerhouse State Historic Park site.

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[11] California Department of Parks and Recreation, *Browns Ravine Multi-Use Trail Pilot Project*, November 2001, pg. 1.

[12] Ibid., pg. 1.

Table RR-8: Trail Facilities

Trail	*Start*	*Finish*	*Use*	*Length (Miles)*[1]	*Surface*	*Connections*	*Facilities*
Pioneer Express	Unit Boundary	Beals Point	Pedestrian Equestrian	21	Dirt	Los Lagos Granite Bay Multi-Use Granite Bay/Beals Point Doton's Point ADA	Drinking water Restrooms Picnic area Concession Beach Camping Equestrian staging
Los Lagos	Auburn-Folsom Road	Beeks Bight	Pedestrian Equestrian	1.5	Dirt	Pioneer Express	None
Granite Bay Multi-Use							
Granite Bay/Beals Point	Granite Bay Beach	Beals Point	Multi-use	2	Dirt	Pioneer Express Lake Natoma Paved (East)	Drinking water Restrooms Picnic area Concession Beach Camping Equestrian staging
Granite Bay	Granite Bay Entrance	Beeks Bight	Multi-use	5	Dirt	Granite Bay/Beals Point Pioneer Express Los Lagos Doton's Point ADA	Drinking water Restrooms Picnic area Concession Beach Equestrian staging
Center Trail	Oak Point Beach	Beeks Bight	Multi-use	1	Dirt	Pioneer Express Granite Bay	None
Lake Natoma Paved							
East Trail	Folsom Truss Bridge	Nimbus Dam	Multi-use	6	Paved	Lake Natoma Dirt (East) Lake Natoma West Trails American River Bike	Drinking water Restrooms Picnic area Concession Beach Equestrian staging

Table RR-8: Trail Facilities

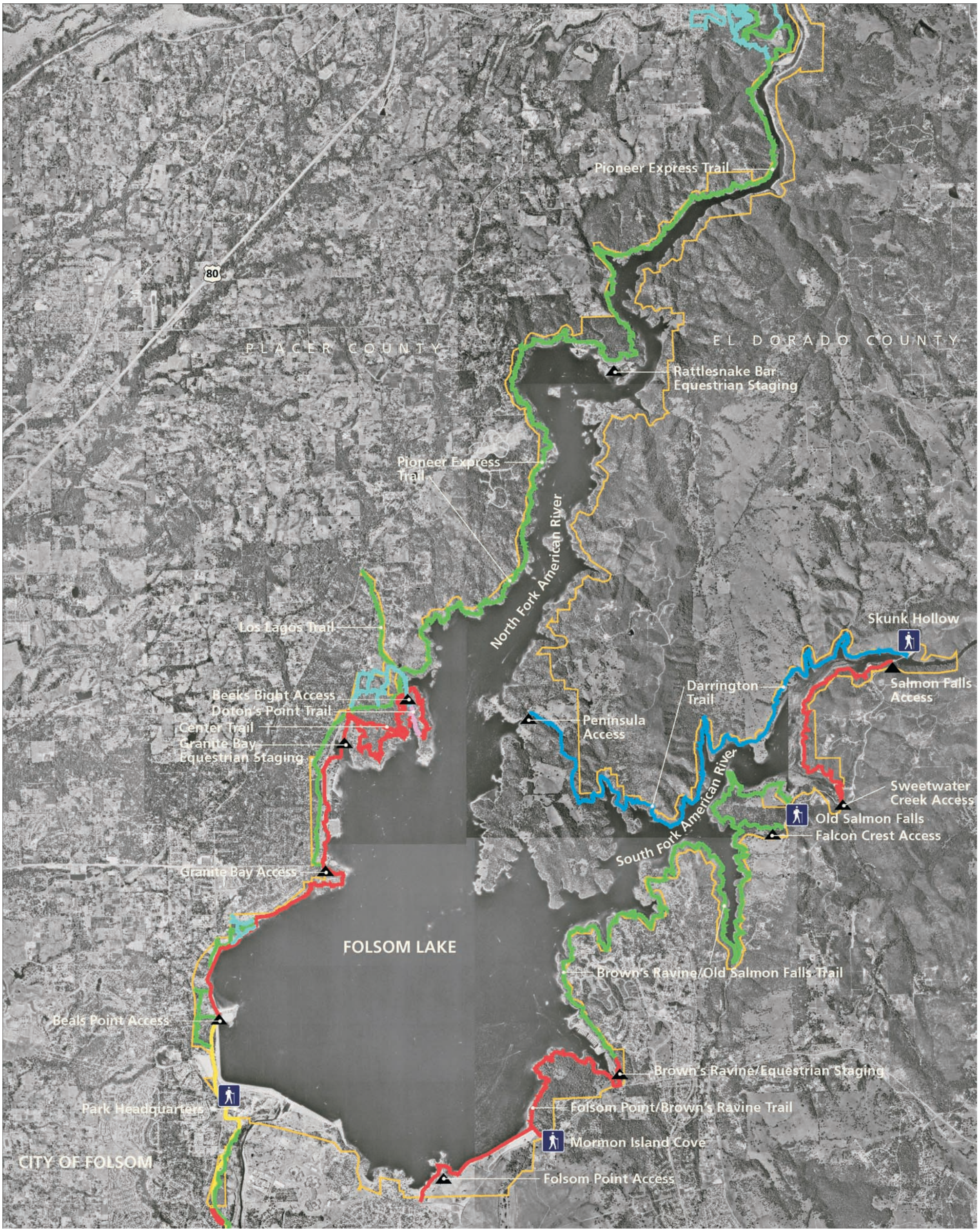
Trail	*Start*	*Finish*	*Use*	*Length (Miles)*[1]	*Surface*	*Connections*	*Facilities*
West Trail	Beals Point	Nimbus Dam	Multi-use	10	Paved	Lake Natoma Dirt (West) Lake Natoma East Trails Pioneer Express Granite Bay/Beals Point American River Bike	Drinking water Restrooms Picnic area Concession Beach Equestrian staging
Lake Natoma Dirt							
East Trail	Folsom Truss Bridge	Nimbus Dam	Multi-use	6	Dirt	Lake Natoma Paved (East) Lake Natoma West Trails American River Bike	Drinking water Restrooms Picnic area Concession Beach Equestrian staging
West Trail	Beals Point	Lake Overlook	Pedestrian Equestrian	9	Dirt	Lake Natoma Paved (West) Lake Natoma East Trails Pioneer Express Granite Bay/Beals Point American River Bike	Drinking water Restrooms Picnic area Concession Beach Equestrian staging
Middle Ridge	Sunset/Main Avenues	Nimbus Dam	Pedestrian Equestrian	1	Dirt	Snowberry Lake Natoma Dirt (West)	None
Snowberry	Sunset/Main Avenues	Snipes Pershing Ravine	Pedestrian Equestrian	1.5	Dirt	Middle Ridge Lake Natoma Dirt (West)	None
Folsom Point/Brown's Ravine	Folsom Point	Brown's Ravine	Multi-use	4	Dirt	Brown's Ravine/Old Salmon Falls	Drinking water Restrooms Picnic area Concession Equestrian staging
Brown's Ravine/Old Salmon Falls	Brown's Ravine	Old Salmon Falls	Pedestrian Equestrian	12	Dirt	Folsom Point/Brown's Ravine	Drinking water Restrooms Picnic area Concession Equestrian staging

Table RR-8: Trail Facilities

Trail	*Start*	*Finish*	*Use*	*Length (Miles)*[1]	*Surface*	*Connections*	*Facilities*
Sweetwater Creek	Sweetwater Creek	Salmon Falls	Multi-use	2	Dirt	Darrington	Drinking water Toilets
Darrington	Salmon Falls	Peninsula Campground	Mountain bike Pedestrian	9	Dirt	Sweetwater Creek Peninsula Trail	Drinking water Restrooms Picnic area Camping
Pedestrian Trails							
Doton's Point (ADA)	Beeks Bight	Doton's Point	Pedestrian	1	Dirt	Pioneer Express Granite Bay Multi-Use	None
Powerhouse Loop	Powerhouse	Powerhouse	Pedestrian	1	Dirt	None	Drinking water Restrooms Picnic area
Peninsula (ADA)	Peninsula Campground	Peninsula Point (South)	Pedestrian	1	Dirt	None	Drinking water
			Total	***94***			

[1]Within Park limits only.

Source: CDPR; Wallace Roberts & Todd, 2003.



LEGEND

- Trail Head
- Access
- Class 1 Paved Trail
- Mountain Bike/Pedestrian Trail
- Multi-Use Trail
- Equestrian/Pedestrian Trail
- Pedestrian Trail
- Unclassified Trail

FOLSOM LAKE STATE
RECREATION AREA
RESOURCE INVENTORY

FIGURE

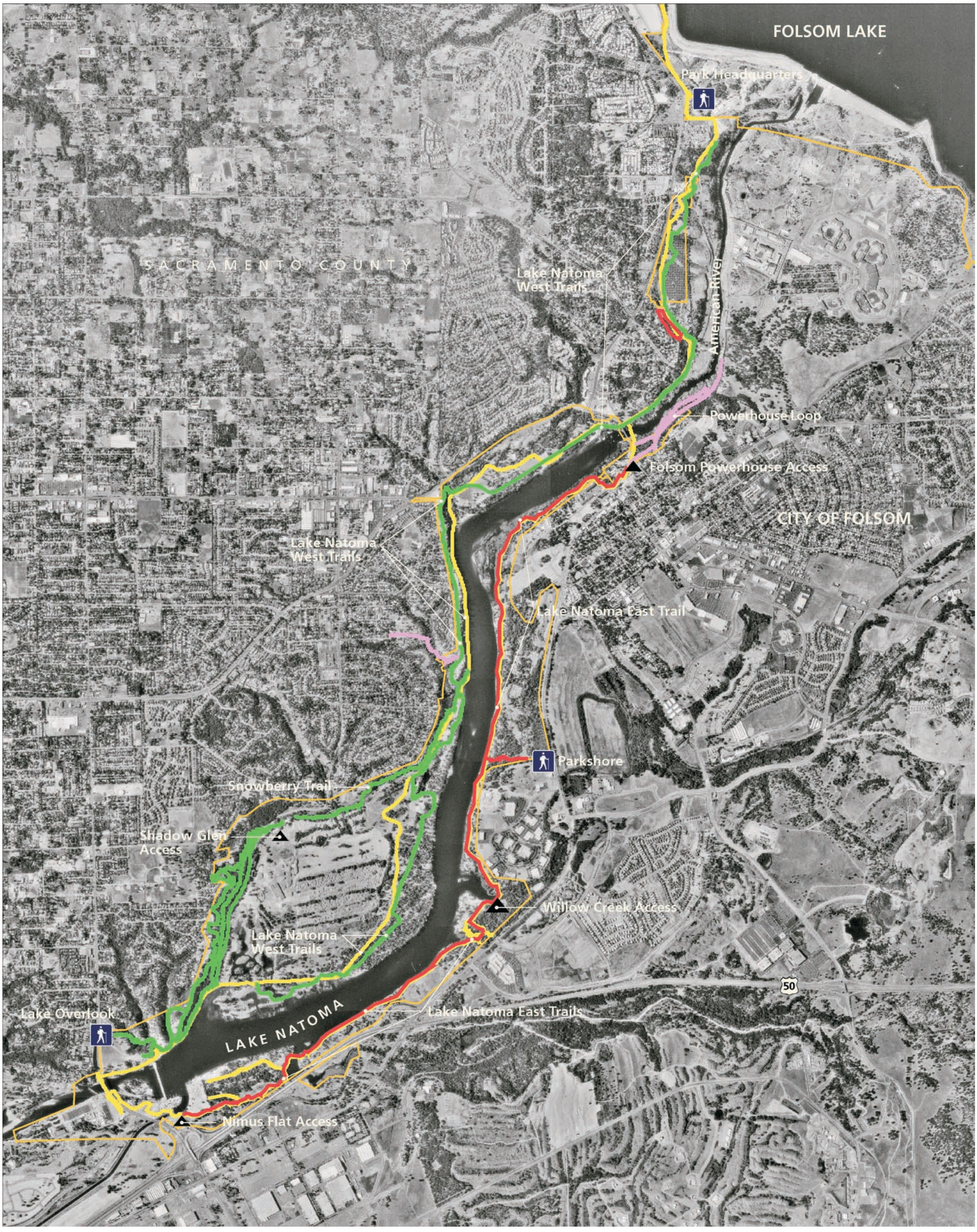
RR-9

Trail Facilities at Folsom Lake

Prepared by
Wallace Roberts & Todd

N

Not to Scale



LEGEND

- Trail Head
- Access
- Class 1 Paved Trail
- Mountain Bike/Pedestrian Trail
- Multi-Use Trail
- Equestrian/Pedestrian Trail
- Pedestrian Trail
- Unclassified Trail

FOLSOM LAKE STATE RECREATION AREA RESOURCE INVENTORY

FIGURE

RR-10

Trail Facilities at Lake Natoma

Prepared by
Wallace Roberts & Todd

N

Not to Scale

Connections to External Trail Systems

There are several connections to the Unit's trail system from outside jurisdictions. In Placer County, a multi-use trail enters the Unit at Sterling Pointe running along Lomida Lane off Auburn-Folsom Road. In El Dorado County, the *1997 Trails Master Plan* includes a proposal to create the 10-mile Salmon Falls-Knickerbocker Trail would connect with the Sweetwater Trail at the Salmon Falls Bridge. The trail would generally follow Salmon Falls Road to Pilot Hill and then Pilot View north to the Knickerbocker Trail. In the City of Folsom, several connections to the Unit's trail systems exist. Folsom-Auburn Road provides a Class II bike lane that allows easy access to the West Lake Natoma Bike Trail and the Unit facilities along it, such as Beals Point, American River Water Education Center, Negro Bar, and Lake Overlook. Access points include Berry Creek Drive and Crestridge Lane. Class II bike lanes along Greenback Lane provides access to facilities at Negro Bar and the West Lake Natoma Bike Trail at American River Canyon Drive and at Folsom-Auburn Road. Class II bike lanes along East Natoma Street and Green Valley Road provide access to Folsom Point and Brown's Ravine. Finally, Class II bike lanes along Folsom Boulevard essentially parallel the East Lake Natoma Bike Trail with access points at the Lake Natoma Crossing, Young Wo Circle, Parkshore Drive, Natoma Station Drive, and Nimbus Flat.

It is worth noting that, according to CDPR staff, there are many locations in the Unit where private landowners have established informal connections to the existing trail network. These connections often involve the installation of a gate in fences along property lines that abut CDPR land. While these informal connections are illegal, enforcement is difficult under current CDPR staffing levels and it is unclear what priority is placed on enforcement.

Recreational Context of the Unit

This section puts the recreational aspects of the Unit into context by summarizing both proximate and more distant recreation resources and opportunities that may also vie for users.

Local Recreation Facilities

There are several important recreation facilities and activities that occur in close proximity to the Unit as summarized below. A number of these facilities have a direct relationship to the Unit in that they abut or provide connection to the Unit.

Placer County

Auburn State Recreation Area

The Auburn SRA covers more than 35,000 acres along 40 miles of the North and Middle Forks of the American River and is comprised lands set aside for the Auburn Dam. This natural area offers a wide variety of recreation opportunities to over 500,000 visitors a year. Major recreational activities include hiking, swimming, boating, fishing, camping, mountain biking, gold panning, and off-highway motorcycle riding. Whitewater recreation is also very popular on both forks of the American River. The Auburn SRA is contiguous with the Folsom Lake SRA along the North Fork of the American River. The boundary separating the two units is located just below the outlet of the Auburn Dam diversion tunnel.

Miners Ravine

Miners Ravine is the closest County recreation facility to the Unit. Located on Auburn-Folsom Road north of Douglas Boulevard, Miners Ravine provide passive recreation opportunities including a self-guided trail with interpretive signs.

Sacramento County

Nimbus Fish Hatchery

The Nimbus Fish Hatchery is located on the American River just below Nimbus Dam and Lake Natoma. The hatchery was built in 1955 by the U.S. Bureau of Reclamation to compensate for the loss of spawning habitat resulting from the construction of Nimbus and Folsom dams and to maintain salmon and steelhead trout populations.[13] A weir across the river prevents Chinook salmon from swimming further upstream and a fish ladder is used to direct salmon and steelhead for artificial spawning at the hatchery. In addition, the facility raises rainbow trout and kokanee salmon for more than 250 lakes and streams in northern and central California for recreational fishing, and produces four million Chinook salmon and 430,000 Steelhead trout annually.[14] The facility includes a visitor center, a short shoreline trail, and a river overlook. The facility is owned and funded by the BOR and operated by the California Department of Fish and Game.

American River Parkway

The American River Parkway extends 23 miles west from Nimbus Dam to Discovery Park at the confluence of the American and Sacramento Rivers in Downtown Sacramento to the west. The Parkway consists of 14 interconnected parks and approximately 5,000 acres of land that includes historic Gold Rush and Maidu Indian sites and lush riverine forests and oak woodlands.[15] The most popular feature is the Parkway's Jedediah Smith Memorial Trail—more commonly known as the American River Bike Trail—that extends 32 miles east from Discovery Park in Sacramento to Beals Point in the Unit. This trail offers hikers, cyclists, and horseback riders opportunities for outdoor recreation, nature viewing, and relaxation. The American River is popular with fishing enthusiasts, canoeists, kayakers, and rafters, and the Parkway offers several picnic areas, and opportunities for nearby golf, guided natural and historic tours, archery, game fields, and so on.[16] More than 5 million visitors use the Parkway each year. The 1985 American River Parkway Plan, prepared by both the City and County of Sacramento, provides direction for land uses within the Parkway and includes Lake Natoma within the Unit. The County of Sacramento is responsible for the operation and maintenance of facilities within the Parkway downstream of Nimbus Dam, while CDPR is responsible for facilities upstream of it. The County is currently updating the Plan.

City Park – Folsom

Located on Stafford Street just east of Downtown and abutting CDPR lands, the 36-acre Folsom City Park provides a wide range of facilities, including the Folsom Community Center, City Park Gazebo, City Park Pavilion, Folsom City Zoo, and the Dan Russell

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[13] U.S. Bureau of Reclamation, *A Visitor's Guide to Nimbus Fish Hatchery*, pg. 1.
[14] Ibid., pg. 2.
[15] City-County Office of Metropolitan Water Planning, *Water Forum Proposal EIR*, 1999, pg. 4.9-3.
[16] http://www.sacparks.net/Parks/arp.htm.

Arena.[17] The zoo, which was established in 1963, occupies about 5 acres of the park and houses between 50 and 60 animals. An estimated 90,000 visitors come to the zoo each year.[18] The 7,000-seat arena, which is home of the annual Memorial Day and 4th of July Rodeos, also hosts circuses, concerts, graduations, and music festivals.

Lew Howard Park – City of Folsom

Lew Howard Park, located on Oak Avenue Parkway at Baldwin Dam Road, provides spectacular views of the Sierras and includes the Hinkle Creek Nature Area, tennis and basketball courts, playgrounds, and the new Folsom Rotary Clubhouse.

Orangevale Park

Orangevale Park, operated by the Orangevale Recreation and Park District, is located in the unincorporated County on Hazel Avenue about 3 miles north of Nimbus Dam. The 76-acre facility include tennis courts, soccer fields, playgrounds, horse arena, individual and group picnic areas, and 22 acres of turf area.[19]

Regional Recreation Facilities

The recreational activities and services available at other reservoirs and lakes within easy driving distance of Folsom Lake provide context for the Unit. These activities and services are summarized below.

Reservoirs

Several reservoirs offering boating and fishing are located along the I-80 and Highway 50 corridors east of the Unit. Facilities along Highway 50 in El Dorado County include Jenkinson Lake, Ice House Reservoir, Union Valley Reservoir, and Loon Lake Reservoir. Jenkinson Lake is located in the Sly Park Recreation Area at Pollock Pines. Operated by the El Dorado Irrigation District, Jenkinson Lake has a surface area of 650 acres and offers boat launch facilities, boat rentals, and fishing for trout and bass.[20] Personal water craft (jetskis) are prohibited. Ice House, Union Valley, and Loon Lake Reservoirs are all part of the Sacramento Municipal Utility District's Crystal Basin Recreation Area.[21] The area spans 85,000 acres within the El Dorado National Forest. These reservoirs include paved launch ramps and are large enough to accommodate motor boats. Trout and bass fishing are popular here, as is swimming. A total of 11 large reservoirs covering 9,000 acres are found in El Dorado National Forest.[22] It should be noted, however, that access roads to most of these reservoirs are closing during the winter.

Facilities along I-80 in Placer and Nevada Counties include Lake Spaulding, Donner Lake, and Stampede Reservoir. Lake Spaulding is located in the Nevada County portion of the Tahoe National Forest just east of Emigrant Gap. The lake, which has a surface area of 700

[17] http://www.folsom.ca.us/index.asp?page=189.
[18] http://www.folsom.ca.us/index.asp?page=72.
[19] http://www.orangevalechamber.com/orangevale_recreation_&_park_district.htm.
[20] http://www.eid.org/Departments/Rec/dept_rec_info_2.htm.
[21] http://www.smud.org/community/crystalbasin.html.
[22] http://www.r5.fs.fed.us/eldorado/facts/description.htm.

acres, has good fishing for trout and bass and there are no boating restrictions.[23] Donner Lake is a popular boating, fishing, and swimming area located in Truckee. The lake is 3 miles long and about ¾-mile wide. Stampede Reservoir is located in the Toiyabe National Forest north of Truckee on the California-Nevada border. The reservoir is 3,400 acres in size, includes two boat launch areas, has no boating restrictions, and is good for swimming and fishing.[24]

There are several other large lakes and reservoirs not on the I-80 and Highway 50 corridors but offering fairly easy drives from Sacramento. To the north in between Marysville and Grass Valley on Highway 20 are Collins and Englebright Lakes and the New Bullards Bar Reservoir. Collins Lake, located 22 miles east of Marysville, is roughly 1,000 acres in size and includes a public boat launch.[25] Waterskiing is permitted in summer months although "fishing only" zones permit a quieter pace. Englebright Lake is located at the conjunction of the Middle and South Yuba Rivers about 15 miles west of Grass Valley. The Lake measures 815 acres, but at 9 miles in length it is a popular spot for waterskiing.[26] New Bullards Bar Reservoir, located on the North Yuba River 21 miles north of Nevada City off Highway 49, offers 4,700 acres of boating area and a length 16 miles.[27] The reservoir, which is managed by the Yuba County Water Agency, provides two launch areas and some of the best Kokanee salmon fishing in the State. Finally, located further north in Oroville is the Lake Oroville, a 15,500-acre reservoir the result of the damming of the Feather River.[28] The lake includes three formal boat launch areas and five informal car-top boat ramp areas. With 167 miles of shoreline, the lake has good bass fishing.

The primary lakes and reservoirs to the south of Sacramento include Lake Camanche and Pardee Reservoir in Calavaras County. Lake Camanche, located 30 minutes east of Lodi on Highway 12, is operated by the East Bay Municipal Utility District and is the result of the damming of the Mokelumne River.[29] The lake measures 7,700 acres with a full service marina, boat rentals, and boat launch facilities provided on both the north and south shores. Located just upstream from Lake Camanche is the Pardee Reservoir, also operated by EBMUD. The reservoir measures 2,250 acres, and while swimming, waterskiing, and other body contact activities are prohibited, boating and fishing are permitted.[30] The reservoir is open mid-February to mid-November.

Camping

Camping facilities are provided at all of the reservoirs summarized here. Jenkinson Lake in the Sly Park Recreation Area offers about 190 individual campsites in 10 camp areas along the shoreline; separate group and youth camping areas are also provided.[31] The campground provides drinking water and vault toilet facilities. The Crystal Basin Recreation Area includes more than 700 developed campsites across more than 20 campgrounds, including an

[23] http://www.seasonpass.com/adventure/TahoeLakes.asp?lid=35.
[24] http://www.recreation.gov/detail.cfm?ID=45.
[25] http://www.anglernet.com/web/maps/collins1.htm.
[26] http://www.anglernet.com/web/maps/engle1.htm.
[27] http://www.anglernet.com/web/maps/bullard1.htm.
[28] http://www.parks.ca.gov/default.asp?page_id=462.
[29] http://www.ebmud.com/services/recreation/sierra/camanche/default.htm.
[30] http://www.ebmud.com/services/recreation/sierra/pardee/default.htm.
[31] http://www.eid.org/Departments/Rec/dept_rec_info_2.htm.

RV campground on Loon Lake and equestrian campgrounds on Loon and Wrights Lakes.[32] Most campgrounds include drinking water and toilets. At Lake Spaulding in Tahoe National Forest, 25 developed campsites are available for both tents and RVs. A total of 76 family and 12 group campgrounds are found in the Tahoe National Forest, although most areas are closed in winter.[33] Camping facilities are also provided in the Toiyabe National Forest at Stampede Reservoir with 252 developed campsites.

A private campground operates at Collins Lake in the Grass Valley area with 150 developed tent and RV campsites with flush toilets and showers. At New Bullards Bar Reservoir further north, more than 160 tent, RV, and boat-in campsites are provided.[34] Englebright Lake includes 16 boat-in camp areas. Further north at Lake Oroville, about 210 developed campsites are available, 75 of which offer full hookups.[35] There are 6 group sites here and 8 boat-in campgrounds, each with between 6 and 10 developed campsites. To the south at Lake Camanche in Calavaras County, a campground, RV park, and housekeeping cottages are provided on both the north and south shores. More than 300 campsites are available here.[36] At the neighboring Pardee Reservoir, 100 tent and RV campsites are available with shower facilities and swimming pools.

Trails

Sly Park Recreation Area includes 9 miles of multi-use trails around Jenkinson Lake. Separate equestrian trails are provided. More than 117 miles of trails are provided at Crystal Basin Recreation Area, including a 4.5-mile paved bike path and dedicated equestrian trials. Day use areas here are located at the boat launches on several of the reservoirs. A total of 350 miles of trails are found in El Dorado National Forest, although most are not accessible during winter. Trail facilities are not as common along the I-80, although a total of more than 630 miles of trails are found in the Tahoe National Forest. In the Highway 20 area between Marysville and Grass Valley there are several trail opportunities, including a trail circling Collins Lake and a 7-mile multi-use trail at New Bullards Bar Reservoir. Only about 6 miles of trails may be found at Lake Oroville, although extensive facilities are provided, including a visitor center, swim beach, picnic area, and restrooms. Finally, to the south, there are multi-use trails at both Lake Camanche and Pardee Reservoir in Calavaras County, although the extent of the trail system is unknown. Equestrian stables and trails exist at Lake Camanche as well. Day use areas at both reservoirs include picnic tables, barbeques, and food and equipment concessions.

[32] http://www.smud.org/community/crystalbasin.html.
[33] http://www.r5.fs.fed.us/tahoe/viscenter/tnfrecprt.html.
[34] http://www.anglernet.com/web/lakes/bullards/bulldscr.htm.
[35] http://www.parks.ca.gov/default.asp?page_id=462.
[36] http://www.smud.org/community/crystalbasin.html.

Recreation Resource Issues

This section summarizes the current issues related to the recreation resources of the Unit. These issues are organized by facility type.

Aquatic Facilities

The following issues are related to the aquatic facilities in the Unit, including the marina, boat launch facilities, and whitewater rafting facilities.

Marinas

- Long waiting lists for slip rentals makes capacity a primary concern;
- Demand for slips would appear to support further expansion of marina here or construction of a second marina elsewhere on Folsom Lake;
- Onsite traffic circulation restricts day-use capacity during peak times (vehicles waiting for main boat ramp block access to the parking area);
- Additional lanes at main boat ramp needed to reduce back-ups, but not without reconfiguring parking area to provide a designated ramp queue lane and improved turnaround area; and
- Additional parking capacity needed to allow day-users (slip holders and drive-ins) easier access to the lake.

Boat Launch Facilities

- Main launch areas (Granite Bay, Folsom Point, Brown's Ravine) fill quickly on peak season weekends with users parking informally along the shoreline or being turned away;
- Full capacity at some launch facilities is not realized with fewer lanes available than is possible based on the width of existing ramps (using California Department of Boating and Waterways design standards) (see Table RR-9);
- Increasing the number of boarding floats along ramps, or realigning them, could increase the number of useable lanes on existing ramps;
- Increased ramp capacity would be difficult without a concurrent increase in parking capacity as parking facilities at some launch areas (Folsom Point and Brown's Ravine) fill quickly on peak season weekends; and
- Full parking capacity at some launch facilities is not realized with fewer spaces available than is recommended (using California Department of Boating and Waterways design standards) (see Table RR-10).

Table RR-9: Lane Capacity of Boat Launch Facilities

Facility	*Width (ft.)*	*Existing Lanes*	*Existing Boarding Floats*	*Possible Lanes*[1]	*Possible Boarding Floats*[2]
Granite Bay					
Stage 1	60	2	1	3	2
Stage 2	700	10	4	38	19
Stage 3	700	10	4	38	19
Stage 4	330	14	7	18	9
5 Percent	60	4	0	4	0[3]
Low Water	45	2	0	3	0[3]
Folsom Point	80	2	1	4	2
Brown's Ravine					
Main Ramp	60	4	1	3	2
Hobie Cove	60	3	1	3	2
Rattlesnake Bar	40	2	1	2	1
Peninsula					
Day Use	30	1	0	2	0[3]
South Ramp	25	1	0	1	1
Beals Point	40	1	0	2	2

[1]Possible lanes based on DBW guidelines assuming 6-foot wide boarding floats.

[2]Possible boarding floats assumes that two lanes are served by a single float where the width is adequate.

[3]Boarding floats are recommended but not required by DBW guidelines. Addition of boarding floats at these locations will reduce the number of possible lanes according to DBW width recommendations.

Source: Concept Marine Associates, Inc., 2003.

Table RR-10: Launch Ramp Parking Evaluation

Facility	*Existing Lanes*	*Existing Parking*	*Suggested Parking*[1]	*Possible Lanes*[2]	*Possible Suggested Parking*[3]
Granite Bay					
Stage 1	2	100	40-60	3	120-180
Stage 2	10	250	160-240	38	760-1140
Stage 3	10	300	160-240	38	760-1140
Stage 4	14	400	280-420	18	360-540
5 Percent	4	91	80-120	4	80-120
Low Water	2	27	40-60	3	60-90
Folsom Point	2	129	40-60	4	80-120
Brown's Ravine					
Main Ramp	4	409	40-60	3	60-90
Hobie Cove	3	194	40-60	3	60-90
Rattlesnake Bar	2	94	40-60	2	40-60
Peninsula					
Day Use	1	60	20-30	2	40-60
South Ramp	1	50	20-30	1	20-30

Table RR-10: Launch Ramp Parking Evaluation

Facility	*Existing Lanes*	*Existing Parking*	*Suggested Parking*[1]	*Possible Lanes*[2]	*Possible Suggested Parking*[3]
Beals Point	1		20-30	2	40-60

[1]Suggested parking spaces based on DBW guidelines for the typical minimum parking per launch lane. Actual parking needed is recommended to be determined according to the expected demand during a typical peak day.

[2]Possible lanes based on DBW guidelines assuming 6-foot wide boarding floats.

[3]Possible suggested parking space based on DBW guidelines for shoreline facilities using possible number of launch ramp lanes.

Source: Concept Marine Associates, Inc., 2003.

Whitewater Rafting Facilities

- Parking areas at Salmon Falls and Skunk Hollow reach capacity by midday on peak season weekends resulting in backups onto Salmon Falls Road;
- Situation is aggravated in late afternoon when rafters arrive over a short timeframe causing backups as commercial shuttle buses and vans queue to load up rafters and equipment; and
- Overflow parking along Salmon Falls Road raises concerns about traffic and pedestrian safety.

Terrestrial Facilities

Campgrounds

- Capacity is an issue with all three campgrounds (Peninsula, Beals Point, and Negro Bar group camp) fully occupied on peak season weekends;
- Dense layout of Beals Point campground results in many small sites with little vegetation or privacy;
- Beals Point campground appears worn due to erosion from vehicles;
- Access for campers with reservations at Beals Point can be difficult during peak times when the day use parking area fills and result in traffic backups;
- The majority of the campsites in the Unit (147) are available for either online or telephone reservations through a reservation service with the remaining 29 sites held open on a first-come first-served basis.
- Campers without reservations at Peninsula campground must drive all the way to the campground from Pilot Hill to find out if sites are available;
- No shower facilities exist at Peninsula campground; and
- Only three group campsites (Negro Bar) exist within the Unit.

Day Use Facilities

- Beals Point and Granite Bay parking areas fill by midday during peak season weekends causing traffic backups onto Douglas Boulevard, Auburn-Folsom Road, and surrounding neighborhood streets;

- Unrestricted vehicle access to the lake at Beals Point, North Granite, and Old Salmon Falls during low water levels results in erosion damage that could impact cultural resource sites below the high water line as well as water quality;

- Only one access to Granite Bay results in significant backups along Douglas Boulevard and onto Auburn-Folsom Road when the parking areas fill;

- No external access to the sprawling and relatively remote North Granite area makes it a difficult area to patrol;

- Remote location of North Granite, particularly Oak Point, makes it a popular location for illegal activities, such as under-age drinking, fighting, off-highway vehicle use, vandalism, and so on;

- Ground squirrels at Beals Point are habituated to the presence of humans and are aggressive;

- Possible erosion on State land and trails resulting from nearby residential development abutting the Unit boundary;

- Monte Vista area of Old Salmon Falls has potential for establishment of an environmental campground; however, nearby residential development is a significant constraint to increased public use in the area;

- Improvements to boat-in day use area on the Peninsula, such as drinking water, vault toilets, enhanced beach area, and extension of Darrington Trail could make this facility more enjoyable;

- Popularity of Folsom Point for the staging of special aquatic events causes both the day use and aquatic facilities to reach capacity quickly on peak season weekends;

- Folsom Point picnic area appears eroded and worn due to heavy foot traffic and informal parking off paved surfaces;

- Possible improvements at Folsom Point could include additional picnic capacity, formalized parking area, and formalized water access and shoreline area (such as a beach).

- Interest by various boat clubs—including Folsom Lake Yacht Club and California State University Sacramento (CSUS) Aquatic Center—in establishing a multi-use aquatic facility at Folsom Point or Browns Ravine;

- Long term use of Observation Point once its use as a staging area for Folsom Dam-related improvement projects is complete, i.e. temperature control device installation

(current), outlet modifications project (late 2003 through 2006), and Folsom Dam raise (2006 through 2011);

- Lack of adequate visitor amenities at Folsom Powerhouse State Historic Park. New visitor center and expanded parking area planned for Folsom Powerhouse State – visitor center could include American River Water Education Center;

- Vandalism and graffiti at the Folsom Powerhouse has necessitated the installation of security fencing on all but the shoreline side of the site;

- Popularity of Willow Creek site may require the development of additional facilities to minimize the wear and tear and erosion caused by informal parking in the picnic area;

- Potential to establish an environmental camping area at Willow Creek and enhance the interpretive opportunities of the heron and egret rookery located just across the Lake Natoma;

- Use of Nimbus Flat by the CSUS Aquatic Center for major competitions and events, particularly during peak season weekends, results in capacity conditions early in the day and complaints that access to the area for non-competition related activities is difficult;

- Canada geese at Nimbus Flat have become permanent residents raising concerns about health and water quality;

- Lack of visitor facilities (toilets and interpretive displays) at Lake Overlook and general disrepair of the site, including parking area and security fencing; and

- Interest from outside groups—Master's Rowing Club and Sacramento African American Cultural and Historical Society—in developing additional recreational and cultural facilities at Negro Bar, including a paddling facility in the area of the existing boat launch and a cultural center in the area of the "cottage".

Trails

- Significant interest and demand for expansion of the existing trail system to accommodate a wider range of users, including mountain bikers;

- Additional trail miles could be provided by extending single-track facilities or by constructing parallel existing single-track facilities, although parallel trails could be the best way to reduce conflicts between multiple trail users and to improve safety;

- Preference of some trail users (usually equestrians and pedestrians) to create new trail facilities where possible instead of changing existing use designations that would take trail mileage away from one user group and assign it to another;

- Trail education program needed to improve the safety of the trail system and enhance cooperation and respect between trail users; and

- Trail enforcement program needed in conjunction with education to improve trail system safety by establishing uniform rules for enforcement, a CDPR or volunteer patrol program, and a reporting system.

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RECREATION, SCENIC AND CULTURAL RESOURCES

AESTHETIC, VISUAL, AND SCENIC RESOURCES

Folsom Lake State Recreation Area

April 2003

by

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AESTHETIC, VISUAL, AND SCENIC RESOURCES

Introduction

Folsom Lake State Recreation Area (the Unit) represents a significant visual and scenic resource within the region. Although the manmade reservoirs were created for flood control, water supply and power generation, the resulting lakefront setting affords visitors with dramatic panoramas of the lakes and the surrounding natural landscape. The growing urban development around the Lakes also affords visitors with views of less scenic urban elements such as the two dams, electric transmission facilities, industrial areas, and residential subdivisions and roadways. Together, the length and configuration of the Unit's shoreline, coupled with the hilly topography provide significant variety in both viewpoint orientation and available viewsheds, creating a wealth of viewing conditions and opportunities. These resources include a combination of panoramic views in which the lakes form the dominant foreground element and the surrounding Sierra Foothill landscape forms the background, as well as distinctive landscape features and built features.

Scenic Resources

Numerous scenic resources, such as panoramic views, vista points, landscape features, and built features contribute to an existing positive visual experience for Unit users. Figure SR-1 illustrates these scenic resources on Folsom Lake. Lake Natoma resources are illustrated in Figure SR-2.

Panoramic Views

The Unit's most significant scenic resources are the dramatic and high quality panoramic views that are available. These panoramas include views across the lake, views from the lake, as well as views out over the surrounding non-park landscape. For example, Lake Overlook above Nimbus Dam provides sweeping views of Lake Natoma and the Sierra Foothills to the north, while the view south extends to the Sacramento Valley and Mt. Diablo in the Bay Area (Photo SR-1). East-facing views from the western shores of Folsom Lake include the sweep of the lake surface in the foreground with the regionally characteristic landscape of rolling hills, open grasslands, and scattered oak and gray pine woodlands on the Peninsula (Photo SR-2). Views north from Folsom Dam provide a sweeping view of Folsom Lake framed by foothills. Each of these panoramas includes a unique combination of water, sky, and natural and built features.

Vista Points

Due to the varied topography and sheer length of shoreline within the Unit, there are innumerable points from which to enjoy the area's scenic resources. However, due to limitations on vehicle access around the lakes there are a handful of key vista points that are widely visited. Lake Overlook—the highest point within the park—is one of the best-known vista points. From this Overlook one is presented with sweeping views of Lake Natoma, the Sierra Foothills, Nimbus Flat, Nimbus Dam, Nimbus Shoals, and urban development in the valley below. Observation Point by Folsom Dam provides sweeping views of Folsom Lake, the levees, and the rugged oak-studded hills of the Peninsula. In addition to these vista points,

other frequently visited viewing areas that provide sweeping vistas of the Unit occur where there are public facilities along the lake shoreline, such as the Folsom Lake Marina, Folsom Point, Beals Point, Granite Bay, Doton's Point, etc. Other vista points are accessible only by trail and receive much lower visitation due to their more limited access and remote location. For example, a vista point exists at the tip of the peninsula on the eastern shore of Folsom Lake. This vista point is visited primarily by mountain bikers and hikers on the Darrington Trail. From this vantage point, views extend from the rugged eastern shore of the North Fork, south toward Folsom Dam, and west toward the beaches at Granite Bay.

Landscape Features

The Unit includes several distinctive landscape features. The two lakes that are the basis for the Unit, Folsom and Natoma, are the most obvious and well-known. The steep-walled gorge below Folsom Dam that links the two lakes is particularly scenic. The rugged peninsula separating the North and South Forks of the American River at Folsom Lake is visible from many parts of the park and contributes to a sense of wild undeveloped countryside due to the limited development. Flagstaff Hill (at over 1,400 feet) and Shirttail Peak (at over 1,300 feet) mark the highest points of the prominent ridgeline that forms the peninsula. Nearby Iron Mountain, located where New York Creek meets the South Fork of the American River, also stands out on the eastern shore of Folsom Lake rising almost 300 feet above the water. Along the western shore of Folsom Lake where it meets the North Fork of the American River, a significant ridgeline rises above the water between North Granite and Horseshoe Bar. Steep gorges further upstream on both the North and South Forks as they extend toward the Sierra Foothills are even more impressive. The Lake Natoma Bluffs rising 150 feet above the western shoreline of Lake Natoma between Negro Bar and Mississippi Bar are another unique geological formation within the Unit (Photo SR-3). The heavily vegetated shoreline along Lake Natoma is also an important landscape feature that plays a significant role in shaping the character of the Unit as well as the surrounding area.

Further, a significant cultural landscape feature is found along the Lake Natoma shoreline in the Mississippi Bar area and along the eastern shore north of Willow Creek. These areas are covered with the dredge tailings from early gold mining to more recent aggregate extraction. These tailings exist as large piles of cobblestones, some several stories high (Photo SR-4). Clearly not part of the natural landscape, the tailings are a distinctive and unusual visual feature. While culturally interesting, the public's perception of their aesthetic value appears to vary.

Distinctive Built Features

The aesthetic value of built features in the natural landscape is subject to different interpretations. Whereas such features are often distinctive because of their contrast with their setting, determining whether their aesthetic contribution is positive or negative can be quite subjective. For example, the damming of the American River at Folsom by the Federal Bureau of Reclamation, has resulted in a number of distinctive built features within the Unit. These features include Folsom Dam, a concrete structure more than 1,400 feet long and 480 feet high, and Nimbus Dam, a concrete structure almost 1,100 feet long and 87 feet high.[1] Associated structures include earthen levees that emerge from Folsom Dam and form the

[1] U.S. Department of the Interior, *Bureau of Reclamation. Folsom Dam Fact Sheet*, Date unknown.

eastern and western shores at the south end of Folsom Lake. While certainly visually distinctive, the effect of these features on the visual character of the Unit is mixed. The large engineering projects certainly detract from the "natural" character of the setting, and the natural character of the Unit is one of its scenic strengths.

Other visually distinctive built features include the three bridges that cross the American River in Folsom. The historic truss bridge, originally built in 1893, was replaced in 1917 with the completion of the adjacent Rainbow Bridge (Photo SR-5).[2] The truss bridge was moved by the State in 1930 to Siskiyou County where it was used until 1998.[3] Taking advantage of this opportunity, the City of Folsom purchased the bridge and reinstalled it in 2000 as a pedestrian and bicycle crossing. The concrete Rainbow Bridge continues to serve as a symbol of Folsom with its underside arch and elegant design. A more recent bridge, the Lake Natoma crossing, mimics many of the design elements of the Rainbow Bridge making it a distinctive feature on Lake Natoma (Photo SR-6). Despite the design, the scale of the structure and the angled alignment of the crossing does break up views up and down the lake. This new bridge, completed in 1999, links Folsom Boulevard on the eastside with Auburn-Folsom Road on the westside.

Located downstream of the three bridges and adjacent to the river, the tall, slender brick building and associated structures that housed the historic Folsom Powerhouse is unique visual feature within the Unit. However, given its downslope location from the main roadway and the wooded condition of the site, it is not a highly visible feature from surrounding areas. This State Historic Park is the site for several structures dating back to the 19th century and is listed on the National Register of Historic Places (1981).

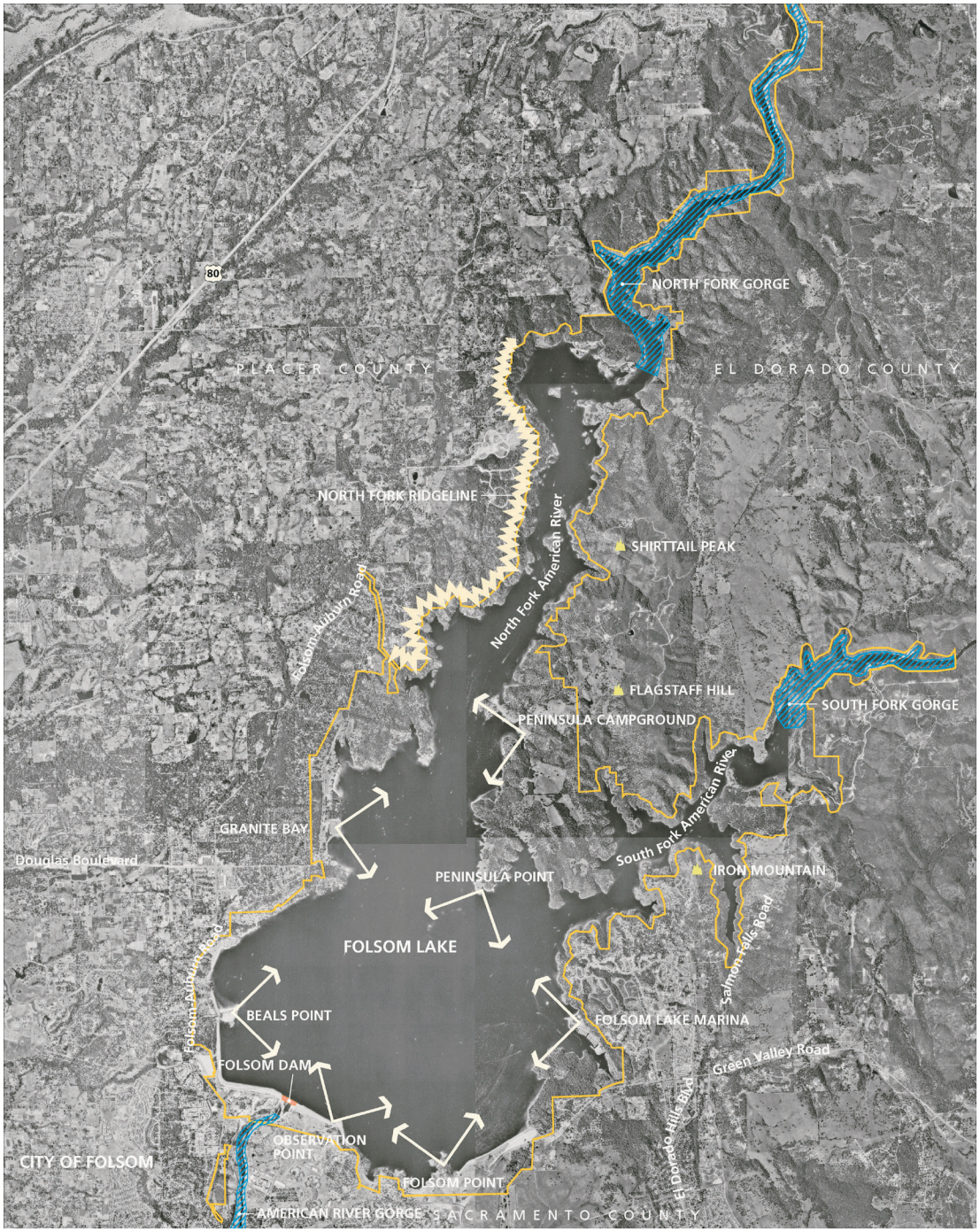
Elements Detracting from Scenic Resources and Visual Quality

There are a number of visual features or characteristics in the Unit and vicinity that detract from the quality of the views and scenic character. Some of these features are within the Unit while others are located outside the Unit boundaries. Figure SR-3 locates visual intrusion of urban development on Folsom Lake and Figure SR-4 illustrates these conditions on Lake Natoma.

Visual Intrusion of Urban Development

There are several locations in the Unit where urban and rural development immediately adjacent to the Unit boundary are visually intrusive. When land was originally acquired in the 1950's to create the reservoir little consideration was given to the potential for urban encroachment. So, in most cases the land acquisition did not extend up and over the primary ridgeline that surrounds Folsom Lake. As the Folsom area continues to urbanize, homes are being built on the ridgelines overlooking Folsom Lake. In fact, views of the lake are a key selling point for selling such real estate. This development has an adverse effect on views from the Unit and the overall scenic quality. Because of their hillside and ridgeline locations, these homes tend to be silhouetted against the sky, significantly altering the skyline and the perception of the Unit area as a rural, natural area. Residential neighborhoods on Folsom

[2] http://www.myfolsom.com/trussbridge.shtml.
[3] Ibid.



FOLSOM LAKE STATE RECREATION AREA RESOURCE INVENTORY

- Dredge Tailings
- Ridgeline
- Vista Point
- Prominent Hilltops
- River Gorge/Canyon

FIGURE

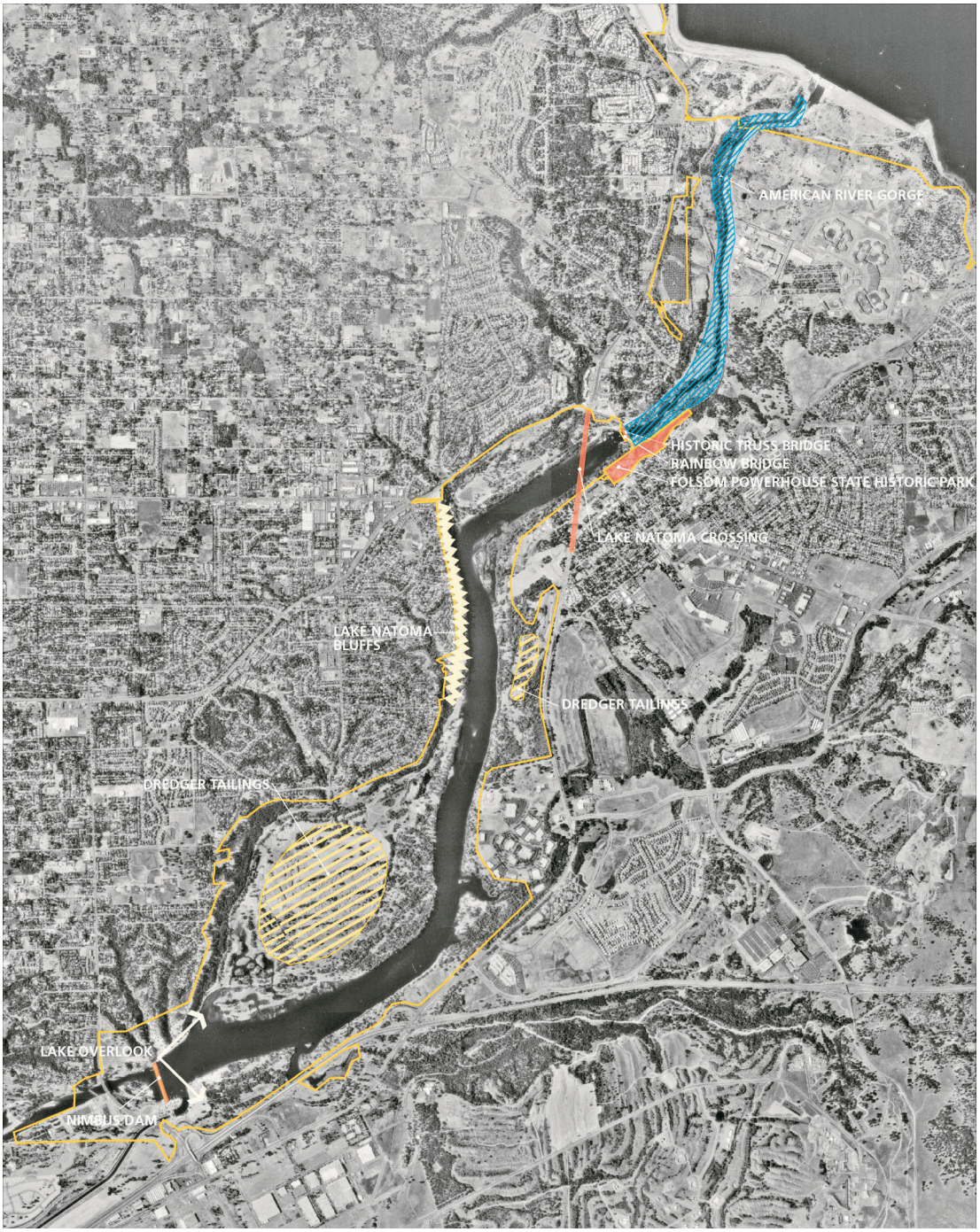
SR-1

Scenic Resources on Folsom Lake

Prepared by
Wallace Roberts & Todd

N

Not to Scale



FOLSOM LAKE STATE RECREATION AREA RESOURCE INVENTORY

- Dredge Tailings
- Ridgeline
- Vista Point
- Prominent Hilltops
- River Gorge/Canyon

FIGURE

SR-2

Scenic Resources on Lake Natoma

Prepared by
Wallace Roberts & Todd

N

Not to Scale

Lake display a range of densities from high end rural ranchette subdivisions to urban small-lot subdivisions.

Along the western side of Folsom Lake, much of the adjacent development is screened from view by both existing vegetation and distance. For example, at Granite Bay, the relatively flat topography and heavily vegetated land area effectively buffers the visitor use facilities from adjacent development. Although a similar setting exists at Beals Point, residential neighborhoods along the western shoreline are visible in the distance due to the beach's location on the west facing side of the point. North of Oak Point, the proximity of urban development becomes much more visible from within the Unit, such as at the Granite Bay equestrian staging area (Photo SR-7). A significant amount of residential development also occurs on the ridgeline overlooking the North Fork of the American River between the North Granite area and Horseshoe Bar.

Along the eastern side of Folsom Lake in El Dorado County, nearby urban and rural residential development is more apparent and has substantially altered the visual character of the Unit in some locations. This is most evident at Brown's Ravine and at Old Salmon Falls, where residential development hugs the Unit boundary on bluffs above these facilities, and on Iron Mountain above New York Creek where it meets the South Fork of the American River. At Brown's Ravine, large homes are clearly visible from the marina area, Hobie Cove, and the day use area (Photo SR-8). This northern view is in stark contrast to other directions that contain oak-studded hillsides, the marina basin, and the open waters of Folsom Lake. A similar situation exists at the remote Old Salmon Falls lower parking area and trailhead. The sense of remoteness are enhanced at this site by the high quality views west toward the oak-covered hills of the peninsula. In contrast, views to the south include large homes on the hillside above the trailhead (Photo SR-9). Although not immediately adjacent to the Unit, new residential development south of Green Valley Road in the area of the Mormon Island Wetland Preserve is clearly visible from the trail along the top of Mormon Island Dam. From this vantage point, the growing suburban neighborhoods of the El Dorado Hills area spread to the south and east (Photo SR-10). Finally, the area adjacent to the Folsom Point entrance at East Natoma Street is now the site of a large large religious assembly facility which significantly changes the character of this entrance to the Unit (Photo SR-11). An attempt by the City of Folsom to preserve nearby parcels adjacent to the Unit boundary as open space failed and further development entitlements have been granted.

On Lake Natoma, views from the Unit are generally more limited and of higher quality due to the dense riparian vegetation along the shoreline and the Lake Natoma Bluffs. Effective screening of the surrounding urban neighborhoods contributes to a more intimate and secluded park-like setting compared to the far larger and more spacious Folsom Lake. Views in the southern portion of Lake Natoma tend to be of lower quality due to Nimbus Dam and associated power transmission lines and other facilities. At the Lake Overlook, residential development abuts the Unit boundary adjacent to the unpaved parking area at the horse assembly area and trailhead. A low earthen berm provides the only separation between the Unit and the neighborhood. Immature trees in the rear yards of these homes do little to provide screening (Photo SR-14). From certain vantage points, the office and industrial buildings that abut Lake Natoma in the area of Blue Ravine Road can be seen from trails along the eastern shoreline; however, heavy vegetation and dredger tailings in the area do much to screen this development from view.

At Nimbus Flat, the Unit gateway at Hazel Avenue north of the interchange with Highway 50 is well landscaped once you pass the gate booth. However, the entrance drive between Hazel Avenue and the gate is less visually appealing than other entrances on Lake Natoma. North of the entrance drive is the South Folsom Canal, which separates this area from the CSUS Aquatic Center (Photo SR-12). A poorly maintained chain-link fence encloses the canal. South of the entrance drive is a Caltrans park-and-ride lot that also serves as a Goodwill donations drop-off point in the form of a parked transport trailer. Neither the canal nor the parking lot are adequately screened from the entrance to Nimbus Flat. Further, the gateway sign for the Unit is located in the Hazel Avenue right-of-way adjacent to the lot (Photo SR-13). Overall, this gateway to the Unit is not in keeping with the park-like setting that visitors encounter once they pass through the gate.

It should be noted that Lake Natoma is part of the American River Parkway under the 1985 American River Parkway Plan. As such, the County of Sacramento has authority over land uses adjacent to Lake Natoma within unincorporated Sacramento County. The County applies a Parkway Corridor (PC) Combining Zone in such areas to ensure land use compatibility and reduce visual intrusion on natural amenities.[4]

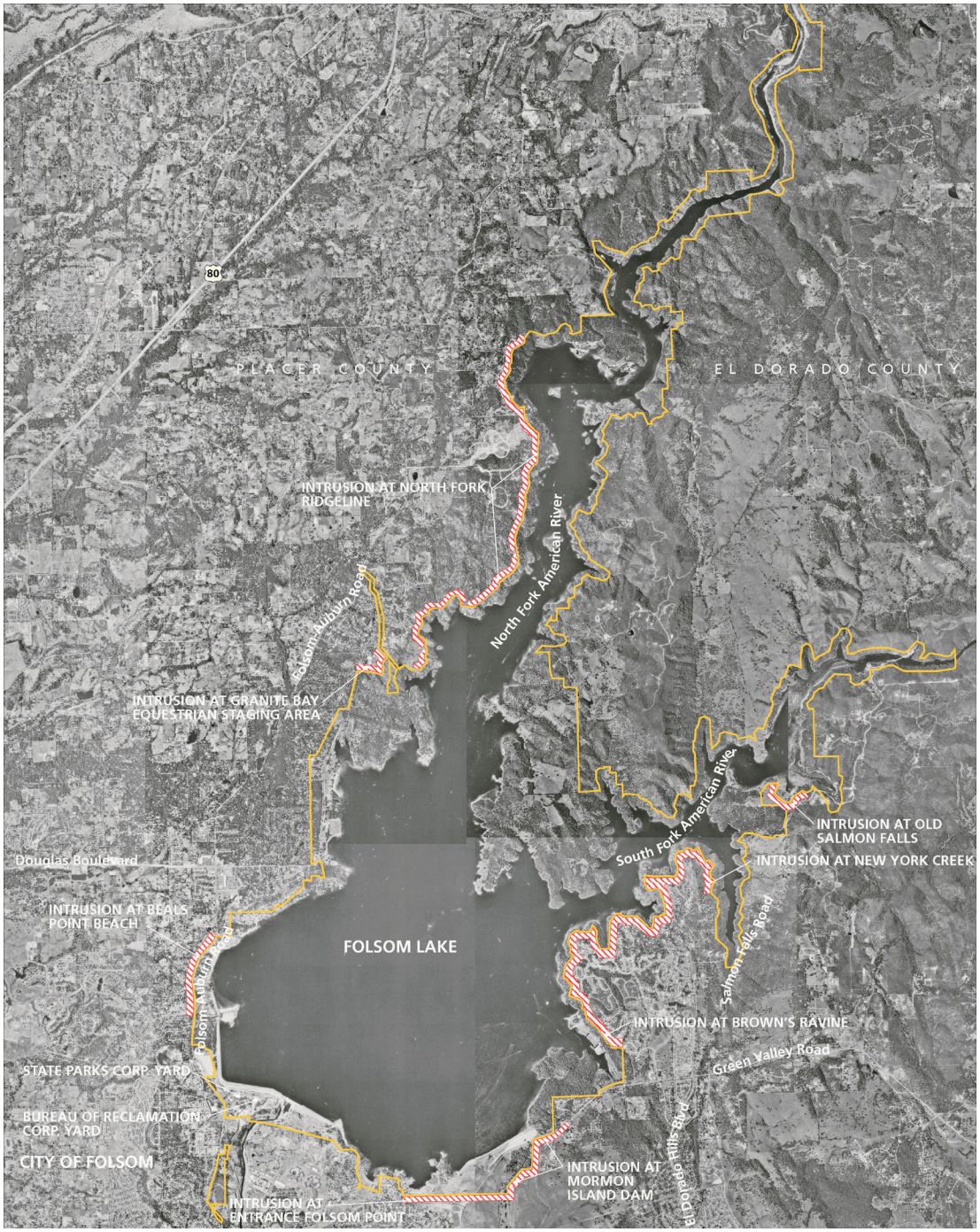
Built Features within the Unit

In several locations throughout the Unit, built features or human intervention detract from the overall visual quality and ultimately the visitor experience. These features include the dams, parking lots, utility corridors, and temporary structures associated with park activities. In addition, the seasonal fluctuations in the water level of Folsom Lake has significant visual implications.

Dams

Although the damming of the American River at Folsom resulted in the creation of the Unit, Folsom Dam, Nimbus Dam, and their associated earthen levees and appurtenances detract from the natural character of the Unit's setting. This is particularly the case on Folsom Lake in late autumn when the surface water elevations are at their lowest of the season. It is at this time that significant portions of the Folsom Dam and levee elevations are visible above the water line. At Folsom Dam, this elevation can be as much as eight stories and extending a length of 1,400 feet.[5] In spring when Folsom Lake is full, the exposed elevation at Folsom Dam can be as little as 14 feet. Folsom Dam also includes a four-story tower on the dam crest that is silhouetted against the sky when viewed from the Lake. Since the Nimbus Dam is an afterbay structure designed to reregulate flows into the American River, surface water elevations on Lake Natoma vary by only four to seven feet.[6] As a result, little of the Nimbus Dam elevation is exposed and the structure appears less intrusive from Lake Natoma. These dams are large engineered structures and have the significant negative impact on water views in the Unit.

[4] County of Sacramento, *Sacramento County Zoning Code, Sec. 235.*, date unknown.
[5] U.S. Department of the Interior, date unknown.
[6] Ibid.



FOLSOM LAKE STATE RECREATION AREA RESOURCE INVENTORY

Visual Intrusion from Development

FIGURE

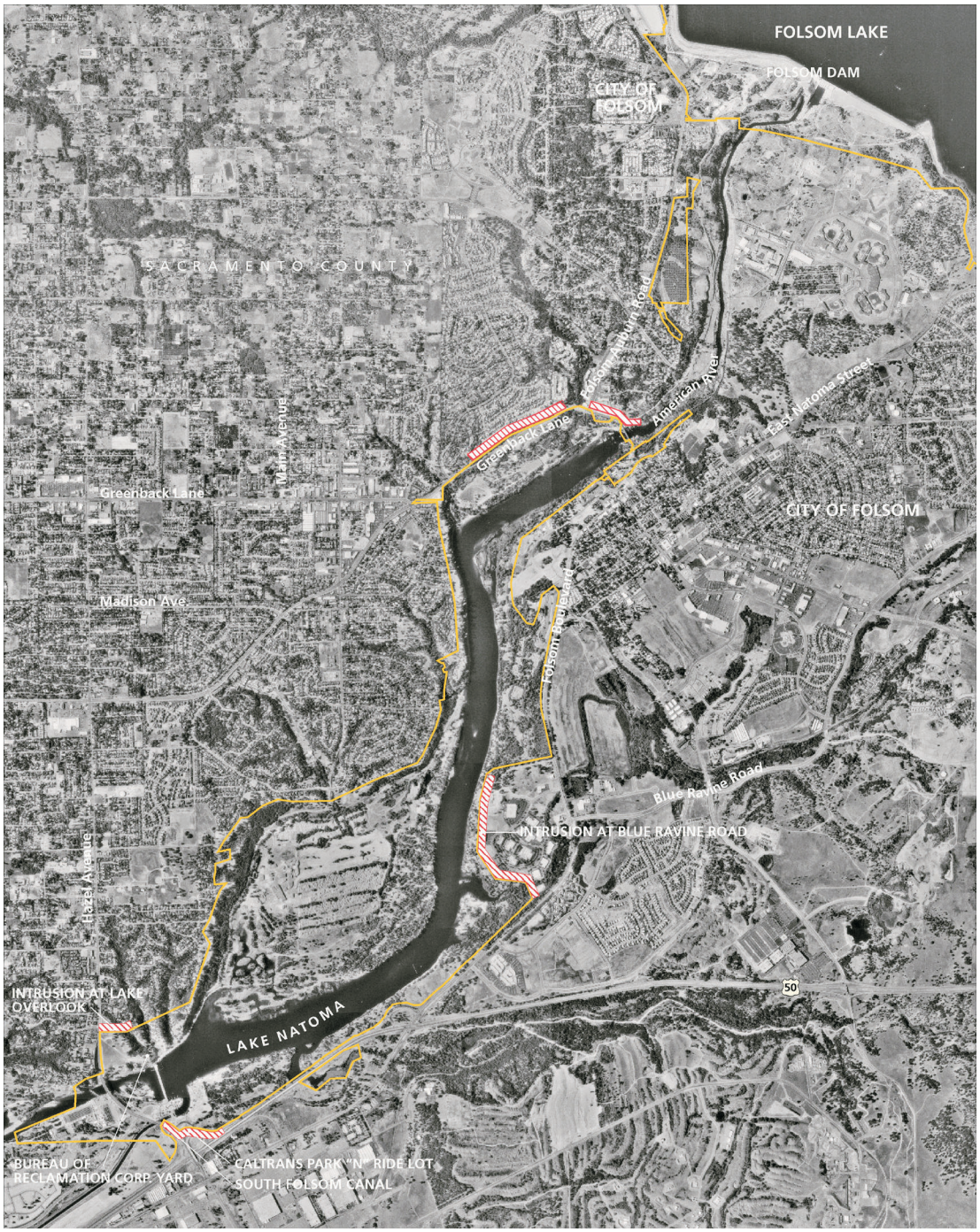
SR-3

Elements Detracting from Scenic Resources and Visual Quality on on Folsom Lake

Prepared by
Wallace Roberts & Todd

N

Not to Scale



FOLSOM LAKE STATE RECREATION AREA RESOURCE INVENTORY

Visual Intrusion from Development

FIGURE

SR-4

Elements Detracting from Scenic Resources and Visual Quality on on Lake Natoma

Prepared by
Wallace Roberts & Todd

N

Not to Scale

Parking Lots

The combination of large numbers of vehicles with large trailers requires the provision of substantial areas of parking. However, more than any other park facility, the large unbroken parking lots at the key day-use facilities tend to degrade the visual quality of these recreation areas. For instance, the main beach parking area at Granite Bay, nearly 5 acres in size, includes no internal or perimeter planting (Photo SR-15). Further, no planting exists at Folsom Point where the ramp parking lot measures almost 7 acres. The same situation exists at the 5-acre Negro Bar boat ramp parking lot (Photo SR-16). While the Granite Bay main boat launch parking area (6 acres) is broken up by internal planting above the high waterline, it is widely distributed and provides little visual relief (Photo SR-17). Similarly, the parking area at the Folsom Dam Observation Point is a huge area of asphalt immediately adjacent to the public roadway, in the foreground of views of the lake by passing motorists. Although the issue of parking capacity in the Unit is a significant one, their implication for the visual experience of the Unit user must be considered.

Utilities

There are several locations within the Unit where utility lines interrupt the scenic landscape and reduce the quality of views from significant vista points. The main utility through the Unit is the Western Area Power Administration high-tension electrical transmission line between the Nimbus Dam substation to the Folsom Dam substation. The corridor right-of-way is 150 feet wide. The line extends from Nimbus Dam north along the western shoreline of Lake Natoma to Mississippi Bar.[7] The line crosses Lake Natoma at the bend near Willow Creek and follows the eastern shoreline to a point just south of the Lake Natoma Crossing. The line crosses the lake once more and follows the western shoreline along the American River Gorge to Folsom Dam.[8] Clearly visible from several vantage points in the Mississippi Bar and Negro Bar areas, the towers and overhead lines are significant foreground features when viewed from Lake Natoma and the Lake Overlook (Figures 18). A municipal electrical utility line passes through the Folsom Powerhouse State Historic Park along the eastern shore of Lake Natoma (Photo SR-19). Despite the history of the Folsom Powerhouse, this utility line is not related to the facility and significantly reduces the quality of views of the Powerhouse buildings and detracts from their historic quality. Various utility structures and appurtenances are associated with electrical power generation at both Folsom and Nimbus dams. In addition, a 42-inch pipeline carrying water from Folsom Lake to the Folsom Prison and the City of Folsom runs from the base of Folsom Dam.[9]

Other Structures and Activities

Three corporation yards exist within the Unit and significantly impact key views. Both the California Department of Parks and Recreation (CDPR) and Bureau of Reclamation (BOR) yards located on Folsom Dam Road are poorly screened from the roadway and lend an industrial feel to the area. This stretch of roadway between the intersection with Auburn-Folsom Road and the Folsom Dam is a major Unit gateway and includes a Park monument

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[7] Western Area Power Administration, *Draft Environmental Assessment for Right-of-Way Maintenance in the Sacramento Valley, California,* May 2002, pg. 3-3.
[8] Ibid., pg. 3-3.
[9] Ibid.

sign, manicured lawns, and ornamental planting. The third yard is a BOR facility located on the western shore of Lake Natoma below the Lake Overlook (Photo SR-18). As with the high-tension electrical transmission line described above, the yard is a significant feature in the foreground view of Lake Natoma from Lake Overlook. Further, the yard is clearly visible from the eastern shore at Nimbus Flat.

Additional activities that adversely affect visual quality within the Unit include the use of temporary storage facilities by concessionaires and security fencing in specified areas. The storage facilities, 20-foot long white metal transportation containers, are used to store boating equipment at the Negro Bar beach, Granite Bay main beach and boat launch, and the Willow Creek day use area (Figures 20-22). These containers sit awkwardly on the park landscape, sharply contrasting with the natural character of their setting. Due to the importance and sensitive nature of the dams, security fencing is necessary in several key areas, particularly areas where the public would otherwise have access. However, this fencing is often in various levels of disrepair and reduces visual quality from many vantages within the Unit. One example of security issues impacting the scenic resources of the Unit is from the Lake Overlook. From this point, an old chain-link fence interrupts southern views and a guardrail intended to restrict off-road vehicle access does little to improve views out from the overlook (Photo SR-23).

Exposed Shoreline of Folsom Lake

Seasonal fluctuation in water levels results in considerable impact on the visual quality of Folsom Lake. The highest elevations occur in late winter or early spring when storm and snowmelt runoff fill the reservoir; the lowest in late fall or early winter following the dry season. As a result, the elevations drop continuously—up to about 70 feet in normal years—from the start of the peak recreation season around Memorial Day through the season's end at Labor Day. Unlike bodies of water under tidal influence or natural riparian corridors as found upstream in the South and North Forks of the American River, Folsom Lake does not have the advantage of habitats that can adapt to such large changes in environmental condition. This leaves much of the exposed shoreline devoid of vegetation. The relatively gradual slope to the lake bottom results in a greater area of exposed shoreline with lower water levels, resulting in the "bathtub ring" effect common to California reservoirs. As Folsom Lake shrinks over the course of the recreation season, so does the quality of the views along its 75-miles of shoreline (Figures 24-26). This condition is further exacerbated by visitors who drive their vehicles out onto the exposed slopes, causing rutting and erosion of the exposed areas. In some years, this condition is mitigated by a striking display of wildflowers along shorelines with a particular aspect, including along the eastern shoreline between New York Creek and Old Salmon Falls.

External Views

Public views of the Unit from external viewpoints are limited due to the topography of the area, the heavy vegetation within the Unit boundaries, and the nature of land ownership around the Unit. Views from private property, particularly of Folsom Lake, are impressive as reflected by the high-end residential estate development occurring around that lake. In El Dorado County, this style of development commands the hills along the majority of the eastern boundary of Folsom Lake to Salmon Falls. As this development extends from Salmon Falls Road north of Green Valley Road, property size increases dramatically as Folsom Lake views become a major selling factor. Along the western boundary of Folsom Lake in Placer

County, most of the choice properties with lake views have been developed. In addition, several exclusive gated subdivisions currently exist on the ridge above the Lake. As a result, few clear public access points exist from which to view Folsom Lake. This situation also applies to Lake Natoma, where the lands abutting the Unit boundary that afford the best vantage points are existing residential neighborhoods with little public access.

Views from Area Roadways

Local roadways that pass through the Unit afford the best public views from external locations. These public views are distinctive since the only way to pass through the Unit is by one of five crossings. The five crossings serve as important gateways to the Unit and provide views of high quality. The visual experience at each crossing is as different as the views they provide; the visual experience also depends on a number of other important factors, such as travel direction, travel speed, and roadway elevation. In the case of the latter, the elevation provided by the bridge crossings results in ideal vantages. It should be noted that, with the exception of the crossing at Folsom Dam, all crossings accommodate pedestrian and bicycle traffic which allows for more leisurely enjoyment of the views.

The Hazel Avenue crossing of the American River south of the Nimbus Dam has the highest capacity and travel speed. Here the northbound views are of higher quality than they are southbound. As one travels north across the bridge, the urban landscape of the Highway 50/Hazel Avenue interchange falls behind as the bluff upon which the Lake Overlook lies looms ahead. The oak-studded bluff is in sharp contrast to the urban-developed plain to the south. Looking east, one can clearly see Nimbus Dam in the foreground, the length of Lake Natoma in the mid-ground and in the far distance the foothills of the Sierra. Although the travel speed on this bridge is fairly high, the bridge is long and provides the opportunity to experience the sweeping views.

Lake Natoma Crossing in Folsom connects Folsom Boulevard on the eastern shore with Auburn-Folsom Boulevard on the western shore. The travel speed, crossing angle, and length of the bridge provide an opportunity to observe the green shorelines of Lake Natoma to the west and the Rainbow Bridge and Historic Truss Bridge to the east. However, view quality in this area depends on the direction of travel. The Rainbow Bridge, located just east of the Lake Natoma Crossing, is the shortest of all the vehicle crossings. Despite this, the travel speed is low with high quality views of the new Lake Natoma Crossing and the lake to the west. High quality views also exist to the east of the Historic Truss Bridge with the American River gorge dropping from Folsom Dam in the immediate foreground with Lake Natoma beyond. Eastbound travelers can catch a glimpse of historic downtown Folsom as well as the Folsom Powerhouse State Historic Park. The fourth crossing, the Historic Truss Bridge, provided the first crossing of the American River in Folsom and now serves as a pedestrian and bicycle bridge. While this crossing provides the best views of the river gorge to the east, the western views of Lake Natoma are partially blocked by the Rainbow Bridge.

The fifth crossing of the Unit is located on the Folsom Dam at the southern limit of Folsom Lake. This low-speed two-lane crossing is more than 1,500 feet long and provides sweeping views of Folsom Lake to the east and of the rugged spillway and the City of Folsom to the west. No pedestrian or bicycle access is provided at this crossing with no stopping along the roadway permitted. In addition, Observation Point at the eastern end of Folsom Dam has been closed for security reasons since September 11, 2001. As a result, the only means of enjoying the views provided from this vantage is by automobile. It is important to note that

the dam road will be closed during construction of the dam raising project. This project is tentatively scheduled to begin in 2005 or 2006 and will not reopen to public travel once the project is complete. A replacement crossing is planned just west of the dam.

Threats to Scenic Resources

The primary threat to scenic resources is from development that is rapidly closing in on the Unit on several fronts. Future development will likely come in the form of estate residential subdivisions on the hillsides above Folsom Lake along the Unit boundary. This threat seems more immediate in unincorporated El Dorado County where several residential estate subdivisions have been approved and new homes that back directly onto Unit lands continue to appear (Photo SR-27). Unfortunately, it is difficult to influence this type of activity outside of the Unit through a State Parks General Plan. With the exception of Granite Bay and the peninsula area, the State owns only a narrow strip of land along the shoreline above the high water mark. As a result, it is difficult to buffer the Unit from surrounding development and screen external views. Furthermore, the topography is such that the State would have to acquire lands between the Unit boundary and the top of surrounding ridgelines in order to protect views from the Unit. Figure SR-5 identifies these land areas on Folsom Lake. Areas for priority acquisition would be the lands not currently developed or approved for development.

Figure SR-5 also shows that the area of the Unit most at risk to this type of development is the peninsula between the two forks of the American River. The peninsula, characterized by rolling hills, open grasslands, and scattered oak and pine groves, represents the largest natural and untouched portion of the Unit (Photo SR-28). Furthermore, the peninsula is the most visible land area from Folsom Lake and its western shore. As residential subdivision development continues to push east along Salmon Falls Road, there is the potential over time for lands currently zoned agricultural to be rezoned as residential, particularly in the peninsula area. If this development were to occur on hillsides and ridgelines visible from within the Unit, then the rugged and untouched character of this area would be lost.

Due to these factors, land acquisition here should be of high priority for the State. Additionally, the State should consider acquiring the western shoreline along the North Fork of the American River in Placer County opposite the peninsula where the topographic conditions are similar. The State is currently considering the purchase of two major parcels totaling almost 1,000 acres adjacent to the existing Unit lands on the peninsula.[10] In this way, the most pristine and rugged natural landscapes within the Unit may be preserved, as will the contribution of these landscapes to a high quality visual resource.

Scenic Resource Issues

This section summarizes the current issues related to the scenic resources of the Unit.

- Visual intrusion of urban development into the Unit along western shoreline of Folsom Lake, including at Beals Point beach, Granite Bay equestrian staging area, and above North Fork of the American River between North Granite and Horseshoe Bar;

[10] State Parks staff, Personal communication, July 2003.

Figure SR-5: Threats to Scenic Resources in the Unit (This figure to be provided at the completion of GIS analysis)

- Visual intrusion of urban development into the Unit along western shoreline of Folsom Lake, including at Beals Point beach, Granite Bay equestrian staging area, and above North Fork of the American River between North Granite and Horseshoe Bar;

- Visual intrusion of urban development into the Unit along eastern shoreline of Folsom Lake, including at Old Salmon Falls, New York Creek, Brown's Ravine, Folsom Point entrance, and Mormon Island Wetland Preserve;

- Visual intrusion of urban development into the Unit on Lake Natoma at equestrian staging area at Lake Overlook and in the area of the office park at Blue Ravine Road;

- Lack of screening of the South Folsom Canal and Caltrans park-and-ride lot that abut the entrance drive to Nimbus Flat;

- Large parking areas without internal or perimeter landscaping detracts from the visual quality of several recreation areas, including at Granite Bay main beach, Folsom Point boat launch, Negro Bar boat launch, Observation Point, Lake Overlook, etc.;

- Interruption of scenic landscape by utility lines and structures, including: Western Area Power Administration high-tension electrical transmission corridor along western shore of Lake Natoma; municipal electrical utility line through Folsom Powerhouse State Historic Park; structures and appurtenances associated with electrical power generation at Folsom and Nimbus dams; and 42-inch pipeline carrying water from Folsom Lake to the Folsom Prison and the City of Folsom;

- Unscreened corporation yards impact key views, including the State Parks and Bureau of Reclamation yards located on Folsom Dam Road, and the Bureau yard on the western shore of Lake Natoma below the Lake Overlook;

- Use of temporary metal storage containers by boat equipment concessionaires at several locations, including at Negro Bar beach, Granite Bay main beach boat launch, and Willow Creek.

- Security fencing associated with dam operation areas and corporation yards is unscreened and in levels of disrepair and reduces visual quality from many vantages within the Unit;

- "Bathtub ring" effect of exposed shoreline at low water levels on Folsom Lake significantly affects the visual quality of the reservoir;

- Primary threat to scenic resources continues to be from development closing in on the Unit on several fronts, particularly at Folsom Lake;

- The hillsides and ridgelines of the peninsula in El Dorado County and the western shoreline along the North Fork of the American River in Placer County that are visible from within the Unit are most at risk to visual intrusion from future development; and

- Topography and existing State ownership of land make it difficult to buffer the Unit from surrounding development and screen external views.



Photo SR-1: Panoramic views of Lake Natoma and Sierra Foothills from Lake Overlook.



Photo SR-2: The peninsula area from Folsom Lake displays untouched oak-studded rolling hills.



Photo SR-3: Natoma Bluffs – a significant landscape feature in the Unit.



Photo SR-4: Dredger tailings reflect a unique cultural landscape along the shores of Lake Natoma.



Photo SR-5: Rainbow Bridge with Historic Truss Bridge behind as viewed from Rainbow Rocks.



Photo SR-6: Lake Natoma Crossing mimics the design elements of the earlier Rainbow Bridge.



Photo SR-7: Residential development adjacent to the Granite Bay horse assembly area.



Photo SR-8: Residences on the hills above Hobie Cove at Brown's Ravine.



Photo SR-9: Adjacent residences at the remote Old Salmon Falls lower parking area.



Photo SR-10: Residential development off Green Valley Road as seen from Mormon Island Dam.



Photo SR-11: Gateway to Folsom Point – a missed opportunity to buffer the Unit from development.



Photo SR-12: South Folsom Canal on north side of Nimbus Flat gateway.



Photo SR-13: Caltrans park and ride lot on south side of Nimbus Flat gateway.


Photo SR-14: Residential development adjacent to the horse assembly area at Nimbus Dam Overlook.



Photo SR-15: Granite Bay main beach parking area – 5 acres of asphalt paving.



Photo SR-16: Negro Bar boat launch parking area – 5 more acres of asphalt paving.



Photo SR-17: Planting at Granite Bay boat launch parking area provides little relief.



Photo SR-18: Corporation yard and high tension electrical transmission line at Nimbus Dam affect key views from the southern end of Lake Natoma.



Photo SR-19: An electrical utility line corridor passes through the Folsom Powerhouse State Historic Park.



Photo SR-20: Storage container at Negro Bar beach area.



Photo SR-21: Storage containers at Granite Bay beach.



Photo SR-22: Storage containers at Willow Creek.



Photo SR-23: Southern views from Lake Overlook.


Photo SR-24: Seasonal low water elevations expose Folsom Lake's extensive shoreline area.



Photo SR-25: Exposed shoreline at Beals Point.



Photo SR-26: Folsom Lake recedes from this Granite Bay boat launch area.



Photo SR-27: Lake-view residential estate subdivisions in El Dorado County.



Photo SR-28: The most significant threat to the Unit's scenic resources.

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RECREATION, SCENIC AND CULTURAL RESOURCES

CULTURAL RESOURCES

Folsom Lake State Recreation Area

April 2003

by

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CULTURAL RESOURCES

Introduction

LSA Associates, Inc. has prepared this summary to provide a cultural resources background for the Folsom Lake State Recreation Area (the Unit). The purpose of this summary is to:

- Describe the archaeological and historical setting of the region encompassing the Unit
- Characterize the types of archaeological and historical resources that have been identified or may potentially occur within the Unit (a complete list of previously identified sites is included in Table CR-2 located in the Appendix of this section)
- Identify areas of cultural resource sensitivity

Literature reviewed includes published articles, maps, agency files and previous studies pertaining to the Unit. Primary sources for background research were provided by the Bureau of Reclamation (BOR) and consisted primarily of previously recorded site records and study reports. A list of source documents is included in the References subsection. No field investigations were performed as part of this Resource Inventory.

Prehistoric Setting

The Unit lies where the lower Sacramento Valley and Delta meets the Sierra Nevada foothills. At the time of European contact, the land which became the Unit lay within the territory of the Nisenan, the southern linguistic group of the Maidu tribe (Wilson and Towne 1978:387). Archaeologists, however, hypothesize that the Nisenan at some point displaced the earlier occupants of the region, the Washoe. Linguistic evidence also supports this hypothesis. Archaeological excavations conducted near the Unit provide a glimpse of the people who inhabited the region and their lifeways.

The prehistory of the Folsom Lake region spans some 4000 years. Earlier groups occupied and intensively used base camps situated in favorable settings, while leaving to make seasonal foraging rounds in areas offering resource abundance and diversity. Later, approximately 500 A.D., populations had greater mobility and began to emphasize the processing of plant food resources. Around 600-800 A.D., the bow and arrow were introduced, and circa 1400-1600 A.D. the mortar and pestle became intensively used. While the reasons for this resource and settlement shift remain unclear, it is hypothesized that growing populations and environmental change induced migration and/or displacement of the Washoe people from their ancestral land in this foothill region.

Regional Chronologies

Sacramento Valley/Delta

The Sacramento Valley/Delta culture area has been a focus of archaeological research since excavations by Sacramento Junior College beginning in the 1930s. The data generated by these and other excavations were used to develop a framework, the Central California Taxonomic System, for associating prehistoric archaeological sites with three main cultural horizons: Early (~5000-2300 years before present [B.P.]), Middle (~2300-1200 B.P.), and Late (~1200-200 B.P.) (Fredrickson 1974, Moratto 1984). Each horizon corresponded to different environmental adaptations and the differential use of local resources. The Early horizon was represented by extended burials with grave offerings, heavily-stemmed and leaf-shaped projectile points, *Olivella* and *Haliotis* ornaments, well-developed charmstones, and a relatively low frequency of milling equipment. The Middle horizon was characterized by varying burial styles and cremations, heavy convex-based projectile points, asymmetrical charmstones, distinctive shell bead types, cobble and wooden mortars, and baked clay and bone artifacts. The Late horizon is marked by pre-interment burning of grave offerings, side-notched projectile points, elaborate *Olivella* and *Haliotis/*clamshell/magnesite beads and cylinders, stone pipes, incised bird bones, and a high frequency of baked-clay artifacts (Waechter and Mikesell 1994:23).

Researchers have continually refined this cultural sequence. Beardsley and Bennyhoff recognized that grave offerings, specifically beads and ornaments, serve as distinct time markers, and used such information to assign relative time ranges to specific cultural periods. Bennyhoff dated the Early Period at approximately 5,000-2,500 B.P., the Middle Period at approximately 2,500-1,300 B.P., and the Late Period from approximately 1,300 B.P. to the historic era (Waechter and Mikesell 1994).

Despite its usefulness in early cultural attribute classification, the Central California Taxonomic System was not noted for its applicability to issues of subsistence strategy, settlement patterns, or trade. In focusing on material culture, it did not adequately address the continuity of gradual cultural change or cultural variability within subregions. Other researchers developed continual refinements to this initial scheme, such as Bennyhoff's (1972) development of *districts* and *phases* as a means to address more geographically-focused cultural adaptations (Waechter and Mikesell 1994:23).

Fredrickson (1973) originated another chronological refinement applicable to the lower Sacramento Valley. His development of the *pattern* as a classification scheme for shared cultural attributes within a defined geographic area resulted in six patterns for the North Coast Ranges, San Francisco Bay, and the lower Sacramento Valley. These patterns were assigned to five time periods: Paleo-Indian (10,000-6,000 B.C.); Lower, Middle, and Upper Archaic (6,000 B.C.-A.D. 500); and Emergent (Upper and Lower, A.D. 500-1,800) (Fredrickson 1973). See Table CR-1 for a delineation of shared cultural attributes and corresponding chronological periods.

Table CR-1. Period Characteristics (adapted from Fredrickson 1974)

		Period Characteristics
1800	Emergent Period, Upper	Clam disk bead money economy appears. Increasing quantities of goods moving farther and farther. Growth of local specializations re: production and exchange. Interpenetration of south and central exchange systems.
1500		
	Emergent Period, Lower	Bow and arrow introduced, replace dart and atlatl; south coast maritime adaptation flowers. Territorial boundaries fairly well established. Evidence of distinctions in social status linked to wealth increasingly common. Regularized exchanges between groups continue with more material entering into the network of exchanges.
500		
AD	Upper Archaic Period	Growth of sociopolitical complexity; development of status distinctions based upon wealth. Emergence of group-oriented religions. Greater complexity of exchange systems; evidence of regular, sustained exchanges between groups. Shell beads gain in significance, possibly indicators of both exchange and status. Possible origins of Kuksu religious system at the end of period.
BC		
1000	Middle Archaic Period	Altithermal may have ended by ca. 3000 B.C.; climate becomes more similar to present-day. Mortars and pestles and inferred acorn technology introduced. Hunting important. Possibility of entry of new population. Diversification of economy; sedentism more fully developed, population growth and expansion. Technological and environmental factors provide dominant themes. Little evidence for significant changes in exchange relations.
3000	Lower Archaic Period	Altithermal may have begun about 6000 B.C.; ancient lakes drying up. Milling stones develop or are introduced; plant food emphasis, little hunting. Although semi-sedentary life style, exchange seems similar to previous period. Most artifacts manufactured of local materials. Little emphasis upon wealth.
6000		
	Paleo-Indian Period	First demonstrated entry and spread of humans into California. Lakeside sites with a probable but not clearly demonstrated hunting emphasis. No evidence for a developed milling technology although cultures with such technology may exist in state at this time depth. Exchange probably ad hoc, individual, one-to-one. Social unit not heavily dependent upon exchanges; resources acquired by changing habitat.
10,000		(No satisfactory information from preceeding Early Lithic Period.)

North-Central Sierran Foothills

As noted by Waechter and Mikesell (1994), interpretation of prehistoric lifeways in the border areas between the North-Central Sierran Foothills and Sacramento Valley/Delta is complicated by the application of cultural chronologies from other areas. One such chronology incorporates two well-documented cultural adaptations, the Martis Complex and the Kings Beach Complex, which were identified by Elsasser and Heizer (1953) through extensive survey of mountainous areas to the east of Folsom Lake around Lake Tahoe. The earlier Martis Complex is marked by "an emphasis on big-game hunting, and on the use of basalt in lieu of obsidian and chert; by the manufacture of robust, roughly flaked points; pestles, bowl mortars, manos and metates; atlatls; pressure-retouched basalt flake scrapers; and finger-held, expanded base flake drills." The Kings Beach Complex is characterized by "a fishing/gathering economy that used obsidian and siliceous flint for projectile point manufacture; bedrock mortars; and small, side-notched projectile points that may have signaled the introduction of bow and arrow technology into the region" (Waechter 1992).

A number of Sierran cultural chronologies have been developed since Elsasser and Heizer's (1953) original delineation of the Martis/Kings Beach complexes (Waechter 1992). Although Elston (1971), Humphreys (1969), and Ritter (1970) contributed such chronologies, Elston et al. (1977) has been considered the most significant. Using data from surveys and excavations in areas surrounding Lake Tahoe, Elston et al. produced the Tahoe Reach chronology. The Tahoe Reach attempted to show continuity in cultural development, using projectile point typology analysis, from the Martis and Kings Beach complexes through ethnographic times. Elston goes on to suggest that prehistoric colonization of the Sierras may have occurred as a result of incursions by Great Basin cultures.

Previous Archaeological Research

What is currently known of the prehistory of the boundary area between the foothills and valley zones comes from studies conducted within twenty miles of Folsom Lake (Waechter and Mikesell 1994). CA-SAC-225, approximately eight miles south of the Lake, is a multi-component site that yielded evidence of primary occupation in the Middle and Late periods (post-3500 B.P.). Additional occupation during the Early and Protohistoric periods, though less intensive, is also indicated. Of interest at CA-SAC-225 is the presence of a large number of groundstone fragements, which Dana McGowen interpreted to be indicators of extensive groundstone manufacturing. McGowen suggested that the occupants of CA-SAC-225 provided these items to other areas of the lower Sacramento Valley that lacked sufficient raw material.

The Folsom Lake project area was first investigated as part of the Smithsonian River Basin Survey initiated prior to the construction of Folsom Dam in the late 1940s. Prehistoric cultural resources within the study area included sites containing midden, bedrock mortars, milling slabs, handstones, pestles, projectile points, scrapers, bifacial tools, cores, and debitage (Waechter and Mikesell 1994). Prehistoric sites were often associated with low, rocky knolls, and resource inventories within the Folsom Lake area determined that site type and constituents were found to vary according to location and environmental setting:

> The sparse tool, milling slab, and debitage scatters were most common at Granite Bay, where the plain is dotted with low rocky knolls. Farther north, along the North Fork arm, the canyon narrows and

> steepens, and bedrock outcrops are much more common; these areas contain many more bedrock mortar sites, ranging from one to 39 mortar cups [Waechter and Mikesell 1994:33].

Severe fluctuations in Folsom Lake water levels have allowed archaeological research to supplement initial pre-reservoir studies. In 1977, due to drought conditions, a large portion of the previously-inundated reservoir basin was accessible for survey. 71 prehistoric sites were recorded during this study, including middens, groundstone scatters, and lithic scatters. Despite the identification of previously-unknown sites, the archaeological data potential of these new discoveries had been severely impacted by inundation (Olsen 1977).

In 1976, an opportunity arose to study the effects of inundation on prehistoric archaeological sites at Folsom Lake. CA-ELD-201 (the Pedersen Site), previously inundated by Folsom Lake, re-emerged as a result of drought. The Pedersen Site, situated at an elevation between 409 and 436 feet, was the subject of salvage excavation to recover valuable information before reinundation. In addition to answering basic archaeological questions about the site's nature and form, the excavation was intended to determine the effects of 20 years of inundation, erosion, and wave action on prehistoric deposits. Foster et al. (1977) found that although, by their estimate, up to one meter of soil had been washed away from the entire site area, the lower reaches of the site were covered with alluvial sand that effectively capped midden buried beneath. The Pedersen Site deposit was diverse, with recovered artifacts including flaked-stone cores, flake tools, cobble tools, scrapers, knives/points made from andesite/basalt/quartz/quarzite/slate/shale, pestles, handstones, battered cobbles, a cache of milling slabs, and limited deer bone. Based on site conditions, Foster et al. found that repeated inundation had resulted in artifact water-wear, bioturbation, loss of artifact provenience, and the destruction of faunal constituents formerly contained in the midden deposit (Waechter and Mikesell 1994:32).

Despite the substantial number of surveys and excavations conducted within or near the reservoir basin, previous researchers have found discrepancies in documentation. In some cases, the lack of locational detail has resulted in redundant effort, as sites were likely recorded more than once. Misplotting and imprecise mapping have also resulted in difficulties during re-location efforts. As noted by Waechter and Mikesell, "These and other previous studies in the region have produced a large, though incomplete, body of data. For the reservoir itself, these data consist almost exclusively of survey-level information, mostly in the form of site records" (Waechter and Mikesell 1994:33).

Ethnography

Language and Territory

Prior to contact with Euro-American peoples, the area west of the Sierran crest to the west bank of the Sacramento River, in which the Unit is located, was controlled by speakers of the Nisenan language. Nisenan territory included the drainages of the Yuba, Bear, and American Rivers.

The Nisenan, whom anthropologists also refer to as Southern Maidu, spoke a language that has been classified as a member of the Penutian language stock, which includes other

languages spoken nearby, such as Patwin (in the lower Sacramento Valley), Sierra Miwok (in the hills and mountains to the south), Plains Miwok (in the northern San Joaquin Valley), and Yokuts (in the lower San Joaquin Valley). Speakers of the Penutian languages are believed to have entered California from the Columbia Plateau to the north, coming in successive waves beginning about 4500 years ago.

There were at least three major dialects of the Nisenan language: Valley Nisenan and Northern Hill and Southern Hill Nisenan. Several subdialects are known for the Hill Nisenan within the County, including those of the Auburn, Clipper Gap, and Colfax areas. Dialects and subdialects reflect the closeness of a given group–the less time spent with outsiders, the more distinctive a group's speech becomes. Just as with dialects of American English, however, Nisenan dialects were mutually understandable.

The banks of the Sacramento River housed the large settlements of the Valley Nisenan, with populations of several hundred people each, while the plains between the river and the foothills were relatively unsettled, used primarily for hunting by both hill and valley groups. Large parties of men from the Auburn group would make fishing trips to the Sacramento River, while the group also controlled a salt spring near Roseville and maintained an acorn-collecting camp in that vicinity. A less amicable "No Man's Land"-from the Sierra crest down to about Emigrant Gap-existed between the Nisenan and the Washoe; some accounts refer to frequent fighting between the two groups in this area, while others describe friendly encounters.

Settlement and Subsistence

The mild to moderate winters, abundant year-round water sources, and relatively accessible terrain of the Hill Nisenan territory supported relatively large, semi-permanent villages, some with populations of several hundred people. The villages were usually placed on ridges and large flats along major streams, while hamlets occupied by extended families of a dozen or more people were located in favored spots in the vicinity. At winter villages and hamlets, Hill Nisenan houses were conical-shaped and covered with slabs of bark, skins, and brush. Acorn granaries were often present, and bedrock milling stations (colloquially known as Indian Grinding Rocks) were present at virtually every settlement. Other locations of importance, each given specific names and known to most members of the tribelet, included summer camps, quarries, ceremonial grounds, trading sites, fishing stations, cemeteries, river crosssings, and battlegrounds.

The combination of principal village and related hamlets formed a village community, or "tribelet," which held a fixed territory and acted as a group under the leadership of a headman. While extended families acted on their own on more individual matters, a headman presided over such group decisions as the nature and timing of group hunts or collection trips and relations with other groups–including trading expeditions and ceremonies. Ceremonial dances to celebrate seasonal events and honor deities were held in the large semisubterranean dance house, which distinguished the principal village from its satellites; 27 such villages were identified in the Auburn-Colfax area by Littlejohn, an ethnographer of the 1920s, each presumably representing a tribelet center. Only a handful of these villages would have been occupied at the same time; people regularly shifted residence every few years, particularly after the death of a headman or another person of importance. From archaeological study, however, it is clear that most of these locations were reoccupied, with abandonment of such short duration that the material remains appear to represent one

continuous occupation, often for many centuries. Information on the size of each tribelet's territory is lost, and it is now unclear where a particular central area of influence began or ended.

In the Sacramento Valley, the low lands along the rivers were flooded every year, creating marshes in the basins along the Sacramento and Feather Rivers. Besides the fish and mollusks that the rivers, sloughs, and lake yielded, the great seasonal marshes attracted immense flocks of water fowl during the spring and fall migrations, who were said to have blackened the sky in their flight. With their permanent villages just upslope from these great flood basins, the Hill Nisenan had an array of game animals to hunt within a short distance of their homes: Tule elk, deer, and predators such as the grizzly bear focused on these upper margins of the basin for at least a few months each year during the winter and spring. The drier foothills surrounding their villages supported a diversity of oaks and other nut-bearing trees; berries, bulbs, and greens; and large and small game were also plentiful.

There were several choices when the summer heat set in: families could move to the uplands, which were just experiencing a "spring" renewal, or to the deep river canyons, where fish, small game, and water-loving plant resources were readily available year round. While some groups travelled, others might occupy the main village on through the summer, taking advantage of the variety of foothill crops that ripened in this season. Throughout Nisenan territory, small camp sites were established along a network of trails; larger base camps were revisited year after year at their upland or riverine destinations. Typically, the Auburn group fished, hunted, and gathered around Georgetown in El Dorado County, while the Colfax group summered around Gold Run and Dutch Flat. The tenuous relationships between the Nisenan and the Washoe were said to have restricted the former's use of the highest elevations, although these groups often met to trade goods from their respective regions. The Washoe exchanged obsidian, salt, pine nuts, rabbit skins, dried fish, and seed beaters for the Nisenan's acorns and shells, the latter supplied to the hill people by the Patwin and Maidu.

Acorns, while not the only Nisenan staple, were a major and regular source of sustenance. They were gathered in late fall as a group activity, when extended families or whole villages would work together, the men knocking the acorns to the ground and the women and children gathering and hauling them by the basketful. Grinding the acorns into a fine flour on the bedrock mortar, leaching the flour, and cooking it into mush or soups was an activity that likely consumed at least some part of every woman's day.

Post-Contact

Located away from the mission influence of the late 18th and early 19th centuries, Nisenan traditional lifeways remained relatively intact longer than central coastal or bay groups. The first severe effect of Euroamerican presence in Calfornia resulted from a series of epidemics in the early 1830s, which swept through the Central Valley from the Tulare Basin north to Oroville. While Hill Nisenan were not directly affected, these diseases killed up to 75 percent of their Valley Nisenan neighbors, in some cases consuming whole villages. Captain John Sutter had little trouble gaining cooperation from the few surviving Valley Nisenan when he arrived in their territory in 1839, removing many of the survivors to his fort for use as laborers. With the discovery of gold at Coloma in 1848, the disruption of traditional Hill Nisenan lifeways began abruptly and was virtually complete within a few years. Overt killings and disease reduced populations, while traditional hunting and gathering areas were

overrun by miners, watercourses were diverted, and old settlements were taken over by outsiders.

Despite more than a century of disruption, the large number of active Nisenan groups in the Auburn area attest to the persistence of native peoples in Placer County. Nisenan people today are concertedly working to preserve cultural information and to protect the archaeological sites that reflect their heritage.

Historical Setting

During the first years of Spanish colonization in Alta California, little attention was paid to the region's interior. Spanish missions and towns were laid out within a day's journey from the coast, where they could be resupplied by ships coming north from Mexico and east from the Phillippines. Meanwhile, California's interior remained relatively undisturbed by Spanish colonization. If interior-dwelling Native Californians had a conflict with colonists or missionized native people, they simply withdrew into the mountains or the tule swamps and waited for the intruders to depart. It was not until after the 1822 transition to Mexican governance that California's governors began granting inland ranchos to settlers. This modification brought "a rather rapid change from amicable to inimical interaction" between inland Native Californians and outsiders (Phillips 1993:158).

In 1839, a Swiss, Johann Augustus Sutter, convinced Governor Juan Bautista Alvarado to grant him 50,000 acres at the confluence of the Sacramento and American rivers. Sutter was an adventurer who had fled his native country to avoid debtor's prison. He dreamed of establishing a self-sufficient "New Helvetia" colony and fort in the Sacramento Valley, where, he told Alvarado, he would act as a semi-official representative of the California government in the interior. Impressed by his plan, the governor offered him a substantial land grant and Mexican citizenship. Sutter and the many Native Californian laborers who worked for him built an adobe near what is today the city of Sacramento (Rolle 1987:129-130, 135-138).

Sutter was not the only recipient of a land grant in the Sacramento area. In 1833, J.B.R. Cooper was given the Rio Ojotska grant on the American River, three miles east of Sacramento; he renounced his claim in 1835. The Scot John Sinclair settled on Rancho Del Paso as early as 1841. William Daylor and Jared Shelton, employees of Sutter's, obtained grants to the Rancho Omochumnes southeast of New Helvetia (Hoover et al. 1990:288-289). One of the largest of the land grants, the 35,000-acre Rancho Rio de los Americanos, was granted to William A. Leidesdorff, one of San Francisco's leading citizens. Leidesdorff, of mixed Danish, African, and Creole extraction, served as the United States vice-consul under Thomas O. Larkin, was part of the San Francisco town council, and worked on a committee to establish the city's first public school (Soule, Gihon, and Nisbet 1854:127, 196-197). Liedesdorff died in 1848 at the age of 36, leaving no heirs, considerable debts, and real estate holdings valued, by 1850, at a million dollars (Soule, Gihon, and Nisbet 1854:307-308) The Rancho Rio de los Americanos was purchased by Captain Joseph L. Folsom, for whom the eponymous city is named (Hoover et al. 1990:288).

None of these grantees had as big an impact as Sutter, whose fort soon became the largest trading post in the region. There were rumors that Sutter planned to form his own semi-

feudal state on the banks of the Sacramento River. Sutter's success was due in large part to his dominance of local Native Californian labor. He compelled hundreds of Native Californians to work at New Helvetia and other ranchos in the region, including Liedesdorff's Rancho Rio de los Americanos, John Marsh's farm east of Mount Diablo, and properties owned by the Peralta and Suñol families, prominent East Bay ranchers (Hurtado 1988:56-61). Sutter's Fort dominated trade in the Sacramento region, becoming the major stopping point for overland travelers coming down out of the Sierra Nevada.

But Sutter's dreams were defeated, ironically enough, by his own sawmill. Toward the end of 1847, Sutter sent his foreman, James W. Marshall, into the foothills above the South Fork of the American River to find a good mill site. On the morning of January 24, 1848, Marshall noticed sparkling gold particles in a stream near the mill. Within months, the American River region was flooded with gold seekers who left behind families and livelihoods in search of fortunes in the goldfields (Hoover et al. 1990:72).

While some miners became wealthy, more had experiences like those described by Daniel B. Woods in his *Sixteen Months at the Gold Diggings*:

> Our diet consists of hard bread, flour, which we eat half cooked, and salt pork, with occasionally a salmon which we purchase of the Indians. Vegetables are not to be procured. Our feet are wet all day, while a hot sun shines down upon our heads, and the very air parches the skin like the hot air of an oven. Our drinking water comes down to us thoroughly impregnated with the mineral substances washed through the thousand cradles[1] above us. After our days of labor, exhausted and faint, we *retire* – if this word may be applied to the simple act of lying down in our clothes – robbing our feet of their boots to make a pillow of them, and wrapping our blankets about us, on a bed of pine boughs, or the ground, beneath the clear, bright stars of night [Woods 1851: July 10, 1849].

Woods was a Philadelphian who came to California through Mexico. He worked along the American River, buying provisions and attending church services at Mormon Island, a mining settlement now inundated by Folsom Lake (Woods 1851:September 9, 1849). Woods' fellow miners along the American were a diverse group, including United States citizens like himself; Chinese; Hawaiians; convicts from New South Wales; African Americans, many of whom had come to the region as sailors; and Native Californians, who were forced into service as laborers by some miners (Hurtado 1988:103-117, Lapp 1987:4-5). The colorful names given to early American River mining settlements – Mormon Island, Alabama Bar, Sailor's Bar, Condemned Bar, and Rattlesnake Bar, among others – give an impression of the range of origins of the area's inhabitants (Woodward 1977:44-55).

But of all those drawn to the mines, it was often the grocers and suppliers of dry goods – not the miners themselves – who made their fortunes in the gold camps. A broadside titled

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[1] A cradle was a device through which potentially gold-bearing soil was rinsed.

"Good News for Miners," printed in 1850 for Warren & Co., dry goods suppliers operating from the "Excelsior Tent" on Mormon Island, proclaimed the availability of staples, "Desirable Goods for Comfort, and Health," and a range of mining tools. The broadside neglects to mention that the "Good News" was really for Warren & Co. - their merchandise fetched prices several times higher than comparable goods bought in Sacramento or San Francisco, and as much as ten times prices on the East Coast (Rolle 1987:177-178).

Transporting merchandise to the gold camps, and getting gold out, over the poor roads, ferries, and bridges which connected the gold fields with Sacramento and San Francisco, was challenging. By 1850, ferries served the American River mining communities of Condemned Bar, Beals Bar, and Rattlesnake Bar. There was regular stagecoach service between Sacramento, Mormon Island, and Coloma (Byrd 1994). Remains of transportation networks remain around and beneath the water line of Folsom Lake.

By the 1850s, most of the gold which could be easily retrieved by miners with simple tools had been taken from the hills. Miners organized companies and turned to hydraulic mining, which washed hillsides with powerful hoses to remove gold deposits (Byrd 1994, Rolle 1987:179). Hydraulic mining required the construction of long ditches and flumes to bring pressurized water to the diggings. In 1851, A. P. Catlin organized the Natoma Water and Mining Company to build a canal from Salmon Falls, on the South Fork of the American River, to the Folsom area. The canal and associated water storage and drainage features were completed in 1854 (Byrd 1994:10).

A decade later, Horatio Gates Livermore had gained control of the Natoma Water and Mining Company. Looking for new industries to expand the company into, he began to consider using water power for a sawmill or other projects around Folsom, but was stymied by the high cost of labor (California State Parks 2000). During this time, however, there was a growing conviction statewide that water control projects would encourage economic growth in California. Mining was ceasing to be the state's dominant industry, and many felt that California's future was in agriculture. To successfully grow crops in the Central Valley, better control over water – especially in the Sacramento Valley, plagued by floods – was key. A dam on the American River could also be used to generate electricity (Farquhar 1965, Jackson, Herbert, and Wee 1990:4).

In the 1880s, after the elder Livermore had died, his sons, Horatio P. and Charles, came to an agreement with the state to use convict labor to build a dam on the American River and create Folsom Lake, completing the project their father initiated. The water from the new dam could be used to power generators at both the Folsom Prison Power Plant and the Folsom Hydroelectric Plant which in turn transmitted electricity to Sacramento, where it would power lights and streetcars. The Livermore brothers, together with Albert Gallatin, formed the Folsom Water Power Company, and in July of 1895, the Folsom Hydroelectric Plant brought electric power over 22 miles of uninsulated lines to the streets of California's capitol (California State Parks 2000).

The powerhouse at Folsom Lake remained in operation until 1952, even as planning for the state's massive Central Valley Project continued. A series of reports, beginning in 1873 with the Army Corps of Engineers *Report of the Board of Commissioners on the Irrigation of the San Joaquin, Tulare, and Sacramento Valleys of the State of California*, emphasized the economic and social benefits of building a massive public works project to convey water from the Sierra Nevada to the Central Valley (Jackson, Herbert, and Wee 1990). California

historian Kenneth Starr writes that in time, the importance of the project "approached the intensity of salvation itself. For Progressives, after all, public works inspired an assent and commitment approaching religious intensity" (Starr 1996:311).

Construction of the Central Valley Project would take roughly thirty years, from the approval of the bonds in 1933 to the completion of the system in the early 1960s. By 1944, the project had built two of the five largest dams in the world (Starr 1996:315). In 1955, a new pair of dams were completed at Folsom, the Folsom and Nimbus dams, bypassing the original powerhouse. The new Folsom Dam was higher than its predecessor, and flooded a larger portion of the American River drainage, about 15 miles up the North Fork and about 10 ½ miles up the South Fork. The Folsom and Nimbus dams generate hydroelectric power, prevent flooding, and provide water for irrigation and domestic use. Nimbus Dam also diverts water into the Folsom South Canal. Folsom and Natoma lakes soon became a valued recreation destinations, offering swimming, hiking, boating, and other recreational activities to thousands of visitors each year.

Sensitivity Analysis

Portions of the Unit are represented by various prehistoric and historical archaeological site types. At present, a total of 229 archaeological sites have been identified within the Unit. Of these 229 sites, 150 are prehistoric, 58 are historical, 21 have both a prehistoric and historical component, and 27 remain unaccounted for due to incomplete documentation. Environmental setting and historical activity areas are the main variables that determine the location and nature of these sites, revealing that certain areas of the Unit are more likely to contain cultural resources of a particular type than others. Two other factors, water fluctuation and the location of the original river channel, influence prehistoric site location and disposition.

Environmental Setting

Analysis of prehistoric site distribution has been conducted for Placer County (Placer County Cultural Resources Inventory 1992). Distribution variables such as elevation, slope, and proximity to water were reviewed to identify any correlations with site location. The analysis indicated that a higher potential for prehistoric sites can be anticipated in areas of moderately or gently sloping terrain within 500 feet of water. Additionally, a large percentage (over 50%) of sites occur below 1,500 feet ASL (above sea level).

Olsen (1977) used data from surveys of the North and South Forks of the American River drainage in her discussion of prehistoric site distribution within the Unit. These surveys, conducted in 1977 to take advantage of drought conditions, included the areas between the high water elevation of 466 feet ASL and lowest drought level in August 1977. A total of 71 sites (both prehistoric and historic) were identified; 53 were located on the North Fork, and 18 on the South Fork. In summarizing her analysis of site location variables, Olsen writes:

> The proceeding data suggests that the prehistoric inhabitants of the Folsom Lake locality preferred to settle on knolls adjacent to drainages, most likely with a south exposure. North and South

> Fork site characteristics seem to indicate a subsistence pattern based on acorns and grass seeds (suggested by BRMs, manos, metates) [Olsen 1977:31].

Historical Activity

Mining, settlement, and water development are dominant themes associated with historical archaeological sites identified within the Unit. The majority of identified historical sites is associated with settlement, primarily consisting of debris scatters and structural remains, and further classified as townsites or agricultural sites. The Mormon Island townsite includes two associated historical sites, while the location of the Goose Flat townsite, indicated by archival sources, corresponds to one identified site. Areas of documented historical activity, such as the hydraulic mining remnants and dredger tailing fields around Rattlesnake Bar and the town of Folsom, tend to yield the greatest number of historical sites. Barring the identification of resources located in unlikely settings, this general tenet of site location should apply to other historical site types within the Unit. The well-developed historic contexts for the Unit and extensive archival reviews of documentary evidence have identified such areas of historical activity, which are likely to contain historical archaeological resources. Field data support this activity area/physical remains correlation (Waechter and Mikesell 1994). In contrast, ephemeral camps located throughout the Reservoir area have not yet provided evidence of "substantial physical remains" (Waechter and Mikesell 1994:42).

Fluctuation Zone

Previous archaeological research indicates that normal fluctuations in seasonal water levels at Folsom Lake have damaged, and sometimes entirely destroyed, prehistoric and historical archaeological sites within the Unit. Foster et al. (1977), Olsen (1978), and Waechter (1992; 1993) report on the detrimental effect of erosion and wave action on soil containing archaeological deposits, particularly in the reservoir's seasonal fluctuation zone, between 400 and 466 feet ASL. In some cases, entire soil strata bearing archaeological materials or features have been washed away, leaving artifacts lying on bare granite bedrock without location information. This destructive process has been cited as a probable reason for the much higher site density per acre encountered in survey areas below the normal 400-466 feet ASL fluctuation zone, where the Lake's "deep pool" protects sites from repeated exposure and erosion (see the following discussion of Beals Point and Beeks Bight) (Foster et al. 1977 in Waechter and Mikesell 1994).

Proximity to River Channel

Archaeological research indicates that the potential for prehistoric archaeological deposits within the Unit is closely related to the distance of a point from the original channel of the American River. Although prehistoric archaeological sites can occur in all areas with the exception of extremely rugged terrain without water, Waechter (1993) reports that pre-survey site density models indicated that terraces near the original channel had the highest likelihood of containing prehistoric resources, with potential decreasing as distance from the former riverbed increased. These models were based on ethnographic and archaeological data indicating the intensive nature of prehistoric habitation along major rivers in the north-central

Sierran Foothills. It should be noted, however, that this correlation does not invalidate the findings of a previous inventory of Placer County historical resources, which states:

> It should be noted that archaeological sites were found in all the settings reviewed. Except for areas of extremely rugged terrain and no water, prehistoric archaeological sites can be expected in most of Placer County
> (Placer County Cultural Resources Inventory 1992).

Beals Point and Beeks Bight

In 1993, Far Western Anthropological Research Group surveyed 470 acres at Beals Point and 185 acres at Beeks Bight. Both of these survey areas were below the high water line of Folsom Lake (466 feet ASL), between the 350 and 420 foot contour lines. The survey yielded 32 previously unrecorded sites (26 prehistoric, six prehistoric and historical) and five previously-recorded sites (two prehistoric, three historical). Historical sites included debris scatters (glass, metal, ceramic), rock walls, concrete foundations, and other features related to homesteading and ranching. Prehistoric sites consisted of bedrock milling stations and milling equipment, as well as scatters of volcanic and granitic cobble tools and debitage (Waechter 1993:16).

This 1993 survey resulted in 0.06 sites/components per acre, which contrasted with earlier studies of Rattlesnake Bar and Granite Bay that yielded site densities of 0.02/acre and 0.005/acre, respectively. Waechter suggested that this difference might be attributable to survey focus on the area between 350-420 feet ASL, which lies below the level of the greatest wave action and would therefore be spared from the most severe erosion. In addition, this area is much closer to the original river channel, which, based on ethnographic and archaeological research, was a predictive indicator of higher potential for the presence of prehistoric sites.

Summary

As determined by previous sensitivity analysis, prehistoric archaeological sites can be reasonably expected throughout the Unit. However, certain environmental settings retain a higher potential for the occurrence of these sites. Areas that contain low, rocky knolls should be considered archaeologically sensitive, especially those near perennial water sources and with southern exposures. Additionally, ethnographic and archaeological evidence indicates that proximity to the original American River channel is also a determinative variable, as occupation and intensive use of the immediate and primary river terraces by prehistoric populations have been documented.

Historical archaeological sites tend to be located near the documented areas of greatest historical activity. Goose Flat, Mormon Island, and Rattlesnake Bar are examples of locations that have produced physical remains of such historical activity. Areas within the Unit that are archivally associated with historical activities relating to mining, settlement, and water development have the greatest potential, based on previous research and field study, to contain historical archaeological sites.

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Table CR-2
Cultural Resources

Trinomial			Topo	Elev	T/R/Sec	Resource Name	Category	Type	Description	Feature	Materials	Condition	NR Status	Reference	Comments
ELD	001		C	345	10N/8E/16		Domestic	P	Age: Unknown Size: 13,253 sq.ft. Density: Unknown Depth: >3 ft.	Midden		Inundated		BOR/FAR 93	
ELD	031		PH	400	11N/8E/35	Racchi Brothers	Domestic	P	Age: 1500-4000 yrs Size: 16,200sq.ft. Density:Unknown Depth: 4 ft.	Burial House floor	Shell beads, cooking stones, slate points	Inundated		BOR	
ELD	032		PH	400-550	11N/8E/35		Unknown	P	Age:150-1500 yrs Size: 22,500 sq.ft. Density: Unknown Depth: 6 ft.	None	Points, shell beads	Inundated		BOR	
ELD	035		PH	500	11N/8E/34		Funerary Domestic	P/H	Age: 100-150 yrs Size: Unknown Density: Unknown Depth: 2 ft.	Cremation Midden	Porcelain and glass beads, mortars, mano			BOR	
ELD	076		PH	440-480	11N/8E/26		Domestic Industry	P	Age: Unknown Size: 22,500 sq.ft. Density: Unknown Depth: Unknown	Midden	Lithic chips and flakes	Inundated		BOR	
ELD	077		PH	425	11N/8E/16		Domestic Subsistence	P/H	Age: Unknown Size: 54,000 m^2 Density: Unknown Depth: 5 ft.	Midden BRM Mound	Lithic points, pipe, vessel frags, mining refuse	Inundated		BOR, W92	
ELD	090		PH	1375	12N/8E/24		Domestic	P	Age: Unknown Size: 900 sq.ft. Density: Unknown Depth: Unknown	BRMs	Groundstone, flaked stone tools			Barrett	
ELD	091		PH	1375	12N/8E/24		Domestic	P/H	Age: Unknown Size: 250 sq.ft. Density:Unknown Depth: Unknown	BRMs	Groundstone, bottle frag			Barrett	
ELD	092		PH	1350	12N/8E/24		Domestic	P	Age: Unknown Size: 250 m^2 Density: Unknown Depth: Unknown	BRMs	None			Barrett	
ELD	093		PH	1400	12N/8E/24		Domestic	P	Age: Unknown Size: 200 m^2 Density: Unknown Depth: Unknown	Midden	Hammerstones			Barrett	

Table CR-2
Cultural Resources

Trinomial			Topo	Elev	T/R/Sec	Resource Name	Category	Type	Description	Feature	Materials	Condition	NR Status	Reference	Comments
ELD	094		PH	1410	12N/8E/24		Domestic	P	Age: Unknown Size: 10 m^2 Density: Unknown Depth: Unknown	BRMs	None			Barrett	
ELD	095		PH	1320	12N/8E/24		Domestic	P	Age: Unknown Size: 625 sq.ft. Density: Unknown Depth: Unknown	BRMs	None			Barrett	
ELD	096		PH	1380	12N/8E/24		Domestic	P	Age: Unknown Size: 625 sq.ft. Density: Unknown Depth: Unknown	BRMs	None			Barrett	
ELD	097		PH	1320	12N/8E/25		Domestic	P	Age: Unknown Size: 250 sq.ft. Density: Unknown Depth: Unknown	BRMs	Hammerstone, chert core	Disturbed by mining		Barrett	
ELD	100		PH	480	12N/8E/23		Domestic	P	Age: Unknown Size: Unknown Density:Unknown Depth: Unknown	BRM	None			Barrett	
ELD	136							P	Age: Unknown Size: Unknown Density: Unknown Depth: Unknown	Unknown	Unknown			W&M	Record not on file at BOR
ELD	139		PH	480		Goose Flat		H	Age: Unknown Size: 60,000 sq.yd. Density: Unknown Depth: Unknown	Burial	None			Barrett	
ELD	201		C	400-440	10N/8E/8	Federson Site	Domestic Subsistence Funerary	P	Age: Unknown Size: 12,000m^2 Density: Unknown Depth: 30 cm	Midden, cremation, house pits, BRM	Manos, points, metates, pestles, mortars			BOR	
ELD	213		F	360	360		Domestic	P	Age: Unknown Size: 15,759m^2 Density: Unknown Depth: 10 cm	Midden	Chert knife	Inundated		Barrett	
ELD	214		F	390	10N/8E/8		Domestic	P	Age: Unknown Size: 6030m^2 Density: Unknown Depth: 20-40cm	Midden	Point, Chopper	Inundated		BOR	

Table CR-2
Cultural Resources

Trinomial			Topo	Elev	T/R/Sec	Resource Name	Category	Type	Description	Feature	Materials	Condition	NR Status	Reference	Comments
ELD	215		F	390	10N/8E/8		Domestic	P	Age: Unknown Size: 6090m^2 Density: Unknown Depth: Unknown	Midden	Lithic scatter	Inundated		BOR	
ELD	216		C	420	10N/8E/8		Agriculture	P/H	Age: 1800 Size: 77m^2 Density: Unknown Depth: Surface	Foundation	Trash scatter, lithic tools	Inundated		BOR	
ELD	217		F	370	10N/8E/8		Subsistence	P	Age: Unknown Size: 840m^2 Density: Unknown Depth: >23cm	BRM, Midden	Lithic tool scatter	Inundated		BOR	
ELD	218		F	365	10N/8E/18		Subsistence	P	Age: Unknown Size: 900m^2 Density:Unknown Depth: Unknown	BRM, Midden	Lithic tool scatter	Inundated Pothunted		BOR	
ELD	219		F	370	10N/8E/17	Massachusetts Flat	Agriculture	H	Age: 1870-90's Size: Large Density: Unknown Depth: Unknown	6 Foundations	Glass, ceramic, farm tools	Eroded Inundated		BOR	
ELD	220		F	390	10N/8E/18		Domestic	P	Age: Unknown Size: 9000m^2 Density: Sparse Depth: 13cm	Midden	Choppers, quartz crystals	Eroded Inundated		BOR	
ELD	221		F	440	10N/8E/18		Domestic	P	Age: Unknown Size: 6324m^2 Density: Light Depth: 6-8"	Midden	Light tool scatter	Eroded		BOR	
ELD	222		F	370	10N/8E/18		Domestic Agriculture	H	Age:1867 Size: Large Density: Unknown Depth: Undetermined	Dump, foundation	Structure	Eroded		BOR	
ELD	223	H	F	380	10N/8E/18		Domestic	P/H	Age:1867 Size:10.5m^2 Density:Unknown Depth: Surface	Foundation, midden	Tools, ceramics, stove parts	Disturbed		BOR	
ELD	224	H	F	370	10N/8E/18		Industry/Processing/Extraction	H	Age: Unknown Size: 102m^2 Density: Unknown Depth: 15m	Mine tunnel	Metal debris			BOR	

Table CR-2
Cultural Resources

Trinomial			Topo	Elev	T/R/Sec	Resource Name	Category	Type	Description	Feature	Materials	Condition	NR Status	Reference	Comments
ELD	225		C	380	10N/8E/5		Industry Domestic	P	Age: Unknown Size: 600m^2 Density: Sparse Depth: Unknown		Lithic tool scatter	Inundated		BOR	
ELD	226		C	360-380	10N/8E/5		Industry Domestic	P	Age: Unknown Size: 1575m^2 Density: Unknown Depth: Surface		Tool scatter	Eroded		BOR	
ELD	227		C	410	10N/8E/8		Domestic	P	Age: Unknown Size: 4160m^2 Density: Unknown Depth: Surface	Midden	Mano, possible metate, flakes, choppers	Inundated		BOR	
ELD	228		C	382	10N/8E/5		Domestic	P	Age: Unknown Size: 10,549m^2 Density: Unknown Depth: Undetermined	Midden	Mano, chopper, debitage	Eroded		BOR	
ELD	229	H	PH	435	11N/8E/31		Domestic	P/H	Age: Unknown Size:1446sq.ft. Density: Unknown Depth: Surface	Foundation	Glass frags, cut nails,			BOR	
ELD	230		PH	430	11N/8E/16		Domestic	P	Age: Unknown Size: 1050m^2 Density:Unknown Depth: Surface	Midden	Choppers, metate, mano, point	Inundated		BOR, W92	
ELD	231		PH	420	11N/8E/9		Domestic	P	Age: Unknown Size: 12,000m^2 Density:Unknown Depth:Undetermined	Village	Manos, metates, pestles, points,	Eroded Inundated		BOR, W92	
ELD	232		PH	470	11N/8E/4		Subsistence	P	Age: Unknown Size: 3080m^2 Density:Unknown Depth: Undetermined	BRMs	Pestle, mano	Eroded Inundated		BOR	
ELD	233	/H	PH	420	11N/8E/16		Domestic Industry/Processing/Extraction	P/H	Age: Unknown Size: 5576m^2 Density: Depth: Undetermined	Village Mine	Metates, manos, flakes, ceramic, iron	Eroded Inundated		BOR, W92	
ELD	234		PH	440	11N/8E/20		Domestic Subsistence	P	Age: Unknown Size: 27,250m^2 Density: Unknown Depth: Unknown	BRMs	Manos, chopper, metates, flakes	Eroded Inundated		BOR	

Table CR-2
Cultural Resources

Trinomial			Topo	Elev	T/R/Sec	Resource Name	Category	Type	Description	Feature	Materials	Condition	NR Status	Reference	Comments
ELD	235		PH	400	10N/8E/5		Domestic Subsistence	P	Age: Unknown Size: 2350m^2 Density: Unknown Depth: Unknown	BRM	Flakes, cores, metate, manos, choppers	Eroded		BOR	
ELD	236		PH	380	11N/8E/31		Domestic Subsistence	P	Age:Unknown Size: 4800m^2 Density: Unknown Depth: Unknown	BRMs	Manos, metate frags, flakes, scrapers	Eroded Inundated		BOR	
ELD	237	/H	PH	440-480	11N/8E/16	Zantgraf Mine	Industry/Processing/Extraction	H	Age: ca. 1912 Size: Unknown Density: Unknown Depth: Unknown	Foundation, stamp mill	Trash scatter	Disturbed		BOR, W92	
ELD	248	H	PH	360	10/N/8E/3		Transportation	H	Age: Unknown Size: 12m x 2.5m Density: N/A Depth: Surface	Bridge		Eroded Inundated		BOR	
ELD	249		PH	400	11N/9E/25		Subsistence	P	Age: Unknown Size: 1m^2 Density: Unknown Depth: Unkknown	BRMs	Manos	Eroded Inundated		BOR	
ELD	250		PH	400	11N/8E/35		Domestic	H	Age: Unknown Size: >500m^2 Density: Unknown Depth: Unknown	Foundation, cella,r trash scatter	Cut nails, glass, metal debris			BOR	
ELD	251	H	PH	440	11N/8E/34		Transportation	H	Age: Unknown Size: 26m x 4m Density: Unknown Depth: Unknown	Bridge				BOR	
ELD	252		PH	450	11N/8E/34		Domestic	P	Age: Unknown Size: 10,200m^2 Density: Unknown Depth: Unknown	Habitation debris	Lithic scatter	Inundated		BOR	
ELD	255		PH	820	12N/8E26			P	Age: Unknown Size: Unknown Density: Unknown Depth: Unknown					Welch	
ELD	256		C	470	10N/8E/4		Domestic	H	Age: Unknown Size: 2065.5 m^2 Density: Unknown Depth: Unknown	Foundation	Trash scatter			BOR	Also SAC-361

Table CR-2
Cultural Resources

Trinomial			Topo	Elev	T/R/Sec	Resource Name	Category	Type	Description	Feature	Materials	Condition	NR Status	Reference	Comments
ELD	257		C	455	10N/8E/4		Subsistence	P	Age:Unknown Size: 13580m^2 Density: Unknown Depth: Unknown	BRMs	Metate frags	Eroded Inundated		BOR	Formerly SAC-362
ELD	258		C	440	10N/8E/3		Domestic Industry	P	Age:Unknown Size: 9240m^2 Density: Unknown Depth: Unknown	Habitation debris	Manos, scrapers, lithic scatter	Eroded Inundated		BOR	Formerly SAC-363
ELD	259		C		10N/8E/2		Unknown (Industry/Processing/Extraction or Agriculture)	H	Age: Unknown Size: >4m long Density: Unknown Depth: Surface	Foundation	Iron pipe	Inundated		BOR	Also SAC-364
ELD	260		C	450	10N/8E/10		Domestic	P	Age: Unknown Size: 14016m^2 Density: Unknown Depth: Unknown	Midden Habitation debris	Manos, metate, lithics	Eroded Disturbed		BOR	Formerly SAC-367
ELD	261		C	430-435	10N/8E/16		Domestic Subsistence	P	Age: Unknown Size: 7650m^2 Density: Unknown Depth: Undetermined	BRM	Lithic scatter	Inundated		BOR	
ELD	262		C	450	10N/8E/16		Domestic	P	Age: Unknown Size: 8004m^2 Density: Unknown Depth: Unknown	Midden	Metate frags, Mano/pestle, scrapers, projectile pt.	Eroded Inundated		BOR	Also SAC-368
ELD	300		PH	500	12N/8E/26		Unknown	P	Age: Unknown Size: Unknown Density: Unknown Depth: Unknown					True	Record not on file at BOR
ELD	301		PH	500	12N/8E/27		Unknown	P	Age: Unknown Size: Unknown Density: Unknown Depth: Unknown					True	Record not on file at BOR
ELD	302		PH	500	12N/8E/28		Unknown	P	Age: Unknown Size: Unknown Density: Unknown Depth: Unknown					True	Record not on file at BOR
ELD	673	H		400				H	Age: Unknown Size: Unknown Density: Unknown Depth: Unknown					W&M	Record not on file at BOR

Table CR-2
Cultural Resources

Trinomial			Topo	Elev	T/R/Sec	Resource Name	Category	Type	Description	Feature	Materials	Condition	NR Status	Reference	Comments
ELD	677	/H		390				P/H	Age: Unknown Size: Unknown Density: Unknown Depth: Unknown					W&M	Record not on file at BOR
ELD	791	/H	PH	460	11N/8E/16		Domestic Subsistence	P/H	Age: Unknown Size:9412m^2 Density: Unknown Depth: Unknown	BRMs	Lithics, trash scatter	Modern disturbance Inundated		W&M, W92	
ELD	792		PH	440	11N/8E/16		Domestic Subsistence	H	Age: Unknown Size:107m^2 Density: Unknown Depth: Unknown	BRMs	Milling slab, flake scatter	Inundated		W&M, W92	
ELD	793		PH	440	11N/8E/16		Domestic Subsistence	P	Age: Unknown Size:10,990m^2 Density: Unknown Depth: Unknown	BRMs	Groundstone, flaked tools, debitage	Inundated		W&M, W92	
ELD	794		PH	400	11N/8E/16		Domestic Subsistence	P	Age: Unknown Size:824m^2 Density: Unknown Depth: Unknown	Lithic tool scatter	Groundstone, flaked tools, shell	Inundated		W&M, W92	
ELD	795		PH	440	11N/8E/16		Unknown	P	Age: Unknown Size:883m^2 Density: Sparse Depth: Unknown	Sparse lithic scatter	Flaked tools, battered/pecked tools	Inundated		W&M, W92	
ELD	791	/H	PH	460	11N/8E/16		Domestic Subsistence	P/H	Age: Unknown Size:9412m^2 Density: Unknown Depth: Unknown	BRMs	Lithics, trash scatter	Modern disturbance Inundated		W&M, W92	
ELD	FD37		PH	440	11N/8E/16		Domestic Subsistence	P	Age: Unknown Size: 5495m^2 Density: Unknown Depth: Unknown	BRM	Groundstone, flaked tools, shell			W92	No trinomial from BOR records
ELD						Condemned Bar		H	Age:ca.1850 Size: Unknown Density: Unknown Depth: Unknown			Inundated	7L	HRI, CHL	
ELD			C			Mormon Island		H	Age: ca. 1848 Size: Unknown Density: Unknown Depth: Unknown	Town site		Inundated	7L	HRI, CHL	Also SAC-189

Table CR-2
Cultural Resources

Trinomial			Topo	Elev	T/R/Sec	Resource Name	Category	Type	Description	Feature	Materials	Condition	NR Status	Reference	Comments
ELD						Negro Hill		H	Age: ca. 1850 Size: Unknown Density: Unknown Depth: Unknown			Inundated	7L	HRI, CHL	
ELD						Salmon Falls		H	Age: Unknown Size: Unknown Density: Unknown Depth: Unknown			Inundated	7L	HRI, CHL	
PLA	030		PH		11N/8E/8	Whiskey Bar	Domestic	P	Age: Unknown Size: Unknown Density:Unknown Depth: Unknown		Clam disc beads, projectile points	Inundated		BOR	
PLA	117		PH	800	12N/8E/32	Piuhu Village	Funerary	P	Age: Unknown Size: 4047 m^2 Density: Unknown Depth:Unknown	Cemetery, burials	Glass and shell beads			Barrett	
PLA	131		PH	400	11N/8E/9	Batak Pai Village (Nisenan)	Domestic	P	Age: Unknown Size: Unknown Density: Unknown Depth: Unknown			Inundated		BOR	Rattlesnake Bridge area W92: Could not find
PLA	158		R	435-460	11N/7E/36		Domestic Subsistence	P	Age: Unknown Size: 23,376m^2 Density: 18 BRMs Depth: .5ft.	BRMs	Lithic scatter	Inundated		BOR	Same as PLA-255
PLA	159		R	500	11N/7E/36		Domestic	P	Age: Unknown Size: 113sq.ft. Density: Unknown Depth: Unknown	House pit				BOR	
PLA	160	H	R	500	11N/7E/36		Domestic Agriculture	H	Age: Unknown Size: 300 sq.ft. Density: Unknown Depth: 1 ft.	Cabin, feeding station	Ranch trash scatter			BOR	
PLA	204		PH	480	11N/8E/9		Subsistence	P	Age: Unknown Size: 3925m^2 Density: Unknown Depth: Unknown	BRMs	Tool and flake scatter			BOR, W92	
PLA	242		F	370	10N/7E/24		Domestic	P	Age: Unknown Size: 897 m^2 Density: Unknown Depth: Unknown	BRM Midden		Inundated		BOR	

Table CR-2
Cultural Resources

Trinomial			Topo	Elev	T/R/Sec	Resource Name	Category	Type	Description	Feature	Materials	Condition	NR Status	Reference	Comments
PLA	243		F	424	10N/7E/12		Subsistence	P	Age: Unknown Size: 500m^2 Density: Unknown Depth: Undetermined	BRMs	Lithic scatter	Eroded Inundated		BOR	
PLA	244		F	426	10N/7E/12		Domestic Subsistence	P	Age: Unknown Size: 4680 m^2 Density: Unknown Depth: 60 cm	BRMs	Lithic scatter	Inundated		BOR	
PLA	245	H	F	390	10N/7E/13		Domestic Agriculture	H	Age: Unknown Size: 15,000 m^2 Density: Unknown Depth: Unknown	Ranch foundations, orchard	Trash pits	"Destroyed"		BOR, Barrett	
PLA	246		F	390	10N/7E/12		Domestic Subsistence	P	Age: Unknown Size: Large Density: Great Depth: Unknown	BRMs, midden	Lithic scatter	Eroded Inundated		BOR	
PLA	247	H	F	390	10N/8E/7		Domestic	H	Age: Unknown Size: 256m^2 Density:Unknown Depth: Surface	Foundation, fireplace	Trash scatter	Eroded Inundated		BOR	
PLA	248		F	390	10N/8E/7		Domestic Subsistence	P	Age: Unknown Size: 5148m^2 Density: Unknown Depth: Unknown	BRMs	Lithic scatter	Eroded Inundated		BOR	
PLA	249		F	415	10N/7E/12		Domestic Subsistence	P	Age: Unknown Size: 3750m^2 Density: Unknown Depth: Unknown	BRMs	Groundstone, lithic scatter	Eroded Inundated		BOR	
PLA	250		F	400	10N/7E/12		Industry/ Processing/ Extraction	H	Age: Unknown Size: 18m^2 Density: Unknown Depth: Unknown	Structure, flume		Eroded Inundated		BOR	
PLA	251		F	400	10N/7E/13		Domestic	H	Age: Unknown Size: 90m^2 Density: Unknown Depth: Unknown	Foundation, dump	Trash scatter	Disturbed		BOR	
PLA	252		F	380	10N/7E/13		Industry/Processi ng/Extraction	H	Age: Unknown Size: 210m^2 Density: Unknown Depth: Unknown	Dump	Trash scatter	Eroded Inundated		BOR	

Table CR-2
Cultural Resources

Trinomial			Topo	Elev	T/R/Sec	Resource Name	Category	Type	Description	Feature	Materials	Condition	NR Status	Reference	Comments
PLA	253		F	380	10N/7E/24		Domestic	H	Age: Unknown Size: 2500m^2 Density: Unknown Depth: Unknown	Foundation, footbridge, road, ditch	Trash scatter	Eroded Inundated		BOR	
PLA	254		R	380	11N/8E/31		Domestic Subsistence	P	Age: Unknown Size: 100m^2 Density: Unknown Depth: Unknown	BRMs	Projectile point	Eroded Inundated		BOR	
PLA	255		R	460	11N/7E/36		Domestic Subsistence	P	Age: Unknown Size: 943m^2 Density: Unknown Depth: Unknown	BRMs, midden	Groundstone, lithic scatter	Eroded Inundated		BOR	Same as PLA-158
PLA	256	H	R	440	11N/7E/36		Domestic	H	Age: Unknown Size: 120m^2 Density: Unknown Depth: Unknown	Trash scatter	Bottles, ceramics, metal debris	Eroded Inundated Pothunted		BOR	
PLA	257	H	PH	445	11N/8E/30		Domestic	H	Age: Unknown Size: 500m^2 Density: Unknown Depth: Unknown	Foundation	Trash scatter	Eroded Inundated		BOR	
PLA	258		PH	380	11N/8E/30		Domestic Subsistence	P	Age: Unknown Size: 5918m^2 Density: Unknown Depth: Unknown	BRMs	Groundstone, lithic scatter	Eroded Inundated		BOR	
PLA	259		PH	455	11N/8E/17		Domestic Subsistence	P	Age: Unknown Size: 7314m^2 Density: Unknown Depth: Unknown	BRMs	Groundstone, lithic tools, lithic scatter	Eroded Inundated		BOR	
PLA	260		PH	440	11N/8E/9		Domestic Subsistence	P	Age: Unknown Size: 337m^2 Density: Unknown Depth: Unknown	BRMs	Lithic scatter	Eroded Inundated		BOR	
PLA	261		PH	350	11N/8E/8		Domestic Subsistence	P	Age: Unknown Size: 728m^2 Density: Unknown Depth: Unknown	BRMs	Lithic scatter	Eroded Inundated		BOR	
PLA	262		PH	360-400	11N/8E/8		Domestic Subsistence	P	Age: Unknown Size: 777m^2 Density: Unknown Depth: Unknown	BRMs	Groundstone, lithic scatter	Eroded Inundated		BOR, W92	

Table CR-2
Cultural Resources

Trinomial			Topo	Elev	T/R/Sec	Resource Name	Category	Type	Description	Feature	Materials	Condition	NR Status	Reference	Comments
PLA	263		PH	455	11N/8E/17		Domestic Subsistence	P	Age: Unknown Size: 9108m^2 Density: Unknown Depth: Unknown	BRMs	Lithic scatter	Eroded Inundated		BOR, W92	
PLA	264		PH	365	11N/8E/17		Domestic Subsistence	P	Age: Unknown Size: 212m^2 Density: Unknown Depth: Unknown	BRMs	None	Eroded Inundated		BOR	
PLA	265		PH	420	11N/8E/14		Domestic Subsistence	P	Age: Unknown Size: 4583m^2 Density: Unknown Depth: Unknown	BRMs	Groundstone, lithic scatter	Eroded Inundated		BOR	
PLA	266	H	PH	350	11N/8E/4		Agriculture	H	Age: Unknown Size: 420m^2 Density: Unknown Depth: Unknown	Trash scatter	Bottles, ceramics, metal debris, farm tools	Eroded Inundated Pothunted		BOR	Associated with Avery's Pond
PLA	267	H	PH	555	11N/8E/4		Domestic	H	Age: Unknown Size: 714m^2 Density: Unknown Depth: Surface	House site, cement steps, pond, flume	Trash scatter	Eroded Inundated Pothunted		BOR	Near Avery's Pond
PLA	268		PH	450	11N/8E/4		Domestic Subsistence	P	Age: Unknown Size: 1112m^2 Density: Unknown Depth: Surface	BRMs	Lithic scatter	Eroded Inundated		BOR	
PLA	269	H	PH	500	12N/8E/34		Domestic	H	Age: Unknown Size: 240m^2 Density: Unknown Depth: Surface	Cement piers, wells, dump	Trash scatter	Eroded Inundated Pothunted		BOR	
PLA	270	H	PH	500	11N/8E/4		Domestic	H	Age: Unknown Size: 2220m^2 Density: Unknown Depth: Surface	Foundation, basement, pipes	Trash scatter	Eroded Inundated		BOR	
PLA	271		PH	480	12N/8E/26		Unknown	P	Age: Unknown Size: Unknown Density: Unknown Depth: Unknown					True	Record not on file at BOR
PLA	272		PH	450	12N/8E/26			P	Age: Unknown Size: Unknown Density: Unknown Depth: Unknown					True	Record not on file at BOR

Table CR-2
Cultural Resources

Trinomial			Topo	Elev	T/R/Sec	Resource Name	Category	Type	Description	Feature	Materials	Condition	NR Status	Reference	Comments
PLA	273		PH	450	12N/8E/26			P	Age: Unknown Size: Unknown Density: Unknown Depth: Unknown					True	Record not on file at BOR
PLA	274		PH	450	12N/8E/26			P	Age: Unknown Size: Unknown Density: Unknown Depth: Unknown					True	Record not on file at BOR
PLA	275		PH	450	12N/8E/26			P	Age: Unknown Size: Unknown Density: Unknown Depth: Unknown					True	Record not on file at BOR
PLA	276		PH	450	12N/8E/26			P	Age: Unknown Size: Unknown Density: Unknown Depth: Unknown					True	Record not on file at BOR
PLA	277		PH	450	12N/8E/26			P	Age: Unknown Size: Unknown Density: Unknown Depth: Unknown					True	Record not on file at BOR
PLA	429		F	400-450	10N/7E/13		Domestic	P	Age: Unknown Size: 5000m^2 Density: Unknown Depth: 10-40 cm	Midden	Groundstone, flake	Eroded		Barrett	
PLA	435			400-410			Domestic	P	Age: Unknown Size: Unknown Density: Unknown Depth: Unknown	Midden	Debitage	Inundated		W&M	Record not on file at BOR
PLA	519	H	PH	580-640	11N/8E/4		Industry/Processing/Extraction Landscape	H	Age: Unknown Size: 600 ft Density: Unknown Depth: .5-2.5 ft	Ditches	None	Eroded		BOR	
PLA	520	H	PH	460	11N/8E/4	Pioneer Express Trail (portion)	Industry/Processing/Extraction Transportation	H	Age: 1855 Size: 600 ft Density: Unknown Depth: 5 ft	Ditch	Retaining wall, pipes, rock footings		7L	HRI, CHL, BOR, W92	
PLA	746		F	410	10N/8E/6		Domestic	P	Age: Unknown Size: 393m^2 Density: Unknown Depth: Unknown	Lithic tool scatter	Flaked cobble tools, debitage	Inundated		W&M, W92	

Table CR-2
Cultural Resources

Trinomial			Topo	Elev	T/R/Sec	Resource Name	Category	Type	Description	Feature	Materials	Condition	NR Status	Reference	Comments
PLA	747		F	410	10N/8E/6		Domestic	P	Age: Unknown Size: Unknown Density: Unknown Depth: Unknown	Lithic tool scatter	Flaked cobble tools, debitage	Inundated		W&M, W92	No trinomial from BOR records, first page missing
PLA	748		F	400	10N/8E/6		Domestic	P	Age: Unknown Size: 1237m^2 Density: Unknown Depth: Unknown	Lithic tool scatter	Flaked cobble tools, debitage	Inundated		W&M, W92	
PLA	749	/H	F	420	10N/8E/6		Domestic	P/H	Age: Unknown Size: 2710m^2 Density: Unknown Depth: Unknown	Trash and lithic scatter	Shell, lithics, cut nails, ceramics	Eroded Inundated		W&M	
PLA	750	H	R	410	10N/8E/6		Domestic	H	Age: Unknown Size: 393m^2 Density: Unknown Depth: Unknown	Trash scatter	Cut nails, ceramics, glass, metal debris	Eroded Inundated		W&M	
PLA	751		R	425	10N/8E/6		Domestic	P	Age: Unknown Size: 5340m^2 Density: Sparse Depth: Unknown	Tool scatter	Hammerstone, cobble tools	Eroded Inundated		W&M, W92	
PLA	752		R	420	10N/8E/6		Domestic	P	Age: Unknown Size: Unknown Density: Unknown Depth: Unknown	Tool scatter	Cobble tools, debitage	Eroded Inundated		W&M, W92	First page missing in record
PLA	753		R	415	10N/8E/6		Domestic	P	Age: Unknown Size: 1156m^2 Density: Sparse Depth: Unknown	Tool scatter	Flaked cobble tools, debitage	Eroded Inundated		W&M, W92	
PLA	754		R	405	10N/8E/6		Domestic Subsistence	P	Age: Unknown Size: 2144m^2 Density: Dense Depth: Unknown	BRMs	Flaked cobble tools, groundstone, debitage	Eroded Inundated		W&M, W92	
PLA	755		R	455	11N/7E/36		Domestic	P	Age: Unknown Size: 271m^2 Density: Sparse Depth: Unknown	Tool scatter	Cobble tools, flakes, shell	Eroded Inundated		W&M, W92	
PLA	756		R	420	11N/7E/36		Domestic	P	Age: Unknown Size: 242m^2 Density: Dense Depth: Unknown	Tool scatter	Cobble tools, flakes	Eroded Inundated		W&M, W92	

Table CR-2
Cultural Resources

Trinomial			Topo	Elev	T/R/Sec	Resource Name	Category	Type	Description	Feature	Materials	Condition	NR Status	Reference	Comments
PLA	757		PH	405	11N/8E/8		Domestic	P	Age: Unknown Size: 389m^2 Density: Unknown Depth: Unknown	Tool scatter	Groundstone, flaked tool	Eroded Inundated		W&M, W92	
PLA	758		PH	410	11N/8E/8		Domestic	P	Age: Unknown Size: 1100m^2 Density: Dense Depth: Unknown	Tool scatter	Groundstone, flaked tools	Eroded Inundated		W&M, W92	
PLA	759		R	440	11N/7E/36		Domestic	P	Age: Unknown Size:2436m^2 Density: Unknown Depth: Unknown	Tool scatter	Groundstone, flaked tools	Eroded Inundated		W&M, W92	
PLA	760		R	405	11N/7E/36		Unknown	P	Age: Unknown Size:Unknown Density: Unknown Depth: Unknown	Flake scatter	Debitage	Eroded Inundated		W&M, W92	No trinomial from BOR records, first page missing
PLA	761		R	395	11N/8E/31		Domestic	P	Age: Unknown Size: 707m^2 Density: Sparse Depth: Unknown	Tool scatter	Groundstone, cobble tools, flake tools	Eroded Inundated		W&M, W92	
PLA	762		R	425	11N/8E/31		Domestic	P	Age: Unknown Size: Unknown Density: Unknown Depth: Unknown	Tool scatter	Groundstone, flake tools, debitage	Eroded Inundated		W&M, W92	Partial site record only
PLA	763		R	440	11N/7E/36		Domestic	P	Age: Unknown Size: 5652m^2 Density: Sparse Depth: Unknown	Tool scatter	Flake tools, debitage	Eroded Inundated		W&M, W92	
PLA	764		R	430	11N/8E/31		Domestic	P	Age: Unknown Size:23,550 m^2 Density: Low Depth: Unknown	Tool scatter	Cobble tools, groundstone, flakes, shell	Eroded Inundated		W&M, W92	
PLA	765		R	425	11N/8E/31		Domestic	P	Age: Unknown Size:7772 m^2 Density: Low Depth: Unknown	Tool scatter	Cobble tools, groundstone, flakes, shell	Eroded Inundated		W&M, W92	
PLA	766	H	PH	450	11N/8E/9		Domestic	H	Age: Unknown Size:4946m^2 Density: Unknown Depth: Unknown	Foundation, wells, fruit trees	Brick, ceramics	Inundated		W&M, W92	

Table CR-2
Cultural Resources

Trinomial			Topo	Elev	T/R/Sec	Resource Name	Category	Type	Description	Feature	Materials	Condition	NR Status	Reference	Comments
PLA	767		PH	440	11N/8E/9		Domestic Subsistance	P	Age: Unknown Size: 1696m^2 Density: Unknown Depth: Unknown	BRMs	Lithic scatter	Inundated		W&M, W92	
PLA	768		R	405	11N/8E/31		Domestic Subsistance	P	Age: Unknown Size: 8674m^2 Density: High Depth: Unknown	Tool scatter	Cobble tools, flakes, fire-cracked rock, shell	Inundated		W&M, W92	
PLA	769	/H	R	480	11N/8E/31		Domestic	P/H	Age: Unknown Size: 2748m^2 Density: Unknown Depth: Unknown	Rock walls	Historic trash, lithics	Inundated		W&M, W92	
PLA	FD15	H	PH	400-445	11N/8E/17	Horsehoe Bar	Extraction	H	Age: Unknown Size: 2983m^2 Density: Unknown Depth: Unknown	Mine tailings, pit	Trash scatter			FAR93	No trinomial from BOR records
PLA	FD23		R	450	11N/8E/31		Domestic	P	Age: Unknown Size: 314m^2 Density: Sparse Depth: Unknown	None	Tools and flake scatter			FAR93	No trinomial from BOR records
PLA	FD41		F	383	10N/7E/24		Domestic Subsistence	P	Age: Unknown Size: 2200m^2 Density: Unknown Depth: Unknown	None	Tool and flake scatter, shell			FAR93	No trinomial from BOR records
PLA	FD42	/H	F	381	10N/7E/24		Domestic Subsistence	P/H	Age: Unknown Size: 1590m^2 Density: Unknown Depth: Unknown	BRM	Shell, lithics, cut nails, ceramics			FAR93	No trinomial from BOR records
PLA	FD45		F	384	10N/7E/24		Domestic Subsistence	P	Age: Unknown Size: 5024m^2 Density: Unknown Depth: Unknown	BRMs	Tool and flake scatter, shell			FAR93	No trinomial from BOR records
PLA	FD46		F	390	10N/7E/24		Domestic Subsistence	P	Age: Unknown Size: 192m^2 Density: Unknown Depth: Unknown	None	Tool and flake scatter, shell			FAR93	No trinomial from BOR records
PLA	FD47		F	422	10N/7E/13		Domestic Subsistence	P	Age: Unknown Size: 3925m^2 Density: Unknown Depth: Unknown	BRMs	Tool and flake scatter, shell			FAR93	No trinomial from BOR records

Table CR-2
Cultural Resources

Trinomial			Topo	Elev	T/R/Sec	Resource Name	Category	Type	Description	Feature	Materials	Condition	NR Status	Reference	Comments
PLA	FD48		F	429	10N/7E/13		Domestic Subsistence	P	Age: Unknown Size: 2240m^2 Density: Unknown Depth: Unknown	None	Tool and flake scatter, shell			FAR93	No trinomial from BOR records
PLA	FD49		F	420	10N/7E/13		Domestic Subsistence	P	Age: Unknown Size: 150m^2 Density: Unknown Depth: Unknown	None	Tool scatter, shell	Eroded		FAR93	No trinomial from BOR records
PLA	FD50	/H	F	405	10N/7E/13		Domestic Subsistence	P/H	Age: Unknown Size: 1130m^2 Density: Unknown Depth: Unknown	BRMs	Tool scatter, shell, trash scatter	Eroded		FAR93	No trinomial from BOR records, bordered by PLA-520H
PLA	FD51	/H	F	395	10N/7E/13		Domestic Subsistence	P/H	Age: Unknown Size: 1885m^2 Density: Unknown Depth: Unknown	Rock wall, rock ring	Trash scatter, tool and flake scatter			FAR93	No trinomial from BOR records
PLA	FD52		F	410	10N/7E/13		Domestic Subsistence	P	Age: Unknown Size: 2510m^2 Density: Unknown Depth: Unknown	None	Tool and flake scatter, shell			FAR93	No trinomial from BOR records
PLA	FD53		F	380	10N/7E/13		Domestic Subsistence	P	Age: Unknown Size: 5180m^2 Density: Unknown Depth: Unknown	Rock alignment	Groundstone, cobble tools, debitage, shell			FAR93	No trinomial from BOR records
PLA	FD54		F	370	10N/7E/13		Domestic Subsistence	P	Age: Unknown Size: 6945m^2 Density: Unknown Depth: Unknown	BRM	Tool and flake scatter			FAR93	No trinomial from BOR records
PLA	FD55		F	370	10N/7E/13		Domestic Subsistence	P	Age: Unknown Size: 2160m^2 Density: Unknown Depth: Unknown	BRMs	Milling slab, handstones, debitage, shell			FAR93	No trinomial from BOR records
PLA	FD56	/H	F	390	10N/7E/13		Domestic Subsistence	P/H	Age: Unknown Size: 2355m^2 Density: Unknown Depth: Unknown	None	Trash scatter, tool and flake scatter			FAR93	No trinomial from BOR records
PLA	FD57		F	410	10N/7E/13		Domestic Subsistence	P	Age: Unknown Size: 2003m^2 Density: Unknown Depth: Unknown	None	Basalt tools and flakes			FAR93	No trinomial from BOR records

Table CR-2
Cultural Resources

Trinomial			Topo	Elev	T/R/Sec	Resource Name	Category	Type	Description	Feature	Materials	Condition	NR Status	Reference	Comments
PLA	FD58		F	412	10N/7E/13		Domestic Subsistence	P	Age: Unknown Size: 705m^2 Density: Sparse Depth: Unknown	None	Tool and flake scatter, shell			FAR93	No trinomial from BOR records
PLA	FD59		F	410	10N/7E/13		Domestic Subsistence	P	Age: Unknown Size: 9890m^2 Density: Unknown Depth: Unknown	BRM	Tool and flake scatter, shell			FAR93	No trinomial from BOR records
PLA	FD60		F	400	10N/7E/12		Domestic Subsistence	P	Age: Unknown Size: 1730m^2 Density: Unknown Depth: Unknown	None	Tool and flake scatter, shell			FAR93	No trinomial from BOR records
PLA	FD61		F	385	10N/7E/13		Domestic	P	Age: Unknown Size: 1695m^2 Density: Unknown Depth: Unknown	Burnt, compacted earth	Tool and flake scatter, shell			FAR93	No trinomial from BOR records
PLA	FD62		PH	390	11N/8E/31		Domestic Subsistence	P	Age: Unknown Size: 1100m^2 Density: Unknown Depth: Unknown	BRMs	Tool and flake scatter, shell			FAR93	No trinomial from BOR records
PLA	FD63		PH	370	11N/8E/31		Domestic Subsistence	P	Age: Unknown Size: 1570m^2 Density: Unknown Depth: Unknown	BRMs	Tool and flake scatter, shell			FAR93	No trinomial from BOR records
PLA	FD64		PH	370	11N/8E/31		Domestic	P	Age: Unknown Size: 824m^2 Density: Unknown Depth: Unknown	None	Tool and flake scatter, shell			FAR93	No trinomial from BOR records
PLA	FD65		PH	330	11N/8E/31		Domestic Subsistence	P	Age: Unknown Size: 1650m^2 Density: Unknown Depth: Unknown	BRMs	Tool and flake scatter, shell			FAR93	No trinomial from BOR records
PLA	FD66		PH	420	11N/8E/30		Domestic	P	Age: Unknown Size: 3770m^2 Density: High Depth: Unknown	None	Tool and flake scatter, shell			FAR93	No trinomial from BOR records
PLA	FD67		R	410	11N/8E/30		Domestic Subsistence	P	Age: Unknown Size: 6280m^2 Density: Sparse Depth: Unknown	BRMs	Tool and flake scatter, shell			FAR93	No trinomial from BOR records, bisected by PLA-520H

Table CR-2
Cultural Resources

Trinomial			Topo	Elev	T/R/Sec	Resource Name	Category	Type	Description	Feature	Materials	Condition	NR Status	Reference	Comments
PLA	FD68		PH	400	11N/8E/30		Domestic	P	Age: Unknown Size: 1235m^2 Density: Sparse Depth: Unknown	None	Tool and flake scatter, shell			FAR93	No trinomial from BOR records
PLA	FD69		R	440	11N/8E/30		Domestic Subsistence	P	Age: Unknown Size: 80m^2 Density: Sparse Depth: Unknown	BRMs	Shell			FAR93	No trinomial from BOR records
PLA	FD70	/H	PH	400	11N/8E/30		Domestic Subsistence Extraction	P/H	Age: Unknown Size: 3455m^2 Density: Sparse Depth: Unknown	BRMs	Mining debris, lithic tools and debitage			FAR93	No trinomial from BOR records
PLA	FD72		PH	360	11N/8E/31		Domestic Subsisitence	P	Age: Unknown Size: 1080m^2 Density: Sparse Depth: Unknown	BRM	Tool and flake scatter, shell			FAR93	No trinomial from BOR records
PLA						Duke Lester House		H	Age: Unknown Size: Unknown Density: Unknown Depth: Unknown					FV	Listed in county, may or may not be in study area
PLA						Tsuda's Store		H	Age: Unknown Size: Unknown Density: Unknown Depth: Unknown					FV	Listed in county, may or may not be in study area
SAC	166		F	130	9N/7E/24		Domestic	P	Age: Unknown Size: Unknown Density: Unknown Depth: Unknown	Sand dune	Occupation debris	Destroyed by trailer camp		Barrett	
SAC	172		F	100	9N/7E/NS		Unknown	P	Age: Unknown Size: Unknown Density: Unknown Depth: Unknown					W&M, Welch	Record not on file at BOR
SAC	173		F	130	9N/7E/NS		Domestic	P	Age: Unknown Size: 750 m^2 Density: Unknown Depth: 3 ft	Midden	Manos, pestle fragment	Inundated		Barrett, Welch	
SAC	174		F	300	9N/7E/NS		Unknown	P	Age: Unknown Size: Unknown Density: Unknown Depth: Unknown					W&M	Record not on file at BOR

Table CR-2
Cultural Resources

Trinomial			Topo	Elev	T/R/Sec	Resource Name	Category	Type	Description	Feature	Materials	Condition	NR Status	Reference	Comments
SAC	175		F				Domestic	P	Age: Unknown Size: Unknown Density: Unknown Depth: Unknown	Village or camp		Inundated		Barrett	
SAC	176		F	130	9N/7E/NS		Domestic	P	Age: Unknown Size: Unknown Density: Unknown Depth: Unknown	Village				Barrett	Record not on file at BOR
SAC	177		F	100	9N/7E/NS		Domestic	P	Age: Unknown Size: Unknown Density: Unknown Depth: Unknown			Inundated		Barrett, Welch	Record not on file at BOR
SAC	178		F	150	10N/7E/NS		Domestic	P	Age: Unknown Size: Unknown Density: Unknown Depth: Unknown					Barrett	Record not on file at BOR
SAC	179		F	150	10N/7E/NS		Domestic Subsistence	P	Age: Unknown Size: Unknown Density: Unknown Depth: Unknown	BRMs		Inundated		Barrett	Record not on file at BOR
SAC	180		F	90	9N/7E/NS		Domestic	P	Age: Unknown Size: 10,000 m^2 Density: Unknown Depth: 4 ft.	Village		Inundated		Barrett	
SAC	181		F	200	10N/7E/NS		Domestic	P	Age: Unknown Size: Unknown Density: Unknown Depth: Unknown	Village		Destroyed		Barrett	Record not on file at BOR
SAC	182		F	200	10N/7E/NS		Domestic	P	Age: Unknown Size: 5000 sq. ft. Density: Unknown Depth: 12"	Village		Destroyed		NCIC, Barrett	Also SAC-167 Record not on file at BOR
SAC	183		F	120	10N/7E/NS		Domestic	P	Age: Unknown Size: 1250 sq. ft. Density: Unknown Depth: 3"	Camp		Destroyed		NCIC, Barrett	Also SAC-168 Record not on file at BOR
SAC	184		F	250	9N/7E/NS		Unknown	P	Age: Unknown Size: Unknown Density: Unknown Depth: Unknown		Lithic scatter			Barrett	Record not on file at BOR

Table CR-2
Cultural Resources

Trinomial			Topo	Elev	T/R/Sec	Resource Name	Category	Type	Description	Feature	Materials	Condition	NR Status	Reference	Comments
SAC	185		F	250	9N/7E/NS		Domestic Subsistence	P	Age: Unknown Size: Unknown Density: Unknown Depth: Unknown	BRMs				Barrett	Record not on file at BOR
SAC	186		F	250	9N/7E/NS		Unknown	P	Age: Unknown Size: Unknown Density: Unknown Depth: Unknown					Welch	Record not on file at BOR
SAC	189		F	250	10N/8E/20	Mormon Island/Mormon Diggings	Domestic Subsistence Industry/Processing/Extraction	P/H	Age: Unknown Size: 30,000 sq.ft. Density: Unknown Depth: Surface to 6" below	BRMs waste rock piles	Trash scatter	Inundated Pothunted		BOR, IHL, CHL	Also El Dorado County Historical Landmark No. 569
SAC	248		C		10N/8E/30			H	Age: Unknown Size: 12m x 2.45m Density: Unknown Depth: Surface	Bridge, roadbed		Inundated		Olsen	Also ELD-248H
SAC	308	H	F	100	9N/7E/NS		Unknown	H	Age: Unknown Size: Unknown Density: Unknown Depth: Unknown					Welch	Record not on file at BOR
SAC	345	H	F	250	10N/7E/NS		Unknown	H	Age: Unknown Size: Unknown Density: Unknown Depth: Unknown					Welch	Record not on file at BOR
SAC	353		F	370	10N/7E/24		Domestic	P	Age: Unknown Size: 3264 m^2 Density: Unknown Depth: 35 cm	Midden	Groundstone, lithic scatter	Inundated		BOR	
SAC	354		F	370	10N/7E/24		Domestic	P	Age: Unknown Size: 5700 m^2 Density: Unknown Depth: 35 cm	Midden	Groundstone, lithic scatter	Inundated		BOR	
SAC	357		F	360	10N/8E/19		Domestic Industry/Processing/Extraction	P/H	Age: Unknown Size: 8428 m^2 Density: Unknown Depth: Unknown	Midden Trench Tailings	Groundstone, lithic scatter	Inundated		BOR	
SAC	358	H	F	390	10N/8E/30		Industry/Processing/Extraction	H	Age: Unknown Size: 15,000 m^2 Density: Unknown Depth: Unknown	Holding ponds, concrete box, dam, road	Metal pipe	Inundated		BOR	

Table CR-2
Cultural Resources

Trinomial			Topo	Elev	T/R/Sec	Resource Name	Category	Type	Description	Feature	Materials	Condition	NR Status	Reference	Comments
SAC	359	H	F	365	10N/8E/20		Domestic	P/H	Age: Unknown Size: 226,800 m^2 Density:Unknown Depth: Unknown	Midden, rock wall	Groundstone, lithic scatter, trash scatter	Inundated		BOR	
SAC	360	H	F	370	10N/8E/20	Mormon Island Cemetery	Funerary	H	Age: ca. 1850 Size: 9600 m^2 Density: Unknown Depth: Unknown	Grave depressions, cement markers	Metal decorative grill, metal stakes	Inundated		BOR	
SAC	361	H	C		10N/8E/4		Domestic	H	Age: ca. 1900 Size: Unknown Density: Unknown Depth: Unknown	Dump, stone foundation	Trash scatter	Inundated		Barrett	Also ELD-256H
SAC	364	H	C	356	10N/8E/20		Agriculture	H	Age: Unknown Size pipe:1m diam x 4m long Density: Unknown Depth: Surface	Catch basin Pipe	Redwood planks, metal bands	Inundated		Barrett	
SAC	365		C	440	10N/8E/16		Domestic Subsistence	P	Age: Unknown Size: 7650 m^2 Density: Unknown Depth: Undetermined	BRM	Groundstone, lithic scatter	Inundated		Barrett	Also ELD-261
SAC	366		C		10N/8E/20		Domestic Subsistence	P	Age: Unknown Size: 18,018 m^2 Density: Unknown Depth: Unknown	BRM	Mano, lithic scatter	Inundated		BOR, Barrett	
SAC	368		C	450	10N/8E/11		Domestic	P	Age: Unknown Size: 8001 m^2 Density: Unknown Depth: Unknown	Midden	Groundstone, projectile point	Inundated		Barrett	Also ELD-262
SAC	414		F					P	Age: Unknown Size: Unknown Density: Unknown Depth: Unknown					Barrett	
SAC	415		F	150	10N/7E/NS		Unknown	P	Age: Unknown Size: Unknown Density: Unknown Depth: Unknown					Barrett	
SAC	427	H	F	150	10N/7E/NS		Unknown	H	Age: Unknown Size: Unknown Density: Unknown Depth: Unknown					Welch	Record not on file at BOR

Table CR-2
Cultural Resources

Trinomial			Topo	Elev	T/R/Sec	Resource Name	Category	Type	Description	Feature	Materials	Condition	NR Status	Reference	Comments
SAC	434	H				Natoma Ditch System	Industry/Processing/Extraction	H	Age: Unknown Size: Unknown Density: Unknown Depth: Unknown					W&M	Record not on file at BOR
SAC	511		F	140	10N/7E/35		Domestic Subsistence	P	Age: Unknown Size: 400m^2 Density: Unknown Depth: Unknown	BRMs				NCIC	
SAC	512	H	F	150	10N/7E/35		Transportation	H	Age: Unknown Size: 324m^2 Density: Unknown Depth: Unknown	Bridge abutment				NCIC	
SAC	513		F	110	10N/7E/35		Domestic Subsistence	P	Age: Unknown Size: 4m^2 Density: Unknown Depth: Unknown	BRMs				NCIC	
SAC	661	H	F	160	10N/7E/35		Recreation	H	Age: Post 1945 Size: Unknown Density: Unknown Depth: Unknown	Camp site	Trash scatter			NCIC	
SAC	FD40	/H	F	383	10N/7E/24		Subsistence	P/H	Age: Mixed Size: Unknown Density: Unknown Depth: Undetermined	BRM foundation	Mortar, shell, trash scatter			FAR93	No trinomial from BOR records
SAC	FD43		F	375	10N/7E/24		Domestic	P	Age: Unknown Size: 345m^2 Density: Sparse Depth: Undetermined	None	Tool and flake scatter, shell			FAR93	No trinomial from BOR records
SAC	FD44		F	370	10N/7E/24		Domestic Subsistence	P	Age: Unknown Size: 295m^2 Density: Sparse Depth: Undetermined	BRM	Tool and flake scatter, shell			FAR93	No trinomial from BOR records
SAC						American River Gold Mining District	Industry/ Extraction Domestic	H	Age: ca. 1850 Size: Unknown Density: Unknown Depth: Unknown					HRI	
SAC			F			Folsom Chinese American Cemetery		H	Age: Unknown Size: Unknown Density: Unknown Depth: Unknown					FV	Listed in county, may or may not be in study area

Table CR-2
Cultural Resources

Trinomial			Topo	Elev	T/R/Sec	Resource Name	Category	Type	Description	Feature	Materials	Condition	NR Status	Reference	Comments
SAC			F			Folsom Powerhouse		H	Age: 1895 Size: Unknown Density: Unknown Depth: Unknown					HRI	
SAC						George Duplex Home		H	Age: Unknown Size: Unknown Density: Unknown Depth: Unknown					FV	Listed in county, may or may not be in study area
SAC						Lincoln Chan Ranch		H	Age: Unknown Size: Unknown Density: Unknown Depth: Unknown					FV	Listed in county, may or may not be in study area
SAC						Marie Pott's Home		H	Age: Unknown Size: Unknown Density: Unknown Depth: Unknown					FV	Listed in county, may or may not be in study area
SAC						Natoma Station Ground Sluices Chinese Diggings		H	Age: Unknown Size: Unknown Density: Unknown Depth: Unknown					PHI	
SAC						Negro Women's Civic Improvement Club		H	Age: Unknown Size: Unknown Density: Unknown Depth: Unknown					FV	Listed in county, may or may not be in study area
SAC			F			Old Folsom Powerhouse		H	Age: 1895 Size: Unknown Density: Unknown Depth: Unknown					HRI, CHL	Specifically excluded from study area
SAC						The Coloma Road-Nimbus Dam		H	Age: 1847 Size: Unknown Density:N/A Depth: N/A					CHL	
SAC			F			Rainbow Bridge		H	Age: 1917 Size: Unknown Density: N/A Depth: N/A				2S2	HPD	CT Bridge #240067

TABLE CR-2

KEY

Trinomial Designation:

ELD: El Dorado County
PLA: Placer County
SAC: Sacramento County
FD: Field designation numbers assigned to sites by Far Western Anthropological Research Group, Inc. during survey 1992-1993

Topo: USGS 7.5 Topographic Quadrangles

C: Clarksville
F: Folsom
PH: Pilot Hill
R: Rocklin

Elev:

Elevation in feet above mean sea level

T/R/Sec:

Township/Range/Section
NS: Not sectioned (within a *Rancho*, outside of the US Geologic Survey grid system}

Category:

National Park Service *Data Categories for Function or Use*

Type Designation:

P: Prehistoric
H: Historic
P/H: Both prehistoric and historic

NR Status:

National Register of Historic Places designations:
2S2: Determined to be eligible for separate listing through a consensus determination by a federal agency and the State Historic Preservation Officer.
7L: Not evaluated

Reference:

Barrett: Barrett, Laura J.
1989 *Status Report: Documentation of Archaeological Sites at Folsom Lake State Recreation Area*. California Department of Parks and Recreation, Sacramento.

BOR: Bureau of Reclamation Site Records

CHL: California Office of Historic Preservation
1990 *California Historical Landmarks*. California Department of Parks and Recreation, Sacramento.

FAR 93 : Waechter, Sharon A. with John Berg, Tammara Ekness-Hoyle, and J. Peter Mundwiller
1993 *Final Report on a Cultural Resources Inventory of a Portion of the Folsom Reservoir Study Area*. Far Western Anthropological Research Group, Inc., Davis.

FV: California Office of Historic Preservation
1988 *Five Views: An Ethnic Historic Sites Survey for California*. California Department of Parks and Recreation, Sacramento. Five Views: An Ethnic Sites Survey for California

GIS: Bureau of Reclamation GIS Database

HPD: Office of Historic Preservation *Directory of Properties in the Historic Property Data File, 10-30-02*.

HRI: California Department of Parks and Recreation
1976 *California Inventory of Historic Resources*. California Department of Parks and Recreation, Sacramento.

NCIC: Site records from the North Central Information Center, on premises of LSA Associates, Pt.Richmond.

OLSEN: Olsen, Gwen J.
1977 *A Survey of Archaeological Resources Inundated by Folsom Reservoir*. California Department of Parks and Recreation, Cultural Heritage Section, Sacramento.

PHI: California Office of Historic Preservation
1992 *Points of Historical Interest*. California Department of Parks and Recreation, Sacramento.

True: True, D. L.
No date; sites on documents provided by Bureau of Reclamation.

W&M: Waechter, Sharon A., and Steven D. Mikesell with Helen McCarthy and David S. Byrd
1994 *Research Design for Prehistoric, Ethnographic, and Historical Cultural Resources at Folsom Reservoir, California*. Far Western Anthropological Research Group, Inc., Davis

W92: Waechter, Sharon A.
1992 *Folsom Reservoir Reoperation Study El Dorado, Placer and Sacramento Counties, California*. Far Western Anthropological Research Group, Inc., Davis.

Welch: Welch, Pat
1995 Record Search at North Central Information Center, Sacramento.

LAND USE, TRAFFIC AND CIRCULATION, AND UTILITIES

LAND USE

Folsom Lake State Recreation Area

April 2003

by

Wallace Roberts & Todd, LLC

1328 Mission Street, 4th Floor

San Francisco, CA 94103

List of Figures

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Figure LU-2: Land Use Surrounding Lake Natoma LU-11

LAND USE

Introduction

The Folsom Lake State Recreation Area (the Unit) includes approximately 18,000 acres of water and land. For the most part, land uses within the Unit are recreation related and reflect a range of activity and development intensity. However, the very existence of the Unit is the result of the Central Valley Project, which dammed the American River and created Folsom Lake and Lake Natoma for the purposes of flood control, water supply, and power generation. Operation of the lakes for these purposes has a direct affect on recreational uses in the Unit and the involvement of several State, federal, and local agencies results in a complex regulatory context. The recreation-related land uses within the Unit, and the impacts on these uses by non-recreational activities are summarized in this Chapter.

The Unit is located in the greater Sacramento Region, defined as the six-county area comprising the Sacramento Area Council of Governments (SACOG), including El Dorado, Placer, Sacramento, Sutter, Yuba, and Yolo counties. According to the U.S. Census, the 2000 regional population was 1.94 million[1] with SACOG projecting the region will see a 49 percent (928,000) increase in residents and a 60 percent (510,000) increase in jobs by 2020.[2] As the region continues to accommodate significant growth, the development trend currently being experienced in the areas surrounding the Unit will also continue – that is the historical pattern of agriculture will give way to largely urban development. In general, the intensity of development that currently surrounds the Unit increases from north to south from rural to urban.

The Unit straddles three County jurisdictions (El Dorado in the east, Placer in the west, and Sacramento in the south) and the City of Folsom. Given that the Unit is increasingly surrounded by urban development, the policies of these jurisdictions have implications for the long-term management of the Unit. Relevant policies are summarized in this Chapter.

Land Use in the Unit

This section briefly summarizes the recreation and non-recreation land uses in the Unit and their relationship to each other. The specifics of each recreation area in the Unit are described more fully in the Recreation Resources section of this document.

Recreation Uses – Folsom Lake

The recreation areas on Folsom Lake provide for a wide range of activities, with most areas accommodating multiple park activities. These areas represent discrete recreation centers with, in most cases, several miles of undeveloped shoreline separating each area. Primary visitor areas are the most developed and provide a wide range of visitor services and easy access on major routes from adjacent to urban centers. Secondary visitor areas are more remotely located and less formally developed.

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[1] U.S. Census Bureau, *Census 2000 Summary File 3*, 2002.
[2] Sacramento Area Council of Governments (SACOG), *SACOG Projections*, March 2001.

The primary visitor areas on Folsom Lake include Granite Bay, Beals Point, Folsom Point, and Brown's Ravine. These areas appeal to a full range of water-dependant and related uses and are the most popular in the Unit accounting for almost 60 percent of total visits in 2000. Granite Bay and Beals Point in Placer County are the main day-use areas on the western shoreline with swim beaches, picnic areas, and boat launch facilities. On the eastern shoreline in El Dorado County, Folsom Point and Brown's Ravine provide boat launch, marina, and picnic facilities. Combined, the primary visitor areas include a 860-slip marina, two guarded swimming beaches, 56 boat launch lanes accommodating the full range of lake levels, 69 campsites, and four picnic areas with tables and barbeques. These areas are also the most developed with respect to the provision of visitor services and include food, beach, and boating equipment concessions, 14 restrooms, equestrian staging areas, trailheads, and parking for a total 3,160 vehicles.

The secondary visitor areas on Folsom Lake include Rattlesnake Bar, Salmon Falls/Skunk Hollow, Old Salmon Falls, and the Peninsula. These facilities tend to be less formally developed and cater to a more narrow range of park users. Rattlesnake Bar in Placer County is a boat launch and equestrian staging area on the North Fork of the American River, while Salmon Falls/Skunk Hollow are whitewater raft take-out facilities for private and commercial boaters on the South Fork of the American River in El Dorado County. Old Salmon Falls is a popular equestrian staging area and trailhead. The peninsula includes the main campground in the Unit with 104 campsites and a boat-in day-use area. Combined, the secondary visitor areas provide two boat launch lanes, five restrooms and six vault toilets, trailheads, and parking for 190 vehicles.

Other facilities on Folsom Lake include: informal parking and trailhead access at Sweetwater Creek and New York Creek on Salmon Falls Road in El Dorado County; Mormon Island Wetland Preserve on Green Valley Road at Blue Ravine Road; Observation Point at the southern end of Folsom Dam; and Park Headquarters on Folsom Dam Road at Auburn-Folsom Road. Mormon Island Wetland Preserve represents the only wetland area in the Unit and incorporates a small area of dense riparian habitat along Humbug Creek. Facilities here are minimal and include a small parking area and an unpaved trail and boardwalk through the wetland. Observation Point is a paved area on the water's edge with space for 77 vehicles that provides sweeping views of Folsom Lake and the Sierra Foothills. In the past, this area was a popular place for meeting and fishing; however, the area is now closed to public access and has been since September 11, 2001, due to security concerns associated with Folsom Dam. The Headquarters compound includes the offices of the California Department of Parks and Recreation (CDPR) Gold Fields District and the Central California Area Office of the U.S. Department of the Interior Bureau of Reclamation (BOR). The compound also comprises associated maintenance yards and facilities for each agency. The American River Water Education Center—managed by both CDPR and the BOR—is also located here and provides tours, exhibits, and interactive activities that explore the watershed of the American River.

Recreation Uses –Lake Natoma

As with the recreation areas on Folsom Lake, those on Lake Natoma accommodate multiple park users, although in a setting that is much less intense. Since Lake Natoma represents the afterbay of Folsom Dam, it is essentially a wide spot in the American River. The lake is long, linear, narrow, and highly scenic. The waters are quiet and sheltered making it an ideal location for paddling and rowing, swimming, and fishing. And since water levels vary by

only 4 to 7 feet, the shoreline is densely riparian and not exposed as it is on Folsom Lake. The lake is entirely surrounded by urban development.

Major facilities on the Lake include Negro Bar, Nimbus Flat, and the California State University Sacramento (CSUS) Aquatic Center. Negro Bar, the most popular day-use area on the lake, includes a full range of facilities including a swim beach, picnic area, group campground, boat launch, and equestrian staging area. Located in the City of Folsom, the area is urban park-like with 3 restrooms, boating equipment concession, and parking for 400 vehicles. The Nimbus Flat day-use area is located on the eastern shore of the lake just above Nimbus Dam in unincorporated Sacramento County. The area includes two small unguarded beaches, picnic area, personal watercraft dock, two restrooms, and a parking area for 230 vehicles. Since Nimbus Flat is located adjacent to the CSUS Aquatic Center, it is often used as an observation and overflow parking area for various aquatic competitions hosted by CSUS. The Aquatic Center provides the base for Sac State's water ski and rowing clubs teams and aquatic courses and offers a full range of public courses in sailing, windsurfing, jet skiing, kayaking, rowing, canoeing, etc., as well as youth programs and summer camps. Facilities here include an administrative building with offices and classrooms, several equipment storage buildings, three launch docks with mooring areas, a small beach area, and a large paved parking area with access off Hazel Avenue. The Center is currently undergoing an expansion project that includes a new administrative building with locker rooms, classrooms, and storage, and a new boathouse and dock.

Secondary facilities on Lake Natoma include Willow Creek, Lake Overlook, and Mississippi Bar. Located on the eastern shore of the lake off Folsom Boulevard, the Willow Creek area is a popular fishing, canoeing, picnicking, bird watching, and trailhead location. Facilities are minimal and include a small picnic area, canoe and kayak concession, informal boat launch, vault toilets, and a gravel parking area for 20 vehicles. Lake Overlook is located high above the north end of Nimbus Dam off Hazel Avenue and is essentially undeveloped. Offering sweeping views of Lake Natoma, the Sierra Foothills, and the Sacramento Valley, this location includes two parking areas (one paved) with a capacity of about 150 vehicles, and an equestrian staging area. Mississippi Bar is a sprawling area of undeveloped land along the western shoreline of the lake between Lake Overlook and Negro Bar. It is comprised of dredge tailings—large piles of cobblestones—resulting form early gold exploration and more recent aggregate mining. The area also includes several lagoons and ponds, some of which are accessible by canoe or kayak from Lake Natoma. The area is bisected by informal horse riding trails from users of the Shadow Glen Stables nearby.

Other facilities on Lake Natoma include the Folsom Powerhouse State Historic Park. Located at the intersection of Riley and Scott Streets in the City of Folsom, the powerhouse is one of the oldest hydroelectric facilities in the world and is listed on the National Register of Historic Places. The facility includes the main powerhouse and associated buildings (including a gift shop), picnic area, restrooms, and a small parking areas for 35 vehicles. The powerhouse is a key interpretive attraction in the Unit and includes an active docent program. Planned improvements to the facility include seismic upgrades, larger parking area with room for buses, and a new visitor center to be located on the north side of the park entrance.

Non-Recreation Uses

Non-recreation land uses within the Unit are associated with Folsom and Nimbus Dams. In 1956, construction of these dams by the U.S. Army Corps of Engineers was completed, resulting in the creation of Folsom Lake and Lake Natoma. The dams and lakes are designed as part of the massive Central Valley Project, a network of dams, reservoirs, canals, powerplants, and pumping plants extending over 500 miles south from the Cascade Mountains and 100 miles west from the Sierra Foothills to the Coastal Range. Responsibility for the operation of these facilities belongs to the BOR.

Folsom Dam is 1,400 feet long and 340 feet high.[3] This concrete structure is flanked by earthfill wing dams and dikes to close the reservoir with a total length of about nine miles.[4] Although the primary function of Folsom Dam is flood control, the reservoir stores water for irrigation and domestic use and for electrical power generation. Folsom Dam includes three generators capable of producing more than 198,000 kilowatts of power.[5] The dam also plays a role in the preservation of the American River fishery and the downstream control of salt water intrusion in the Sacramento-San Joaquin Delta. Nimbus Dam is located 7 miles downstream from Folsom Dam. Nimbus Dam represents the afterbay structure for Folsom Dam – the afterbay being Lake Natoma. The dam, which measures almost 1,100 feet in length and 76 feet in height, is designed to re-regulate flows into the American River and to generate electricity from water releases.[6] Nimbus Dam includes two generators capable of producing more than 15,520 kilowatts of power. The various uses of water in the system, and the allocation of quantities, is carefully orchestrated and involves several federal, State, and local agencies. Since Folsom Lake is a reservoir, water levels normally vary from about 466 feet in early summer to about 426 feet in early winter. Since Lake Natoma is a regulating reservoir, water levels vary between 4 and 7 feet.

Relationship of Recreation and Non-Recreation Uses

Recreation use in the Unit is closely related to the function of Folsom Lake as a reservoir since water levels directly affect the availability of boat ramps, beaches, mooring sites, and other facilities that depend largely on water depth or surface area. As noted, these levels can vary greatly, although much less so on Lake Natoma. There are several projects and proposals in the works that will affect the operation of Folsom Dam and water levels on the reservoir.

Water Forum Agreement

The first is the Water Forum Agreement (WFA). The Water Forum comprises a diverse group of stakeholders representing water-related interests in the cities of Sacramento, Folsom, Galt, Citrus Heights and Roseville, the County of Sacramento, South Placer County, and western El Dorado County. The objectives of the WFA are to provide a reliable and safe water supply for the region's economic health and planned development through the year 2030 and to preserve the fishery, wildlife, recreational, and aesthetic values of the Lower

[3] http://www.mp.usbr.gov/arwec/water_education/folsom.htm
[4] Ibid.
[5] http://www.parks.ca.gov/default.asp?page_id=882.
[6] http://www.mp.usbr.gov/arwec/water_education/nimbus.htm

American River. The WFA represents a comprehensive package of linked actions to make more water available for consumption while protecting the natural resources of the Lower American River from environmental damage.[7]

The WFA provides for increased surface water diversions to meet planned growth in the area through 2030 and assurances that customer demand may be met in dry years. It is expected that compared to current conditions, the increased diversions would result in lower water levels on Folsom Lake and directly affect boating and swimming opportunities in the Unit.[8] Essentially, the lower water levels would reduce the availability of boat ramps, marina slips, and beaches during the peak season. Recreation uses on Lake Natoma would not be affected. The WFA proposes several measures to mitigate the impacts on recreation uses in the Unit. These could include:

- Construction of boating facilities to increase access and reservoir use during higher water periods in compensation for the reduced availability of facilities during low water periods. Projects could include new facilities at Dike 8 and New York Cove;

- Facility improvements at the marina area to enhance operations during sufficiently high water periods in compensation for the reduced availability of wet slips during low water periods; [9]

- Construction of water impoundments using earthfill dams at Beals Point, Dike 8, and/or Granite Bay to provide dependable swimming opportunities close to existing facilities regardless of water levels; and

- Landside improvements to support other recreation uses, such as trail extensions, in compensation for reduced swimming opportunities, or improvements to shoreline facilities, such as parking areas, concession facilities, and beaches to improve low water access.[10]

Under the WFA, at least $3 million in new funding is to be secured by Water Forum members by 2008 and given over to CDPR to implement these improvements.[11]

Folsom Dam Modification Project

In February 1986, a series of winter storms caused record floodflows in the American River basin. Outflows from Folsom Lake combined with high flows on the Sacramento River resulted in water levels reaching the safety capacity of the levees that protect metropolitan Sacramento.[12] In January 1997, storm events created the largest precipitation peaks ever recorded on the American and Sacramento rivers. These events raised significant concern over the adequacy of the existing flood control system and led to a series of investigations by

[7] City-County Office of Metropolitan Water Planning, Water Forum Proposal EIR, 1999, pg. 2-2.
[8] Ibid., pg. 2-43.
[9] Ibid., pg. 2-44, 2-45.
[10] Ibid., pg. 2-46 to 2-48.
[11] Water Forum, Water Forum Agreement, January 2000, pg. 32.
[12] State of California Reclamation Board and U.S. Army Corps of Engineers, *Final Environmental Assessment/Initial Study: American River Watershed, California, Folsom Dam Modification Project,* August 2001, pg. 2.

the U.S. Army Corps of Engineers (ACOE), the State Reclamation Board, and the Sacramento Area Flood Control Agency (SAFCA) into the need for improved flood protection for the Sacramento area.[13] Several proposals put forward by the agencies were authorized by U.S. Congress, including the Folsom Dam Modification Project in 1999.

This project is intended to reduce the probability of flooding in Sacramento in any year from 1 chance in 85 to 1 chance in 140.[14] The first phase of the project will involve enlarging the eight existing river outlets at Folsom Dam to permit increased release capacity. Construction is expected to begin in early 2003 and be completed in about six years. In addition to the outlet modifications, the Army Corps will modify the use of surcharge storage in Folsom Lake—using both operational and physical means—to allow non-damaging releases to occur at Folsom Dam while allowing water levels in Folsom Lake to reach up to 474 feet.[15] Changes to existing emergency release operations would reflect the new flood surcharge elevation of 474 feet for releases. Physical modifications to the dam itself would include the replacement of the three emergency spillway gates to allow an additional 3 feet of headroom above the new flood surcharge elevation of 474 feet.[16] In addition, an advance release strategy will be developed based on improved weather forecasts using the Advanced Hydrologic Prediction System of the National Weather Service. Under this strategy, the BOR would act on a five-day forecast of high flow to increase releases and accommodate incoming flood volumes.

The physical modifications to the dam will impact the recreation uses at Folsom Lake to some degree. First, since the modifications will increase the flood protection capacity of Folsom Lake, increased lake levels that are beyond the current functional range of the swimming beaches at Beals Point and Granite Bay will occur during large flood events. However, since flood events occur during winter months when the beaches are not used, impacts are likely to be minimal. It should be noted that several facilities on Folsom Lake would be completely or partially inundated under the current maximum flood control level of 474 feet. Impacts will also occur as a result of construction. For instance, Observation Point at the eastern end of Folsom Dam will be used as a staging area for necessary dredging operations during the winter months over a three-year period. Although Observation Point is currently closed due to security concerns, the use of this area for this project certainly precludes its use for recreation purposes. Folsom Dam Road is now indefinitely closed to the public, which affects visitor access to the Unit.

Folsom Dam Raise Project

Despite the improvements associated with the Folsom Dam Modification Project, the ACOE, the BOR, and SAFCA have determined that Folsom Dam will not meet current federal dam safety standards without failure. As a result, these agencies have proposed to raise Folsom Dam by seven feet and increase the maximum flood pool water elevation to from 474 feet to 482 feet.[17] The effect would be the addition of 95,000 acre-feet of storage capacity to Folsom

[13] U.S. Army Corps of Engineers *et al., Final Supplemental Plan Formulation Report/EIS/EIR: American River Watershed, California, Long-term Study*, February 2002, pg. S-1.
[14] Ibid., pg. 8.
[15] Ibid., pg. 11.
[16] Ibid., pg. 11.
[17] U.S. Army Corps of Engineers *et al.*, pg. S-7.

Lake and a reduction in the probability of flooding in Sacramento in any year to 1 chance in 213.

The dam raise is a significant project with significant construction and operational impacts on recreation use in the Unit. Key components of the project include:

- Enlargement of all eight existing spillway gates;
- Modification of spillway bridge piers and replacement of spillway bridge;
- Construction of a concrete parapet wall to raise Folsom Dam;
- Raising of wing dams and dikes by 3.5 feet with embankment material;
- Extraction of materials for embankments from the Peninsula area and Mississippi Bar with hauling by barge and truck along local roadways (including the use of Willow Creek as a material storage and transfer site);
- Staging of construction equipment on landsite sites at dams and dikes being raised; and
- Construction of a temporary bridge downstream from Folsom Dam to provide a detour of Folsom Dam Road during construction (the BOR is pursuing funding for construction of a bridge that would permanently relocate traffic from Folsom Dam).

Significant impacts on recreation uses in the Unit resulting from construction activities associated with the dam raise project are expected, including the disruption of recreation activities between Beals Point and Beeks Bight on Folsom Lake due to dike construction and on Lake Natoma due to the temporary conversion of the Willow Creek area to a borrow material storage and transfer site.[18] More specifically, these impacts include:

- Disruption of recreation activities on the American River Bike Trail between Negro Bar and Beals Point due to the construction of temporary access roads and bridges;
- Relocation of the CDPR and BOR headquarters complex to accommodate the western landing of the temporary construction bridge under the proposed alignment;
- Disruption of recreation activities between Beals Point and Beeks Bight due to construction activities associated with increasing the height of dikes along the western shoreline of Folsom Lake;
- Disruption of recreation activities on the American River Bike Trail at Mississippi Bar due to the transport of borrow material from the site to the barge loading site at Willow Creek across Lake Natoma; and
- Disruption of recreation activities at Lake Natoma at Willow Creek due to the temporary use of the site as a borrow material storage and transfer site.[19]

[18] Ibid., pg. S-16.
[19] Ibid., pg. S-18.

Once completed, the dam raise project could have operational impacts on recreation uses in the Unit. Currently, CDPR assumes a maximum water level of 466 feet on Folsom Lake for recreation facilities, operations, and planning purposes, although current flood control operations could result in a temporary water level of 475 feet in a very large flood event.[20] Most CDPR facilities on Folsom Lake are at elevations of between 468 and 474 feet. Although a flood event large enough to inundate these facilities has not occurred in the American River watershed in the last 100 years, the dam raise project is intended to further reduce the potential of such an event occurring. The dam raise project would increase the temporary water level that could be accommodated to 482 feet, a level that would completely inundate all recreation facilities on Folsom Lake rendering them inoperable. While the likelihood of such a scenario is minimal, the various upgrades associated with the dam raise project will reduce potential flood damage on Folsom Lake caused by a more likely flood event that could result in water levels that reach existing recreation facilities. In any case, the General Plan/Resource Management Plan for the Unit will have to consider the potential for such flood events to occur and what effects they would have on recreation facilities and operations.

Land Ownership in the Unit

The CDPR and the BOR are currently working to resolve Unit boundary issues before mapping and analysis regarding ownership can be completed using the new GIS being developed as part of the General Plan update project. Once these issues have been resolved, a brief discussion of ownership within the Unit by these agencies will be inserted here.

Land Use Surrounding the Unit

The following discussion provides a summary of land use surrounding the Unit, as illustrated in Figures LU-1 and LU-2. The discussion is organized by municipal jurisdiction.

Placer County

The northwestern portion of the Unit is located within unincorporated Placer County. The southeastern portion of the County is the focus for urban development, accommodating significant growth that is changing the historical pattern of agriculture in the area. In general, land uses in the County that abut the Unit decrease in intensity from south to north. Moving north from the Sacramento County line, Auburn-Folsom Road serves as both the boundary and buffer between urban residential development and the Unit; however, as the roadway and the Folsom Lake shoreline diverge at Eureka Road, urban residential development closes in on Unit lands and puts competing uses in close proximity. This is particularly true at Granite Bay, where the highest density residential development—about 4 units per acre—in the County abuts the Unit. North of Granite Bay, residential densities thin out and the character of development is more rural than urban. In the area of Horseshoe Bar, residential development occurs on 5-acre lots. Further north in the area of Rattlesnake Bar and beyond, residential densities are at about 1 unit per 100 acres with small hobby farms and equestrian uses. Most of the lands in the County that provide views of Folsom Lake have been developed, particularly in the Lakeshore area on the ridge above the western shoreline of the North Fork of the American River between Granite Bay and Horseshoe Bar. As a result,

[20] Ibid., pg. 12-31.

visible residential development abutting the Unit in this area appears to be more intense than it really is.

El Dorado County

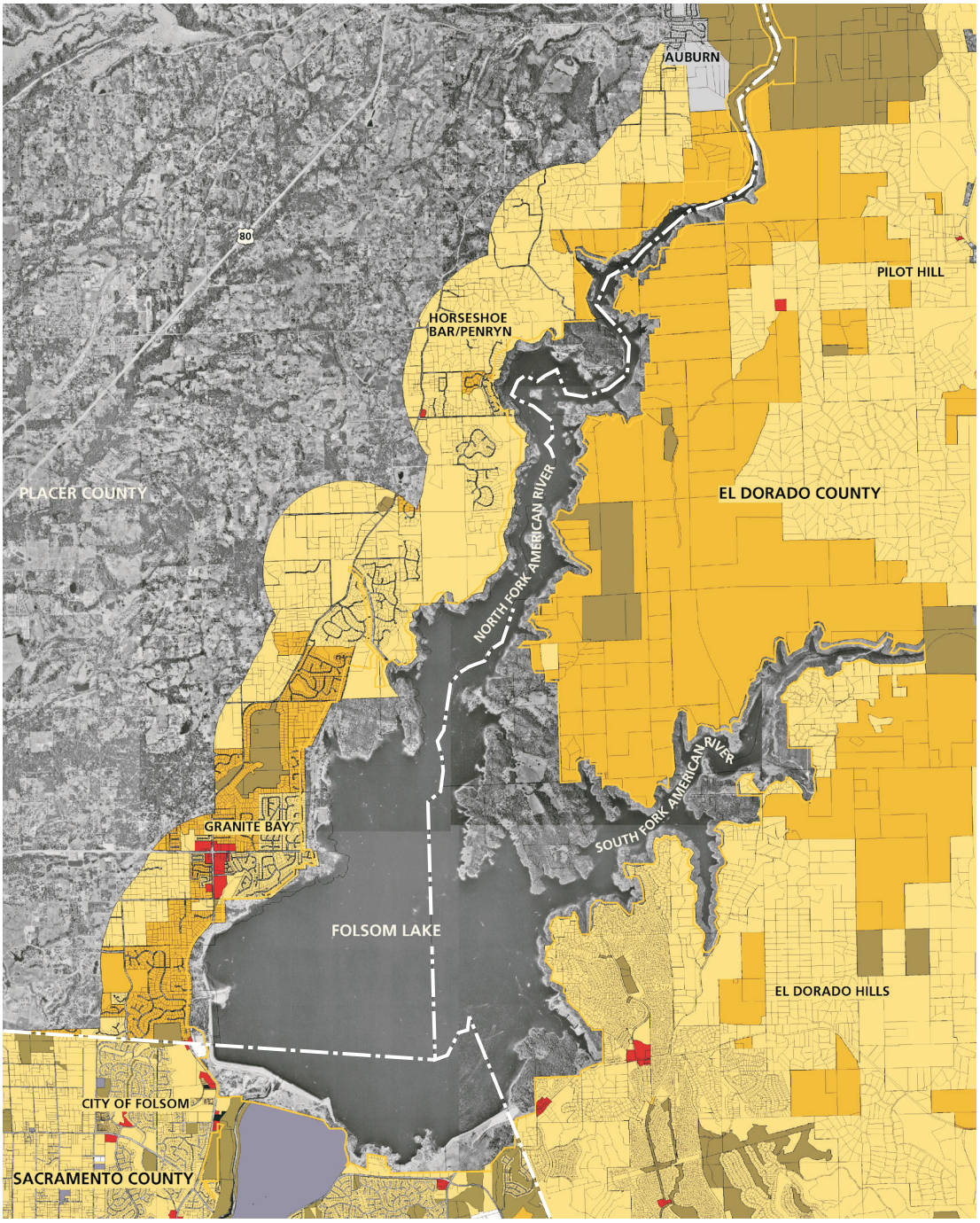
The northeastern portion of the Unit is located within unincorporated El Dorado County. As in Placer County across Folsom Lake to the west, the lands that abut the Unit are in urban and rural residential development with densities decreasing from south to north. The most concentrated urban residential development abuts the Folsom Lake Marina at Brown's Ravine and extends from Unit lands northeast to New York Creek. The majority of this area is characterized by single family development at densities of up to 7 units per acre and include among others the Marina Village, Lakehills Estates, and Summit Village developments. The area northeast of Lakehills Drive to New York Creek—on Iron Mountain at Shoreline Pointe—is comprised of larger residential estates on 5 and 10-acre lots. This form of development continues along Salmon Falls Road to the South Fork crossing at Skunk Hollow, although with more intense 1 and 3-acre lot subdivisions in the area surrounding Old Salmon Falls on Falcon Crest Lane and Hidden Bridge Road. In the Peninsula, the lands abutting the Unit are largely undeveloped and consist of oak-studded hillsides suitable for grazing. However, this area has been zoned by the County for a mix of 40-acre rural residential development, 10-acre estate residential, and open space.

Sacramento County

The southern half of the Unit—from the bottom of Folsom Lake south on Lake Natoma to Nimbus Dam—is located in Sacramento County, although the majority of this area falls within the City of Folsom. Unincorporated Sacramento County abuts the Unit south of the Madison Avenue/Greenback Lane intersection in Orangevale on the west side of Lake Natoma and south of the Folsom Avenue/Highway 50 intersection in Rancho Cordova on the east side. In Orangevale, low density residential development abuts the Unit from Negro Bar and the Lake Natoma Bluffs south along Mississippi Bar to Lake Overlook above Nimbus Dam. In Rancho Cordova, Highway 50 south of Folsom Boulevard separates the Unit from highway commercial and industrial uses that extend along this route to the Hazel Avenue interchange at Nimbus Flat.

City of Folsom

As noted, the majority of the southern half of the Unit is located in the City of Folsom. On the western side of the American River, the City extends south from the Placer County line to the intersection of Madison Avenue and Greenback Lane at Negro Bar. On the eastern side of the River, the City extends south from the El Dorado County line to the Highway 50/Folsom Boulevard interchange at Museum Flat. With the exception of commercial development at the intersections of Folsom-Auburn Road/Greenback Lane and Madison Avenue/Greenback Lane, the lands that abut the Unit along the western side of the American River are in single family residential development. More intense, larger-scale development abuts Unit lands along its eastern boundary in the City. For instance, the 1,200-acre Folsom State Prison and California State Prison, Sacramento site is located immediately south of Folsom Dam.



FOLSOM LAKE STATE RECREATION AREA RESOURCE INVENTORY

- Residential
- Commercial
- Agricultural
- Open Space
- Institutional
- Industrial
- City of Auburn
- County Line

FIGURE

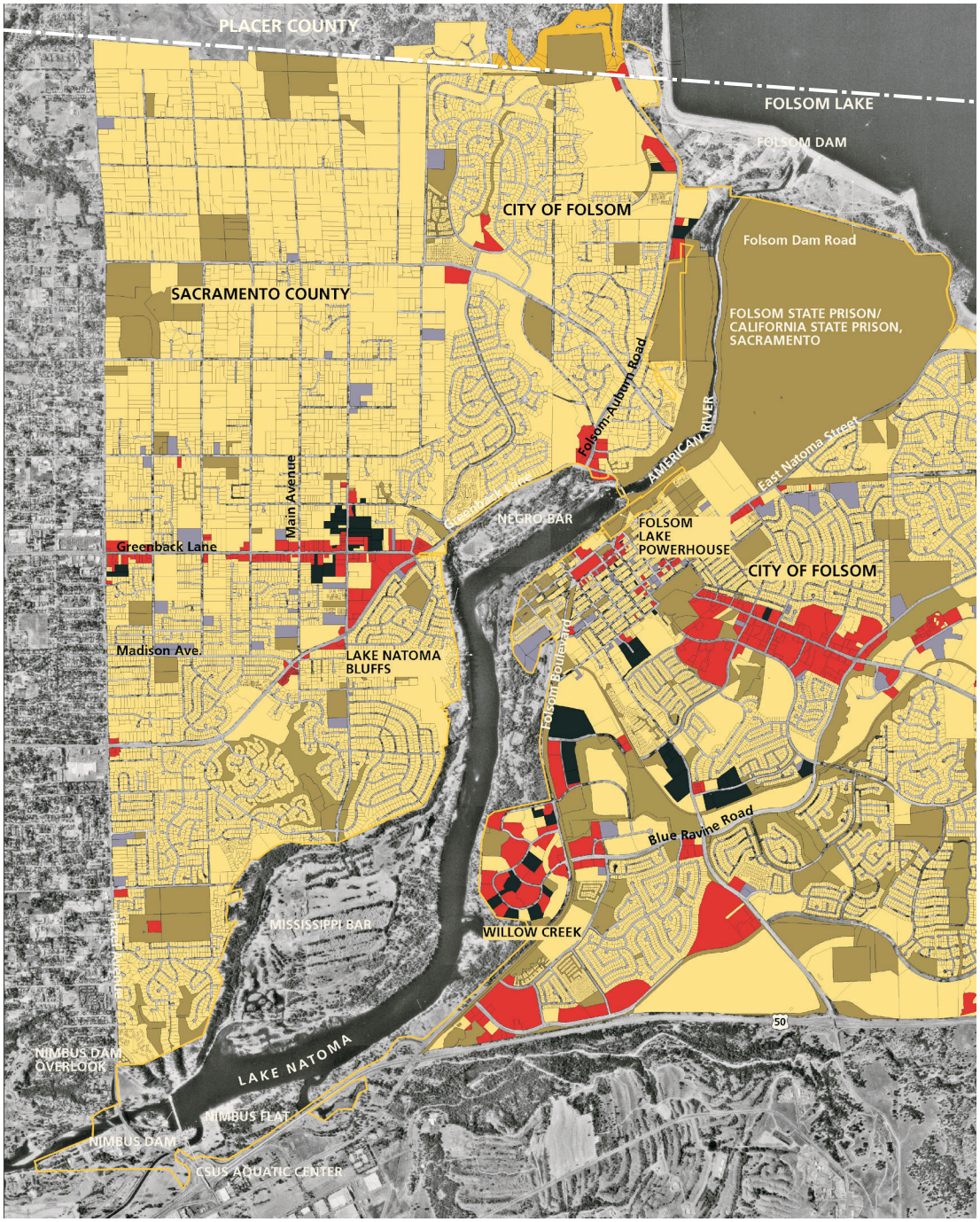
LU-1

Land Use Adjacent to Folsom Lake

Prepared by
Wallace Roberts & Todd

N

Not to Scale



FOLSOM LAKE STATE
RECREATION AREA
RESOURCE INVENTORY

- Residential
- Commercial
- Agricultural
- Open Space
- Institutional
- Industrial
- County Line

FIGURE

LU-2

Land Use Adjacent to Lake Natoma

Prepared by
Wallace Roberts & Todd

N

Not to Scale

These facilities hold more than 4,200 inmates and employ almost 2,000 staff. The location and size of the Folsom Dam and prison sites serves to buffer the southern lakeshore from the encroachment of residential development, which is confined to areas east of East Natoma Street.

The Unit abuts historic Downtown Folsom, a compact 5- by 3-block retail area, along Leidesdorff and Riley streets. This area includes a shopping complex and lakeside hotel at Leidesdorff and Folsom Boulevard. South of Downtown, Folsom Boulevard serves, for the most part, as a boundary and buffer between the Unit and urban development. The exceptions here are the residential subdivision at Young Wo Circle and the campus industrial/office park in the area of Parkshore Drive and Blue Ravine Road. Although both areas back onto the Unit, they are relatively well concealed by the topography and dense shoreline vegetation. Further south, Folsom Boulevard again separates the Unit from intense commercial development associated with the factory outlet shopping center between Natoma Station Drive and Iron Point Road. South of this area, Folsom Boulevard and Highway 50 converge and the Highway runs along Unit lands to Hazel Avenue in unincorporated Sacramento County. Almost 3,600 acres of land in this area south of Highway 50 was added to the City's Sphere of Influence in June 2001, meaning that the City could eventually annex the area and approve development. The Sacramento County Local Agency Formation Commission (LAFCO) estimates the area could accommodate 29 million square feet of office space or 12,000 homes and 9.5 million square feet of commercial space.[21]

As noted, the urban residential development that abuts the Unit in Folsom is essentially low density single-family residential. The City has recently rezoned several parcels across the city to multi-family residential as a means of increasing housing affordability. Two of the rezoned parcels are near the Unit, including a site east of Lake Natoma on Folsom Boulevard at Glenn Drive across from the Unit, and a site west of the American River Gorge below Folsom Dam on Folsom-Auburn Road at Berry Creek Drive.

Unit Interface with Surrounding Lands

The interface of the Unit with the surrounding lands raises several complex issues, most of which relate to the proximity of urban and rural development to the Unit. These issues include land use and intensity, visual intrusion, access, noise, and wildfire hazard. Ownership of surrounding lands is also summarized.

Land Use and Intensity

As noted in the discussion above, the majority of urban and rural development surrounding the Unit is residential in nature and of low intensity and scale. The exceptions are more intense commercial uses that abut the Unit in the City of Folsom. The main issue here is the compatibility of these land uses at their interface with the Unit. Currently, single family residential is the predominant land use abutting the Unit. According to the general plans of the surrounding jurisdictions, this situation is not expected to change during the long-term planning horizon of the Unit's new General Plan. With the exception of recreation, open space, and agricultural uses, single family residential is the most compatible use at the Unit

[21] Mike McCarthy, *Sacramento Business Journal,* "Quietly, owners begin to push south of US 50," December 7, 2001.

interface. This use typically reflects low maximum building heights (25-45 feet), large yard setbacks (20-30 feet), and low maximum lot coverage by buildings (25-35 percent). Some areas of commercial development abut the Unit in the City of Folsom. For the most part, the intensity of these uses is such that compatibility is not a significant concern. In general, the simple buffering and screening of these uses softens the interface between the Unit and development. While issues associated with visual intrusion, access, noise, wildfire hazards, etc., do result from the interface of the Unit with surrounding lands, these issues are more easily managed than instances of significant incompatibility.

Visual Intrusion

As noted in the Aesthetic, Visual, and Scenic Resources section of this document, the visual intrusion of development is directly related to the proximity of development to the Unit. Visual intrusion occurs when park users can see outside development from within the Unit, a situation that is particularly common in areas where the ridgelines and hillsides above the Unit boundary are developed or where inadequately buffered or screened development abuts the Unit boundary. Visual intrusion affects the character and feel of the Unit for park users and their perception of place. While some park users may not seek solitude from the outside world in their recreational pursuits, those who do must travel to the far undeveloped reaches of the Unit. Noted examples of visual intrusion in the Unit include Nimbus Flat, Lake Overlook, Beals Point, Mormon Island Dam, Brown's Ravine, New York Creek, and Old Salmon Falls.

Access

Access is also an important issue at the interface of the Unit with surrounding lands. One issue relates to the impacts on adjacent development caused by Unit recreation facilities reaching capacity. Between 1.5 and 2 million people visit the Unit each year, and as noted in the Recreation Resources section of this document, several facilities in the Unit reach capacity by midday on peak season weekends. These facilities include Beals Point, Granite Bay, Brown's Ravine, and Salmon Falls/Skunk Hollow. As the parking lots at these day-use facilities reach capacity, traffic will backup along entrance roads and onto major access routes and local streets. This results in traffic delays, illegal parking, pedestrian hazards, noise, and access difficulties for neighbors of the Unit. A second issue is informal access to the Unit from abutting neighborhoods. In several locations, CDPR staff report that homeowners with property backing onto Unit lands will often add a gate to the fence along the property line to access the Unit, particularly in locations where trail facilities are in close proximity to private property. In other instances, homeowners will completely remove property line fencing and extend their yard use into the Unit. Finally, in very few instances, homeowners will use Unit lands as a dump site for yard waste and personal refuse.

Noise

There are locations at the interface of the Unit and surrounding lands where noise is an issue. In these locations, park users are affected by noise coming from beyond the Unit or neighbors are affected by noise coming from within the Unit. For park users, noise coming from outside the Unit is limited to those locations proximate to major routes parallel or cross the Unit. These locations include Nimbus Flat on Lake Natoma where Highway 50 and Hazel Avenue pass close by, and Negro Bar in the area of the Lake Natoma Crossing. For neighbors, noise coming from inside the Unit is generally the result of traffic backups at

popular day use facilities that reach capacity on peak season weekends, and from water-based activities on Folsom Lake. The noise from power boats and jetskis on Folsom Lake can travel great distances depending upon atmospheric conditions and wind direction. In addition, music coming from boats moored or floating in nearshore areas can generate complaints from lakeside neighbors, particularly in the lower reaches of the North and South Forks of the American River.

Wildfire Hazard

The proximity of development to the natural areas of the Unit raises the issue of wildfire safety, particularly in the northern portions of the Unit along the North and South Forks of the American River. In these more remote rural areas of unincorporated Placer and El Dorado counties, emergency response times higher, and the natural landscape within the Unit poses the highest risk of wildfires. While a fire management plan will be prepared concurrently with the General Plan update for the Unit, the proximity of development to natural areas does increase the risk of potential loss due to wildfires.

Ownership

The ownership characteristics of larger parcels (greater than 10 acres) that abut the Unit boundary is an important consideration for potential acquisition opportunities. The majority of large parcels that abut the Unit boundary are in private ownership. The largest parcels are generally located along the eastern shoreline of the North Fork of the American River, in the Peninsula area, along the northern shoreline of the South Fork, and in the area of Old Salmon Falls. Along the North Fork, several parcels measure between 100 and 200 acres each, with two parcels exceeding 400 acres in size. Of these parcels, approximately 1,500 acres are held by three owners. In the Peninsula area, parcels range between 10 and 20 acres and are in multiple ownership. In the area of the North Fork, approximately 1,600 acres are held by three owners. In the Old Salmon Falls area, 320 acres are under single ownership. Smaller but still sizeable parcels (between 15 and 40 acres) in private ownership also abut the Unit along the western shoreline of the North Fork. Acquisition of property abutting the Unit in the areas described here could be used to protect the natural and scenic resources that exist in these more remote and untouched areas.

Major Projects

Several major projects are proposed or approved in the area proximate to the Unit. These projects are summarized below.

Hazel Avenue Widening

An Environmental Impact Report (EIR) is currently underway on the proposed widening of Hazel Avenue in Sacramento County. Hazel Avenue is a four-lane arterial that extends from Folsom Boulevard north to the Placer County line and provides one of the limited number of American River crossings for both Sacramento County and regional travel. The roadway crosses the American River just below Nimbus Dam and is the only route providing access to Nimbus Flat and Lake Overlook. The proposed project would widen the roadway to six lanes with a landscaped center median and parkway feature, Class II bike lane in each direction,

and improved access points for pedestrians and cyclists to the American River Parkway.[22] It has not yet been determined if the Hazel Avenue bridge across the American River will be widened to accommodate all traffic, including bicycles and pedestrians, or if a separate and parallel bridge for recreational pedestrian, bicycle, and equestrian use will be built.[23] The environmental review and public comment period on the project began in summer of 2002 and is expected be completed by the summer of 2004. Once the design process is complete, construction would begin in summer 2005.

Downtown Sacramento-Folsom Corridor Project

The Sacramento Regional Transit District has begun construction of its Downtown Sacramento-Folsom Corridor light rail transit (LRT) project. This project will improve public transit service in the rapidly growing Highway 50 corridor, enhance regional connectivity, alleviate increasing traffic congestion, and improve mobility options for employment centers along the corridor.[24] The Highway 50 corridor is experiencing rapid growth in both population and employment with the greatest proportion of growth occurring in the City of Folsom. The corridor contains 25 percent of the County population but almost 50 percent of the County employment.[25] Growth along the Highway 50 corridor has resulted in significant traffic congestion, especially along major arterials that serve the corridor during peak times, such as Folsom Boulevard and Hazel Avenue.

Three LRT stations will be located in Folsom, including: Iron Point Station between Iron Point Road and Natoma Station Drive; Silverbrook Station south of Glenn Drive on Folsom Boulevard; and Historic Folsom Station between the Sutter Street off-ramp and the recently re-constructed Leidesdorff Street.[26] The Iron Point Station will include two park-and-ride lots designed by the City of Folsom to accommodate 240 vehicles. The Silverbrook Station will include a park-and-ride lot for 190 vehicles. Historic Folsom Station will be integrated with a parking lot and other facilities planned by the City as part of the historic Railroad Block Master Plan. Both the Iron Point and Silverbrook stations will be located on the southern side of Folsom Boulevard directly across the roadway from the Unit boundary and will significantly improve transit access to the Unit.

Auburn-Folsom Road Widening

A recent study completed by Placer County found that in 1995, just under half of all trips on Auburn-Folsom Road in the southeastern quadrant of the County were through trips, i.e. neither trip end was in southeastern Placer County. The study also found that by 2020, the amount of through traffic on Auburn-Folsom Road is expected to increase by almost 200 percent.[27] Auburn-Folsom Road and connecting arterials—such as Douglas Boulevard—are currently congested during peak travel times causing delays and neighborhood traffic problems associated with short cutting. In addition, bikeway facilities are lacking. At this

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[22] Community Advisory Committee of the Hazel Avenue Corridor Study, *Hazel Avenue Corridor Study Report to the Sacramento County Board of Supervisors*, June, 11, 2002, pg. 12.
[23] Ibid., pg. 13.
[24] Sacramento Regional Transit District, *Downtown Sacramento-Folsom Corridor Final EIS/EIR*, March 2000, pg. S-2.
[25] Ibid., pg. 2.
[26] http://www.sacrt.com/Extensions/Folsom_Line/folsom_line.html.
[27] Placer County, *Southeast Placer County Transportation Study*, November 2000, pg. 1.

time, the City of Folsom proposes to widen Folsom-Auburn Road from two to four lanes from Folsom Dam Road north to the Placer County line with completion expected in late 2003. In addition, Placer County proposes to widen Auburn-Folsom Road from two lanes to four lanes from the Sacramento County line north to Douglas Boulevard with an anticipated completion year of 2006. These projects should enhance access to the Unit at both Beals Point and Granite Bay and may ease traffic impacts that result from these recreation facilities reaching capacity on peak season weekends.

Folsom Dam Bridge

As noted in the Folsom Dam Raise Project discussion above, a temporary two-lane construction bridge approximately 2,400 feet in length will be constructed downstream from Folsom Dam. The bridge will be aligned to provide a detour route across the American River during the construction period when the spillway bridge would be unavailable for public use.28 Approximately 4 million vehicles cross Folsom Dam each year. The proposed alignment, located entirely within BOR land, would begin at the existing Folsom Dam Road/Folsom-Auburn Road intersection in the west and reconnect with Folsom Dam Road just east of the Folsom Dam. This alignment would require the removal and relocation of the CDPR and BOR headquarters complex on Folsom Dam Road. After completion of the dam raise, traffic would revert to the new spillway bridge over Folsom Dam and the construction bridge would either be dismantled or left in service to facilitate dam maintenance. As noted, funding is being pursued for construction of a bridge that would permanently relocate traffic from Folsom Dam. A permanent structure would likely be built to four or six lanes.

Local Planning Policy Context

This section summarizes the relevant land use plans and policies of local jurisdictions as they relate to the Unit. These jurisdictions include Placer, El Dorado, and Sacramento Counties, and the City of Folsom.

Placer County

As noted in the "Land Use Surrounding the Unit" section above, the Unit is divided north-south between Placer and El Dorado Counties. The western half of the Unit is located in Placer County. Several countywide general plan policies relate to the Unit. In addition, two community plan areas—Granite Bay and Horseshoe Bar/Penryn—relate specifically to the majority of the unincorporated County lands that abut the western boundary of the Unit. As with the countywide general plan policies, the community plan policies that relate to the Unit are summarized here.

Countywide Policies

While no policies in the 1994 Placer County General Plan directly relate to the Unit, several key policies are relevant and could affect the future development on adjacent lands or the involvement of CDPR. These policies include the following:

[28] U.S. Army Corps of Engineers *et al.*, pg. S-15.

Recreation and Trails

- The County shall work with other public agencies to coordinate the development of equestrian, pedestrian, and bicycle trails.

- The County shall encourage federal, state, and local agencies currently providing recreation facilities to maintain, at a minimum, and improve, if possible, their current levels of service.

- The County shall support development of a countywide trail system. Whenever possible, trails should connect to the county wide trail system, regional trails, and the trail or bikeways plans of cities.

Flooding and Water Quality

- The County shall encourage the protection of floodplain lands and where appropriate, acquire public easements for purposes of flood protection, public safety, wildlife preservation, groundwater recharge, access and recreation.

- The County shall support efforts to acquire land or obtain easements for drainage and other public uses of floodplains where it is desirable to maintain drainage channels in a natural state.

- The County shall protect the watersheds of all bodies of water associated with the storage and delivery of domestic water by limiting grading, construction of impervious surfaces, application of fertilizers, and development of septic systems within these watersheds.

- The County shall require new development to adequately mitigate increases in stormwater peak flows and/or volume. Mitigation measures should take into consideration impacts on adjoining lands in the unincorporated area and on properties in jurisdictions within and immediately adjacent to Placer County.

- The County shall support and cooperate with efforts of other local, state, and federal agencies and private entities engaged in the preservation and protection of significant biological resources from incompatible land uses and development. Significant biological resources include endangered, threatened, or rare species and their habitats, wetland habitats, wildlife migration corridors, and locally-important species/communities.

- The County shall cooperate with, encourage, and support the plans of other public agencies to acquire fee title or conservation easements to privately-owned lands in order to preserve important wildlife corridors and to provide habitat protection of California Species of Concern and state or federally listed rare, threatened, or endangered plant and animal species.

- The County shall support the preservation of outstanding areas of natural vegetation, including, but not limited to, oak woodlands, riparian areas, and vernal pools.

- The County shall ensure the conservation of sufficiently large, continuous expanses of native vegetation to provide suitable habitat for maintaining abundant and diverse wildlife.

- The County shall support the preservation and enhancement of natural land forms, natural vegetation and natural resources as open space to the maximum extent feasible. The County shall permanently protect, as open space, areas of natural resource value, including wetlands preserves, riparian corridors, woodlands, and floodplains.

- The County shall coordinate with local, state and federal agencies and private organizations to establish visual and physical links among open space areas to form a system that, where appropriate, includes trails. Dedication of easements shall be encouraged, and in many cases, required as lands are developed and built.

Placer Legacy

The Placer Legacy Open Space and Agricultural Conservation Program is intended to protect and conserve open space and agricultural lands in Placer County.[29] The program has been developed to implement the goals, policies and programs of the 1994 Placer County General Plan. The program will: maintain agricultural uses; protect plant and animal diversity; protect and expand recreation areas; protect scenic and historically significant areas and sites; establish open-space buffers between communities; and ensure public safety. The program is both voluntary and non-regulatory and remains a priority for the County. Last year, $1.3 million was set aside for land acquisition purposes and $3 million in grant funding was obtained.[30] To date, the program has, among other things, resulted in the planning for protection and improvement of seven watersheds in western Placer County, the development of a GIS that allows detailed mapping and analysis, the development of strategies to protect, restore, and enhance natural areas, and focused efforts on grant funding, voluntary donations, and public/private sector partnerships.[31]

Community Plan Policies

The Granite Bay and Horseshoe Bar/Penryn Community Plans address almost the entire extent of the lands in unincorporated Placer County that directly abut the Unit's west side. These plans are currently being updated by the County to reflect current population and transportation trends. The following lists the policies that relate to the Unit by community plan.

Granite Bay Community Plan

Adopted in 1989, the Granite Bay Community Plan affects lands abutting the Unit from the Sacramento County line in the south to Dick Cook Road in the north. This plan is currently being updated by the County. Several key policies are relevant to the Unit and could affect

[29] Placer County Planning Department, *Placer Legacy Open Space and Agricultural Conservation Program*, June 2000, pg. 1.
[30] http://www.placer.ca.gov/planning/legacy/legacy.htm.
[31] Ibid.

the future development on adjacent lands or the involvement of CDPR. These policies include the following:[32]

Recreation and Trails

- Coordinate the development of trails and other recreation facilities with other public agencies such as CDPR.

- Trails and paths intended for general circulation shall provide reasonably direct and convenient routes of travel for potential users. Routes for trails and paths intended primarily for recreational use should enhance the recreation experience. Regional trails are needed for inter-community travel and to provide access to state and county parks. Regional trails should be located so that they serve the needs of the public and minimize any infringement on the privacy of local residents.

- Regional bikeways should facilitate travel between communities and provide access to parks. Regional bikeways should be located on or along collector or arterial roads. County or state funds should be sought for construction of regional bikeways.

- The local public path and trail system shall be linked with the existing private and regional systems and the road system.

Flooding and Water Quality

- Encourage compatible recreational use of riparian areas along streams and creeks in the area where feasible.

- Care shall be taken in the development and use of lands in the Granite Bay area to protect the community and downstream communities against excessive stormwater runoff, flooding, air and water pollution, erosion, fire, landslides and other natural hazards.

- Urban/suburban development within the Folsom Lake Watershed shall be strongly discouraged. Water quality of Folsom Lake shall be monitored.

Open Space and Environmental Management

- Retention of open space shall be considered in the review of all applications for development.

- Valuable natural features, such as rolling terrain, streams, and stream corridors, scenic corridors, meadowlands, ridge tops, and significant stands of trees shall be preserved and protected through imaginative planning, good conservation practices and, where appropriate, the dedication of open space, conservation or scenic easements.

- Those areas rich in wildlife or of a fragile ecological nature, e.g. areas of rare or endangered species of plants, riparian areas, etc., shall be avoided in land development.

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[32] Placer County, *Granite Bay Community Plan*, May 1989.

Where necessary, in order to preserve these areas, they should be publicly acquired to ensure protection.

- Blocks of undisturbed oak woodlands and annual grassland habitat that have significant value to wildlife shall be preserved as Open Space, Resource Conservation Zones, or the equivalent, where an appropriate mechanism to do so can be identified.

- Open spaces should be linked visually and physically to form a system of open spaces. Where appropriate, trails shall connect open space areas. Dedication of easements shall be encouraged or required as lands are developed and built.

Scenic Resources

- A variety of vistas shall be provided and preserved, ranging from the small enclosed private views to the more distant views shared by many people.

- Scenic or conservation easements over properties adjacent to the roadway may be needed to ensure preservation of a vista from the road and to preserve the natural, rural character of the community.

Horseshoe Bar/Penryn Community Plan

The 1994 Horseshoe Bar/Penryn Community Plan affects lands north of Dick Cook Road to just south of the unincorporated community of Newcastle. This plan is currently being updated by the County. Several key policies are relevant to the Unit and could affect the future development on adjacent lands or the involvement of CDPR. These policies include the following:[33]

Recreation and Trails

- Develop a multiple-use (i.e. hiking, equestrian, bicycle) trail system to connect local trails to regional trail systems;

- Coordinate the development of trails and other recreation facilities with other public agencies, including the adjoining cities of Rocklin and Loomis.

- Trails should link and be in proximity to residential areas, horse populations, park and recreation areas, schools, major waterways such as rivers and lakes, and major vista locations.

- The local public path and trail system shall be linked with the existing private and regional systems and the Folsom Lake State Recreation Area trail system.

[33] Placer County, *Horseshoe Bar/Penryn Community Plan,* August 1994.

Flooding and Water Quality

- Where development at a base zoning density greater than a 4.6-acre minimum parcel size are allowed to occur within the Folsom Lake Watershed, encourage the use of Planned Unit Developments (PUDs) and/or other mechanisms to locate development as far as possible from the Lake and those drainageways and creeks emptying in the Lake.

- Encourage the use of open space to preserve and enhance the watersheds, stream corridors and wetlands significant to the protection of water resources such as the American River/Folsom Lake, Secret Ravine, Miners Ravine, Antelope Creek, and Mormon Ravine.

- Strongly discourage septic systems on property located within the Folsom Lake Watershed within the service boundaries of Sewer Maintenance District No. 3, as a means of maintaining the water quality of Folsom Lake.

Open Space and Environmental Management

- Natural open space recreation land within the planning area should be carefully managed and its uses controlled to ensure that vegetation, soil, wildlife, and visual qualities are protected and, where necessary, enhanced.

- Reduce the negative impacts on water quality resulting from urban runoff for all commercial, industrial, and residential projects by treating such runoff through application of Best Management Practices before it enters intermittent or permanent streams.

- Conserve large, continuous expanses of native vegetation as the most suitable habitat for maintaining abundant and diverse wildlife.

- Identify and protect important spawning grounds, migratory routes, waterfowl resting areas, oak woodlands, wildlife corridors, and other unique wildlife habitats critical to protecting and sustaining wildlife populations.

- Open spaces should be linked visually and physically to form a system of open spaces and recreational uses. Where appropriate, trails shall connect open space areas. Dedication of easements shall be encouraged or required as lands are developed and built.

Scenic Resources

- Structures built within the Folsom Lake Watershed shall be designed to blend in with the surrounding vegetation, and/or be screened so as to not be obtrusive as viewed from the Lake's surface.

Folsom Lake Development Guidelines

- Commercial developments should be prohibited within the Folsom Lake Watershed.

- Wherever possible, residential development densities should be transferred from the Folsom Lake Watershed into a less sensitive watershed (i.e. Miners Ravine), through utilization of the Planned Unit Development concept.

- Where transfers outside the Folsom Lake Watershed are not possible due to limited ownership and other factors, the larger lot sizes of the Plan range should be utilized.

- Wherever possible, require roads and sewers to be located outside the Folsom Lake Watershed.

- Within the Folsom Lake Watershed, require the establishment of water quality management programs within each new project measure (monitor) and to minimize pollutant impacts.

- Where structures, roads, sewer lines, and other improvements are allowed with the Folsom Lake Watershed, require the use of grassy buffers, sedimentation and bio-assimilation ponds, and other "Best Management Practices" to mitigate water quality impacts.

- Within the Folsom Lake Watershed, greater setbacks may be required where there are steep slopes, highly erosive soils, or other factors which may increase the likelihood of development adversely affecting the quality of the water in Folsom Lake. The Division of Environmental Health shall develop criteria to be used to determine when such greater setbacks are appropriate.

- Within the Folsom Lake watershed, allow septic systems only on parcels of 4.6 acres and larger where there is no possibility of extending sewers to serve.

In order to soften the impacts of more dense development upon the most vulnerable parts of the Folsom Lake Watershed, require that those lots closest to the Folsom public property line and the lots adjacent to natural preservation easements be sized toward the largest acreage identified in the general plan designation rather than to the minimum lot size allowable under the zoning. This approach shall also apply in Planned Unit Developments.

El Dorado County

The eastern half of the Unit is located in El Dorado County. The current General Plan was adopted in 1996, but in 1999 the Superior Court, County of Sacramento, in the matter of *El Dorado County Taxpayers from Quality Growth, et al. v. El Dorado County Board of Supervisors and El Dorado County*, ruled that in certain respects the County failed to comply with the California Environmental Quality Act (CEQA) in the adoption of the General Plan. As a result, certification of the General Plan Environmental Impact Report (EIR) and adoption of the General Plan were set aside. In response to the Judgement and the Writ of Mandate, the County is proposing to adopt a new General Plan and conduct a full environmental review pursuant to CEQA. It is unclear at this time what effect the new General Plan could have on the Unit. While no policies in the 1996 El Dorado County General Plan directly relate to the Unit, several key policies are relevant and could affect the future development on adjacent lands or the involvement of CDPR. These policies include the following:

Trails

- Plan bicycle, hiking, and equestrian routes to facilitate access to recreational areas such as regional parks, rivers, and major tourist commercial/recreational facilities.

- Plan a bikeway, hiking, and equestrian network to interface with other modes of transportation (train or transit stations and Park-N-Ride lots, etc.) in order to encourage and support the use of non-motorized transportation modes and reduce the use of motor vehicles.

- Locate regional bikeways, hiking, and equestrian routes along designated scenic highways wherever environmentally, physically, or economically feasible and encourage the development of scenic vista points and rest areas where feasible and appropriate.

- Plan, develop, and maintain a network of Countywide regional trails in both incorporated and unincorporated areas, through cooperative efforts with cities, State and federal government, schools and utility companies.

- Encourage other jurisdictions to adopt a system of bikeway, hiking, and equestrian trails that complement the County system.

- The proposed El Dorado Trail/Pony Express Trail as well as trails connecting regional parks shall be the County's primary responsibility for trail establishment and maintenance.

- Integrate and link, where possible, existing and proposed National, State, regional, County, city and local hiking and equestrian trails for public use.

- Recognize the national historic trails that are located within the County and promote and pursue cooperative efforts with private, regional, State, and Federal agencies to develop and fund these trails on public and private land.

- On public lands and where trails can be developed, maintained, and managed, a system of trails along the American and Cosumnes River system may be created to increase public access to scenic waterways.

- Maintain areas of importance for outdoor recreation including areas of outstanding scenic, historic and cultural value; areas particularly suited for park and recreation purposes including those providing access to lake shores, beaches and rivers and streams; and areas which serve as links between major recreation and open space reservations including utility easements, banks of rivers and streams, trails and scenic highway corridors.

Recreation and Parks

- The primary responsibilities of the County as a recreation provider shall be the establishment and provision of a regional park system to serve the residents of and visitors to the County.

- Coordinate with Federal, State, other agencies, and private landholders to provide public access to recreational resources, including rivers, lakes, and public lands.

- The River Management Plan, South Fork of the American River, (River Management Plan) is considered the implementation plan for the river management policies of this chapter.

- The County shall study the feasibility of adopting an impact fee schedule and a County-wide benefit assessment district to pay for the acquisition, development, operation, and maintenance of regional parks and facilities.

- The County shall actively pursue lands that can be transferred to the County from Federal, State, and other ownerships suitable and needed for public use.

Flooding and Water Quality

- As a means to improve the water quality affecting the County's recreational waters, enhanced and increased detailed analytical water quality studies and monitoring should be implemented to identify and reduce point and non-point pollutants and contaminants. Where such studies or monitoring reports have identified sources of pollution, the County shall propose means to prevent, control, or treat identified pollutants and contaminants.

- Modification of natural stream beds and flow shall be regulated to ensure that adequate mitigation measures are utilized.

Environmental Management

- To the extent feasible in light of other General Plan policies and to the extent permitted by State law, the County of El Dorado will protect identified critical fish and wildlife habitat, as identified on the Important Biological Resources Map maintained at the Planning Department, through any of the following techniques: utilization of open space, Natural Resource land use designation, clustering, large lot design, setbacks, etc.

- Low impact uses such as trails and linear parks may be provided within river and stream buffers if all applicable mitigation measures are incorporated into the design.

- Setbacks from all rivers, streams, and lakes shall be included in the Zoning Ordinance for all ministerial and discretionary development projects.

Sacramento County

The southern portion of the Unit is located in Sacramento County. While no policies in the Sacramento County General Plan directly relate to the Unit, several key policies are relevant and could affect the future development on adjacent lands or the involvement of CDPR. These policies include the following:

Land Use

- The County shall not approve land use projects which are for noncontiguous development, i.e. leapfrog.

- The County shall coordinate with regional planning agencies setting land use and environmental policies and programs and cooperate in the implementation of programs consistent with General Plan policy.

- Encourage local park districts to collaborate and coordinate with other districts, agencies and organizations.

Open Space

- Permanently protect, as open space, areas of natural resource value, including wetlands preserves, riparian corridors, woodlands and floodplains.

- Maintain open space and natural areas that are interconnected and of sufficient size to protect biodiversity accommodate wildlife movement and sustain ecosystems.

Conservation

- Encourage the County and Cities of Folsom, Sacramento, and Galt to jointly participate in a long-term water quality monitoring program for receiving waters within the county.

- Marshland and riparian areas of special significance shall be designated as natural preserves on the General Plan.

- Ensure no net loss of marsh and riparian woodland acreage, values or functions.

- Seasonal and permanent marshland within designated natural preserves shall not be drained or filled for the purpose of converting the land to another use.

- Manage vegetation on public lands with special status species to encourage native species and discourage nonindigenous invasive species.

- Control human access to critical habitat areas on public lands to minimize impact upon and disturbance of threatened and endangered species.

Flood Control

- Encroachments within the designated floodway of Sacramento waterways shall be consistent with policies to protect marsh and riparian areas.

- Reduce bank and levee erosion by prohibiting erosive wake activity generated by recreational and commercial boating.

- Provide unobstructed water flows throughout the network of natural waterways by prohibiting blockage, tunneling, or obstruction of contiguous stream channels.

Scenic Resources

- Locate and design production and distribution facilities so as to minimize visual intrusion problems in urban areas and areas of scenic and/or cultural value including the following: Recreation and historic area; Scenic highways; Landscape corridors; State or federal designated wild and scenic rivers; Visually prominent locations such as ridges, designated scenic corridors, and open viewsheds; Native American sacred sites.

- Solar facilities should be excluded from areas of scenic value and should not be sited in visually prominent locations such as ridges designated scenic corridors, designated historic areas, and open viewsheds.

- Transmission lines should avoid paralleling recreation areas, historic areas, rural scenic highways, landscaped corridors, and designated federal or state wild and scenic river systems.

City of Folsom

The City of Folsom is located along the southern shore of Folsom Lake and straddles Lake Natoma. While no policies in the Folsom General Plan directly relate to the Unit, several key policies are relevant and could affect the future development on adjacent lands or the involvement of CDPR. These policies include the following:

Land Use

- New development shall preserve and/or enhance to the maximum degree feasible, the existing natural vegetation, landscape features and open space, consistent with the goals and policies of this Plan.

- Development proposed along streams shall be in conformance with a comprehensive development and management plan to be prepared for stream waterbeds prior to project approval.

- The location, configuration, and extent of open space and parkway designated on the land use map shall be determined on a project by project basis through site specific mapping

approved by the City and consistent with the mitigation of environmental impacts and implementation of the overall goals and policies of the General Plan.

- The General Plan and zoning designations for annexed lands should consider the following criteria: 1) The capacity of facilities and municipal services; 2) The environmental effects that development on lands proposed for annexation may have on properties within the existing city limits; 3) Existing land uses, if any, on and in the vicinity of the annexed land; 4) The extent of any natural habitats and features of the landscape which should be preserved; 5) The demonstrated need for additional housing, retail commercial uses, other commercial uses, and industrial uses.

- The City should develop a package of incentives and encourage the following: 1) additional active parkland; 2) development of parkland; 3) increased historic preservation; 4) additional open space; 5) preservation of natural habitat; 6) preservation Savanna Oak clusters; 7) additional items as desired.

- To encourage the preservation of open spaces and natural features of the landscape, a project applicant may be allowed to concentrate the proposed development on a portion of the site through the clustering of buildings, smaller lot sizes, or taller buildings, provided that the overall unit buildout within the Plan area shall not exceed that authorized by the Land Use Element of the General Plan.

- Utility company rights-of-way may be considered for their use as public or private open space, trails, parkland, or other compatible recreational uses.

Transportation and Circulation

- The City shall plan for an integrated circulation system which provides for travel by private vehicles, commercial vehicle routes, a public transportation system, and for pedestrian and bicycle routes.

- Routes for additional bridge crossings over the American River shall be designated on the Plan Map. Because the Proposed Oak Avenue and Folsom-Auburn Road crossings will serve a significant amount of regional through traffic with distinctly different origins and destinations, financing and construction for the bridges should be considered as a package rather than separately.

- The City should develop and maintain a bikeways and pedestrian master plan that links residential developments with sources of employment, public open spaces, parks, schools, neighborhood shopping areas, the central commercial district, other major recreational destinations, and adjoining communities.

- The City should endeavor to provide routes for recreational travel, providing access to important recreational areas of the City, including Folsom Lake.

Open Space and Conservation

- The City may allow proposed development to be concentrated on a portion of a site and include taller buildings or smaller lot sizes to preserve a greater number of existing trees.

- Sensitive habitat areas and open space shall have their borders defined by public access ways, and/or shall have views from adjacent buildings oriented toward the areas.

- The City shall adopt standards for the designation, enhancement and maintenance of identified sensitive habitat areas.

- The City shall encourage the improvement of public access to recreational facilities and spaces through the publication of a trails and recreation guide which maps the trails, open spaces, and parks within the City of Folsom and shows the interconnection with trails and facilities in adjoining communities.

- The City shall adopt a Scenic Corridor Plan for the identified scenic corridors including but not limited to: 1) Folsom Boulevard scenic corridor from Highway 50 to Sutter Street; 2) Greenback Lane scenic corridor from the City Limits to Riley Street; 3) East Natoma Street scenic corridor from Oak Avenue Parkway to the El Dorado County Line; 4) Folsom-Auburn Road scenic corridor from the City Limits to Greenback Lane.

Safety Element

- The City shall work with the U.S. Army Corp of Engineers in developing standards for development within the inundation boundary resulting from a failure of Folsom Dam or the dikes retaining Folsom Lake.

Parks and Recreation

- The City shall encourage, where appropriate, the inclusion of bikeways, walkways, and equestrian trails in parks, parkways, and open space acreage.

- Where feasible, park sites throughout the City shall be integrated with the Bikeways Master Plan and bicycle trails outside the City such as the American River Bike Path.

- The City shall actively encourage the protection and preservation of natural habitats identified in the Open Space and Conservation Element.

- The City shall encourage the development of parkways and greenbelts as an integral link between the Citywide park system.

- The City shall encourage the aid of State or County park rangers, i.e., Folsom Lake State Recreation Area, to provide leadership in programs that inform the community on topics such as conservation and fire safety.

- The City shall work cooperatively with the County Department of Parks and Recreation, State Department of Parks and Recreation, State Department of Corrections and State

Department of Fish and Game in coordinating facility development and program offerings.

Regional Planning Policy Context

This section summarizes regional plans and activities that address common elements crossing jurisdiction boundaries. These plans and activities are relevant to the Unit and could affect the future development on adjacent lands or the involvement of CDPR.

American River Parkway Plan

The natural beauty, proximity to an urban population, and recreational values of the lower American River corridor is of such significance that the river has been designated a Recreational River in both the federal and state wild and scenic river systems, and the trail system of the Parkway has been designated a National Recreational Trail. Additionally, the California legislature in 1985 acknowledged the Parkway's statewide significance by adopting the Parkway Plan through the passage of the *Urban American River Parkway Preservation Act* (Public Resources Code § 5840).[34] The 1985 American River Parkway Plan has authority over the land uses within the Parkway which extends from Downtown Sacramento at the confluence with the Sacramento River to Folsom Dam within the Unit. It is a component of both the Sacramento County and City of Sacramento general plans.

This Plan provides the policies for the preservation and use of the Parkway as a continuous open space greenbelt. The strongest working portions of the Plan are the land use designations and policies, which direct all recreation, restoration, preservation and development of facilities. For instance, the (PC) Parkway Corridor Combining Zone in the County of Sacramento Zoning Code includes special development requirements to improve public access and enjoyment of the riverfront, and to strengthen the amenity that the riverfront can provide to adjoining property.

Although the Plan is the primary management plan for the Lower American River, it has not been updated in more than 15 years and does not reflect recent flood and environmental resource management initiatives that are included in the River Corridor Management Plan described below. The process of updating the Parkway Plan is to begin early in 2003, a process that will allow decision-makers to strengthen the resource management provisions of Plan and address important land use and recreation-related issues that have developed in the past 15 years. It will also refine Parkway management mechanisms as necessary to give appropriate status to the cooperative relationships that have arisen in connection with the Floodway Management Plan and the Water Forum Agreement outlined below.

As noted, the geographic scope of the Parkway Plan includes Lake Natoma, an area that is formally managed in compliance with the Folsom Lake State Recreation Area General Plan. The Parkway Plan incorporates Folsom Lake General Plan by reference thereby acknowledging its validity as the land use plan for Lake Natoma. In keeping with this collaboration, the Parkway Plan states:

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[34] Lower American River Task Force, *River Corridor Management Plan Recreation Management Element*, December 2001, pg. 4.

> "In order to facilitate the coordination in the planning and management of the American River Parkway, it should be the responsibility of the respective State and county agencies to inform each other of any large scale public or private improvement proposals, requests for entitlement of use, plans for large scale events, or proposed policy changes which would affect the Parkway."

River Corridor Management Plan for the Lower American River

The purpose of the 2001 River Corridor Management Plan is to institute a cooperative approach to managing and enhancing the Lower American River corridor's aquatic and terrestrial ecosystems, flood-control systems, and recreation values within the framework of the 1985 American River Parkway Plan. The Plan will also provide a significant foundation of policy work and scientific research for the update of the Parkway Plan, a process that began in early 2003. The Plan is used to inform resource managers and the community about the condition of American River Parkway resources, the challenges facing resource managers and the community, and the goals and objectives for improving resource conditions in a cooperative manner. It also recommends actions to achieve these goals and objectives. The Plan is intended to serve as a single blueprint for enhancing Parkway resources and to provide a cohesive framework for which both public and private entities working in the Lower American River can voluntarily coordinate their efforts to responsibly steward Parkway resources. It is also intended to assist management entities in assessing where their efforts might be most effective in achieving the Plan's goals and objectives and facilitate compliance with existing laws, regulations, and policies.

The River Corridor Management Plan includes a Recreation Management Element. The objectives of the element include:

- Developing and maintaining a trail system that is connected to the emerging trail network; accommodates the needs of pedestrians, bicyclists (especially commuters), and equestrians; and provides appropriate access for the disabled;

- Providing safe and appropriate access and facilities for rafting, canoeing, boating, fishing, viewing wildlife and other permitted activities;

- Providing a variety of interpretive facilities and services throughout the Parkway that help visitors attain an appreciation of the Parkway's natural, historical, and cultural resources;

- Providing a safe and secure environment for Parkway visitors, including improved emergency access supported by rangers and law enforcement personnel;

- Ensuring appropriate land uses adjacent to the Parkway, including residential and commercial uses, planned redevelopment, and transportation corridor improvements, that are consistent with the Parkway Plan and coordinated with adjacent land management agencies and land use jurisdictions;

- Operating and maintaining recreation facilities and resources in accordance with accepted "best practice" standards as a top priority;

- Ensuring that flood and natural resource management efforts are closely coordinated with recreation management efforts; and

- Ensuring the protection and enhancement of natural vegetation and wildlife habitat.[35]

In addition to these objectives, the Recreation Management Element includes specific recommendations relating to public access and trails, interpretation and education, land acquisition, adjacent land uses, public safety, public outreach, and operations and maintenance/recreation facilities. Specific recommendations related to the Unit include the acquisition of land for the Parkway—including the Snipes-Pershing property adjacent to Mississippi Bar recently acquired by CDPR—and coordination with CDPR on the update of the General Plan for the Unit.[36]

It should be noted that the River Corridor Management Plan is not legally binding and does not alter the mission, authority, or responsibility of any management entity, nor does it alter the status or use of the Parkway Plan.

Floodway Management Plan

The Floodway Management Plan was completed in 1998. Through a consensus-based process similar to that used in the development of the River Corridor Management Plan, the Floodway Plan documents a broad range of resource issues and concerns and develops goals and recommendations to better manage resources. Many of the recommendations included in the Plan are intended to provide guidance to resource managers on issues involving multiple resources. A great deal of the management direction provided by the Floodway Plan is carried forward in the Corridor Management Plan. Specific recommendations are intended to encourage additional research, communication, and documentation of important resource conditions and management needs. As with the River Corridor Management Plan and the American River Parkway Plan, the Floodway Management Plan applies to Lake Natoma, an area that is formally managed in compliance with the Folsom Lake State Recreation Area General Plan.

El Dorado County River Management Plan

Over the past 25 years, El Dorado County has banned and then actively managed whitewater recreation on the South Fork of the American River. In response to landowner complaints about noise, trespassing, litter, and inadequate sanitation, the County banned whitewater recreation by ordinance in 1976; however, the ordinance was later struck down by the State Court of Appeal in the case of *People ex rel. Younger v. County of El Dorado* (1979).[37] Following the Younger decision, the County adopted a Stream and River Rafting ordinance in 1980, and in 1981 the County began active management of commercial outfitters on the South Fork. In 1995, Mr. Bernard Carlson sued the County on the grounds that the commercial permitting process in the 1988 River Management Plan (RMP), as amended, was discretionary rather than ministerial under the California Environmental Quality Act (CEQA). Mr. Carlson prevailed in this litigation and, as a term of settlement, the County

[35] Ibid., pg. 17.
[36] Ibid., pg. 20.
[37] El Dorado County, *El Dorado River Management Plan*, November 2001, pg. 1-2.

agreed to contract with independent consultants to update the existing RMP and prepare a new one.

The 2001 RMP establishes a set of operational rules for commercial and private boaters navigating the 20.7-mile segment of the South Fork of the American River between the Chili Bar Dam, near State Highway 193, and Salmon Falls Road, at the upper extent of Folsom Lake.[38] The purpose of the RMP is to enhance public health, safety, and welfare, and to preserve environmental values. It includes detailed educational, safety, transportation, monitoring, and agency coordination programs designed to implement the RMP. The RMP also outlines permitting requirements, specifies the carrying capacity of the waterway, and identifies the regulations and ordinances that will operate the Plan. As noted in the Recreation Resources section of this document, commercial and private boaters on the South Fork take-out within the Unit. Commercial boaters are required to take-out at Salmon Falls while private boaters take out just east of the American River Bridge at Skunk Hollow. The Recreation Resources section also notes the difficulties at these take-out sites related to parking capacity, congestion, and traffic and pedestrian safety along Salmon Falls Road.

Community Open Space Efforts

There are several ongoing efforts by regional conservation organizations to protect open space. These groups may provide opportunities for partnerships with CDPR in acquiring, or protection by other means, important open space lands and significant habitat areas that abut the Unit. For instance, the American River Conservancy works with land owners in El Dorado County who are interested in selling or donating land. The Conservancy is currently working to complete a 6-mile greenbelt and hiking trail corridor along the South Fork that will link the Unit at Salmon Falls with Highway 49.[39] The Conservancy also owns and manages the Pine Hill Ecological Preserve. This 1,300-acre area of rare and endangered plant habitat is located adjacent to the Unit at Salmon Falls and has to potential to be expanded to include a total of 5,000 acres.[40]

In Placer County, the Placer County Land Trust works with landowners and conservation partners to permanently preserve natural open space and agricultural lands. The Trust is currently working with other groups to preserve critical lands adjacent to the North and Middle Forks of the American River. Among other organizations working in this area include Protect American River Canyons (PARC). In Sacramento County, the Sacramento Valley Conservancy has preserved more than 1,300 acres of open space and sensitive habitat areas. The Conservancy worked with CDPR to acquire the 35-acre Snipes-Pershing along the Lake Natoma Bluffs. The site provides a link between Orangevale and the American River Bikeway along the western shore of Lake Natoma in the Unit.[41]

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[38] Ibid., pg. 1-1.
[39] http://www.arconservancy.org/land_conservation.htm.
[40] Ibid.
[41] http://www.sacramentovalleyconservancy.org/image/projectmap.pdf

Regional Demographic Context

This section summarizes the regional demographic context as it relates to the Unit. This context is useful in describing current Unit users and in possibly identifying their needs. This section also outlines the projected growth for the region, which is useful in estimating future demand on Unit facilities and the potential need for additional facilities. A summary of the demographic aspects of the counties that abut the Unit (El Dorado, Placer, and Sacramento) is also included.

Sacramento Region

As noted in the introduction to this section, the Sacramento Region is defined as the six-county area comprising the Sacramento Area Council of Governments (SACOG), including El Dorado, Placer, Sacramento, Sutter, Yuba, and Yolo Counties. According to the U.S. Census, the 2000 regional population was 1.94 million.[42] Of this population, 69.9 percent are White, 9.1 percent are Asian, 6.8 percent are Black or African-American, 1.1 percent are American Indian or Alaska native, 0.4 percent are Native Hawaiian or Other Pacific Islander, and 7.5 percent are some other race.[43] The remaining 5.2 percent of the population is comprised of two or more races. Overall, almost 16 percent of the regional population is Hispanic or Latino. With respect to households in the region, about 67 percent are family households with 61 percent of all households being owner-occupied. Strong growth is projected for the Sacramento Region to 2025. According to SACOG, the region will see a 49 percent (928,000) increase in residents and a 60 percent (510,000) increase in jobs.[44]

El Dorado County (excluding the Tahoe Basin)

El Dorado County has the smallest population of the three counties that abut the Unit. According to the U.S. Census, the 2000 County population was 156,300. The County is not as racially diverse as the region with 90 percent of the population being White. Seventy-three percent of households in the County are family households with 75 percent of all households being owner-occupied. County employment is dominated by management and professional (37 percent) and sales and office (25 percent) occupations. Other key occupations include service (19 percent), construction, extraction, and maintenance (10 percent), and production and transportation (7.6 percent).[45] About 69 percent of all workers in the County work in the private sector, 19 percent in the public sector, and 12 percent are self-employed. The median household income is $51,480 and the median family income is $50,250. Five percent of families in the County live below the poverty level. As with the Region, SACOG projects significant growth in El Dorado County to 2025, particularly with respect to employment which is expected to almost double with the addition of 31, 180 jobs.[46] The number of residents is projected to increase by 56 percent (69,500). El Dorado County is projected to see the most significant increase in population and employment through 2010, after which the annual rates of growth are expected to drop significantly.

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[42] U.S. Census Bureau, 2002.
[43] Ibid.
[44] SACOG, 2001.
[45] U.S. Census Bureau, 2002.
[46] SACOG, 2001.

Although the SACOG projections indicate the overall rate of growth for El Dorado County, the projections do not shed light on the actual distribution of growth since so much of the County is unincorporated. These projections are also based in part on the buildout of the County's General Plan which is currently undergoing significant revision due to a legal challenge. However, it can be assumed based on current development patterns in the County that future development will be focused in the western portions of the County including the lands that abut the Unit's eastern boundary.[47] This would support the fact that population and employment growth rates in unincorporated El Dorado County will continue to be slightly higher than growth rates for the County overall.

Placer County (excluding the Tahoe Basin)

Placer County is the second most populous in the Sacramento Region with a 2000 population of 218,000 according to the U.S. Census. As in neighboring El Dorado County, Placer County is not as racially diverse as the region with 89 percent of the population being White. Seventy-three percent of households in the County are family households with 73 percent of all households being owner-occupied. As in El Dorado County, management and professional is the dominant occupation in Placer County (40 percent), followed by sales and office (28 percent), service (13 percent), construction, extraction, and maintenance (10 percent), and production and transportation (9 percent).[48] Seventy-two percent of all workers in the County work in the private sector, 17 percent in the public sector, and 10 percent are self-employed. The median household income ($57,535) and median family income ($65,860) are both significantly higher here than in El Dorado County, and fewer families (4 percent) live below the poverty level.[49]

Tremendous growth is projected for Placer County to 2025. SACOG expects a 75 percent increase in population (178,200 new residents) and a 98 percent increase in employment (112,700 new jobs) to 2025. Annual rates of growth are expected to remain high (between 2.5 and 4.3 percent for population and between 3.0 and 4.4 percent for employment) through 2015 and then drop off steeply.[50] However, even the annual growth rates at 2025 (0.9 percent for population and 1.4 percent for employment) are significant. The majority of the growth projected in Placer County will largely reflect the current development pattern and be directed to southeastern portions of the County in the Lincoln-Loomis-Rocklin-Roseville and Auburn-Colfax areas. These cities, which are located along the I-80 corridor, are in close proximity to Folsom Lake and it can be assumed that growth here will result in more visitors to the Unit. Population and employment growth rates in Placer County cities is projected to be higher than in the unincorporated areas through 2015, after which growth in the unincorporated areas will outpace growth in cities.[51]

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[47] In a recent report prepared by Economic & Planning Systems, Inc. titled, "El Dorado County Land Use Forecasts for Draft General Plan" three development scenarios are explored. Each of the scenarios concentrates new residential development in the western portions of El Dorado County, including lands adjacent to the Unit.

[48] U.S. Census Bureau, 2002.

[49] Ibid.

[50] SACOG, 2001.

[51] Ibid.

Sacramento County

Sacramento County is the most densely populated of the three counties that abut the Unit. According to the U.S. Census, in 2000 its population totaled 1,223,500, an increase of 192,000 residents or 19 percent. Sacramento County is the most racially diverse in the Region. Sixty-four percent of the County population are White, 11 percent are Asian, 10 percent are Black or African-American, 1.1 percent are American Indian or Alaska native, 0.6 percent are Native Hawaiian or Other Pacific Islander, and 7.5 percent are some other race.[52] The remaining 5.2 percent of the population are comprised of two or more races. Overall, 16 percent of the County population is Hispanic or Latino.

Sacramento County has significantly fewer family households (66 percent) and owner-occupied households (58 percent) than either El Dorado or Placer Counties. Employment in the County is dominated by management and professional (36 percent) and sales and office (30 percent) occupations. Other key occupations include service (14.5 percent), production and transportation (10 percent), and construction, extraction, and maintenance (9 percent). About 70 percent of all workers in the County work in the private sector, 23 percent in the public sector, and 7 percent are self-employed.[53] The median household income of $43,800 and median family income of $50,700 are both significantly less than in El Dorado and Placer Counties. Ten percent of families in the County live below the poverty level.

As with the Region, SACOG projects significant growth in Sacramento County to 2025, although nowhere near the levels projected for neighboring El Dorado and Placer Counties. A 39 percent increase in residents (476,640) and a 45 percent increase in jobs (252,490) is expected.[54] Sacramento County is projected to see the most significant increase in population and employment through 2015, after which the annual rates of growth are expected to drop by about 50 percent.

City of Folsom

The City of Folsom is the only city that abuts the Unit. In 2000, the population of Folsom was 51,880. Seventy-eight percent of the City population is White, 7 percent is Asian, 6 percent are Black or African-American, 0.6 percent are American Indian of Alaska native, 0.2 percent are Native Hawaiian or Other Pacific Islander, and 4.7 percent are some other race.[55] The remaining 3.4 percent of the population are comprised of two or more races. Overall, 9.5 percent of the City population is Hispanic or Latino. As in surrounding El Dorado County, 73 percent of households in the City are family households with 76 percent of all households being owner-occupied. More than in the surrounding counties, City employment is heavily dominated by management and professional (52 percent) and sales and office (26 percent) occupations, with the remaining occupations comprising service (11 percent), production and transportation (5.3 percent), and construction, extraction, and maintenance (5 percent).[56] About 73 percent of all workers in the City work in the private sector, 20 percent in the public sector, and 7 percent are self-employed. The median

[52] U.S. Census Bureau, 2002.
[53] Ibid.
[54] SACOG, 2001.
[55] U.S. Census Bureau, 2002.
[56] Ibid.

household and median family incomes are the highest in the Region at $73,175 and $82,450 respectively. Only 2.5 percent of families in the City live below the poverty level.

According to SACOG, Folsom will experience significant growth to 2025. SACOG projects a 42 percent increase (22,520 residents) in population and a 76 percent increase (17,695 jobs) in employment.[57] These rates of growth are less than in El Dorado and Placer Counties, but more than Sacramento County. SACOG also projects that the population of Folsom will level off after 2015 while employment will continue to increase, although at a rate that will fall off sharply after 2010.

Land Use Issues

This section summarizes the current issues related to land use and the Unit, including flood control, interface with surrounding lands, and major projects.

Flood Control System

- Possible reduction in the availability of boat ramps, marina slips, and beaches on Folsom Lake during the peak season resulting from the proposed increase in surface water diversions from Folsom Lake under the Water Forum Agreement (WFA). The increased diversions are intended to meet planned growth in the area through 2030.

- Implementation of the $3 million in improvements proposed by the WFA to mitigate the impacts of lower water levels on Folsom Lake, including: improved high water boat access; improved facility service range at the marina; water impoundments at Beals Point and/or Granite Bay to enhance swimming opportunities; improved shoreline facilities to enhance low water access, and so on.

- Possible construction-related impacts of the Folsom Dam Modification project on recreation uses at Folsom Lake, including the use of Observation Point as a construction staging area over a three-year period beginning in 2003 and the intermittent closure of Folsom Dam Road over a six-year period.

- Possible flood control operation-related impacts of the Folsom Dam Modification project on recreation uses at Folsom Lake, including increased flood control capacity and lake levels during large flood events that are beyond the current functional range of the swimming beaches at Beals Point and Granite Bay. Several facilities on Folsom Lake would be completely or partially inundated under the current maximum flood control level of 474 feet.

- Possible construction-related impacts of the Folsom Dam Raise project on recreation uses in the Unit, including:

  - Disruption of recreation activities on the American River Bike Trail between Negro Bar and Beals Point due to temporary access roads;

[57] SACOG, 2001.

- Relocation of the CDPR and BOR headquarters complex to accommodate the proposed alignment of a temporary construction bridge;

- Disruption of recreation activities between Beals Point and Beeks Bight due to increasing of dike height along Folsom Lake;

- Disruption of recreation activities on the American River Bike Trail at Mississippi Bar due to use of the area as a borrow material site; and

- Disruption of recreation activities at Lake Natoma at Willow Creek due to temporary use of the area as a borrow material storage and transfer site.

- Possible flood control operation-related impacts of the Folsom Dam Raise project on recreation uses at Folsom Lake, including an increase in the temporary water level that could be accommodated to 482 feet, a level that would completely inundate all recreation facilities on Folsom Lake and rendering them inoperable (most recreation facilities on Folsom Lake are at elevations of between 468 and 474 feet).

Interface with Surrounding Lands

- Enhanced buffering and screening to soften the interface between the Unit and surrounding development where such development could be incompatible. Such incompatible activities could include commercial and industrial uses, utility uses, transportation uses, and so on.

- Visual intrusion of surrounding development in the Unit, particularly in areas where ridgelines and hillsides above the Unit boundary are developed or where inadequately buffered or screened development abuts the Unit boundary. Areas include: Nimbus Flat, Lake Overlook, Beals Point, Mormon Island Dam, Brown's Ravine, New York Creek, and Old Salmon Falls.

- Access and off-site difficulties when the parking lots at day-use facilities reach capacity by midday on peak season weekends, including: traffic delays, illegal parking, pedestrian hazards, noise, and access difficulties for neighbors of the Unit. Facilities include Beals Point, Granite Bay, Brown's Ravine, and Salmon Falls/Skunk Hollow.

- Informal access by homeowners to the Unit from surrounding neighborhoods. Problems include: addition of gates in property line fencing to access the Unit where trail facilities are in close proximity; removal of property line fencing to extend yard use into the Unit; and; use of Unit lands as dump for yard waste and personal refuse.

- Recreation experience affected by noise coming from outside the Unit, including in locations proximate to major routes that parallel or cross the Unit. These locations include Nimbus Flat on Lake Natoma where Highway 50 and Hazel Avenue pass close by, and Negro Bar in the area of the Lake Natoma Crossing.

- Surrounding lands affected by noise coming from inside the Unit, including: traffic backups at popular day use facilities that reach capacity on peak season weekends; water-based activities on Folsom Lake, including from power boats and jetskis and music from boats moored or floating in nearshore.

- Wildfire risk due to the proximity of development to natural areas of the Unit, particularly in the rural northern portions of the Unit along the North and South Forks of the American River. It is in these more remote rural areas of that emergency response times are higher, and where the natural landscape within the Unit poses the highest risk of wildfires.

Major Projects

- Widening of Hazel Avenue in Sacramento County from four to six lanes, the addition of Class II bike lanes, and improved access points for pedestrians and cyclists to the Unit and the American River Parkway will impact the Unit. It has yet to determined if the Hazel Avenue bridge will accommodate all traffic or if a separate and parallel bridge for recreational pedestrian, bicycle, and equestrian use will be built.

- Construction of the Downtown Sacramento-Folsom Corridor light rail transit (LRT) project by the Sacramento Regional Transit District will include stations in close proximity to the Unit, including at Iron Point Road, Glenn Drive, and Leidesdorff Street in Folsom. The Iron Point and Silverbrook stations will be located directly across Folsom Boulevard from the Unit boundary and will significantly improve transit access to the Unit.

- Widening of Folsom-Auburn Road by the City of Folsom from two to four lanes from Folsom Dam Road north to the Placer County line is to be completed in late 2003. Widening of Auburn-Folsom Road by Placer County from two lanes to four lanes from the Sacramento County line north to Douglas Boulevard is to be completed in 2006. These projects may enhance access to Beals Point and Granite Bay in the Unit and may ease traffic backups on peak season weekends.

- Construction of a temporary two-lane construction bridge just downstream from Folsom Dam will occur as part of the Folsom Dam Raise project. The bridge will be aligned to provide a detour route across the American River for the approximately 4 million vehicles that cross Folsom Dam each year. It has yet to be determined if the bridge will be dismantled, left in service to facilitate dam maintenance, or constructed to permanently relocate traffic from Folsom Dam.

Other Issues

- The Sacramento Area Council of Governments (SACOG) projects that the six-county Sacramento region will see a 49 percent (928,000) increase in residents and a 60 percent (510,000) increase in jobs to 2020.

- The update of the 1985 American River Parkway Plan will begin in early 2003 and will require coordination with the update of the Folsom Lake SRA General Plan/Resource Management Plan. It is unknown how the current preservation policies in the Parkway Plan and the regulatory requirements of the (PC) Parkway Corridor Combining Zone will be affected by the update process. Regardless, the Parkway Plan update will affect the Unit in that Lake Natoma is part of the Parkway.

- Resource and recreational policy in the update of the Folsom Lake SRA General Plan/ Resource Management Plan as it relates to Lake Natoma will have to reflect and

incorporate the goals, objectives, and recommended actions of the River Corridor Management Plan of the Lower American River.

- The current General Plan for the Unit set aside a 28-acre area on the eastern shore of Lake Natoma between Willow Creek and Nimbus Flat for a proposed State Indian Museum. In 1991 a study on the proposal was completed, and a year later, a detailed feasibility study was also completed. In August, 2002, signed Senate Bill 2063 established the California Indian Cultural Center and Museum under CDPR and a task force to recommend a location, design, content, and governing structure. The task force will begin it's work in Spring 2003 and is schedule to recommend a site by February 2004. Sites other than that provided for in the current General Plan will also be considered.

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LAND USE, TRAFFIC/CIRCULATION, AND UTILITIES

TRAFFIC/CIRCULATION

Folsom Lake State Recreation Area

April 2003

by

LSA Associates, Inc.

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Irvine, CA 92614

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TRAFFIC/CIRCULATION

Introduction

The purpose of this section of the Resource Inventory is to document the existing traffic/circulation system in the vicinity of the Folsom State Recreation Area (the Unit), as well as to discuss current traffic conditions along roadways that provide access to the Unit. This section also describes other future approved (committed) roadway and/or intersection improvements that may affect future circulation in the vicinity of the Unit.

The Unit study area location is illustrated in Figure TC-1. The description of the existing circulation system is based on site observations conducted in July, 2002. Existing daily traffic volumes on the State Highways (I-80 and SR-50) within the Unit study area are based on the most recent daily vehicle counts collected by Caltrans and reported on their website (www.dot.ca.gov). Existing daily traffic volumes on study area roadways were obtained by LSA from the City of Folsom, City of Roseville, Placer County, and El Dorado County.

This section provides information that was available from the local and regional agencies at the time of preparation. In order to present the most current traffic data in the subsequent environmental analysis, no current traffic counts were conducted. Existing traffic counts at key study area locations within the Unit will be conducted during a typical summer weekend in June, 2003.

Existing Circulation System

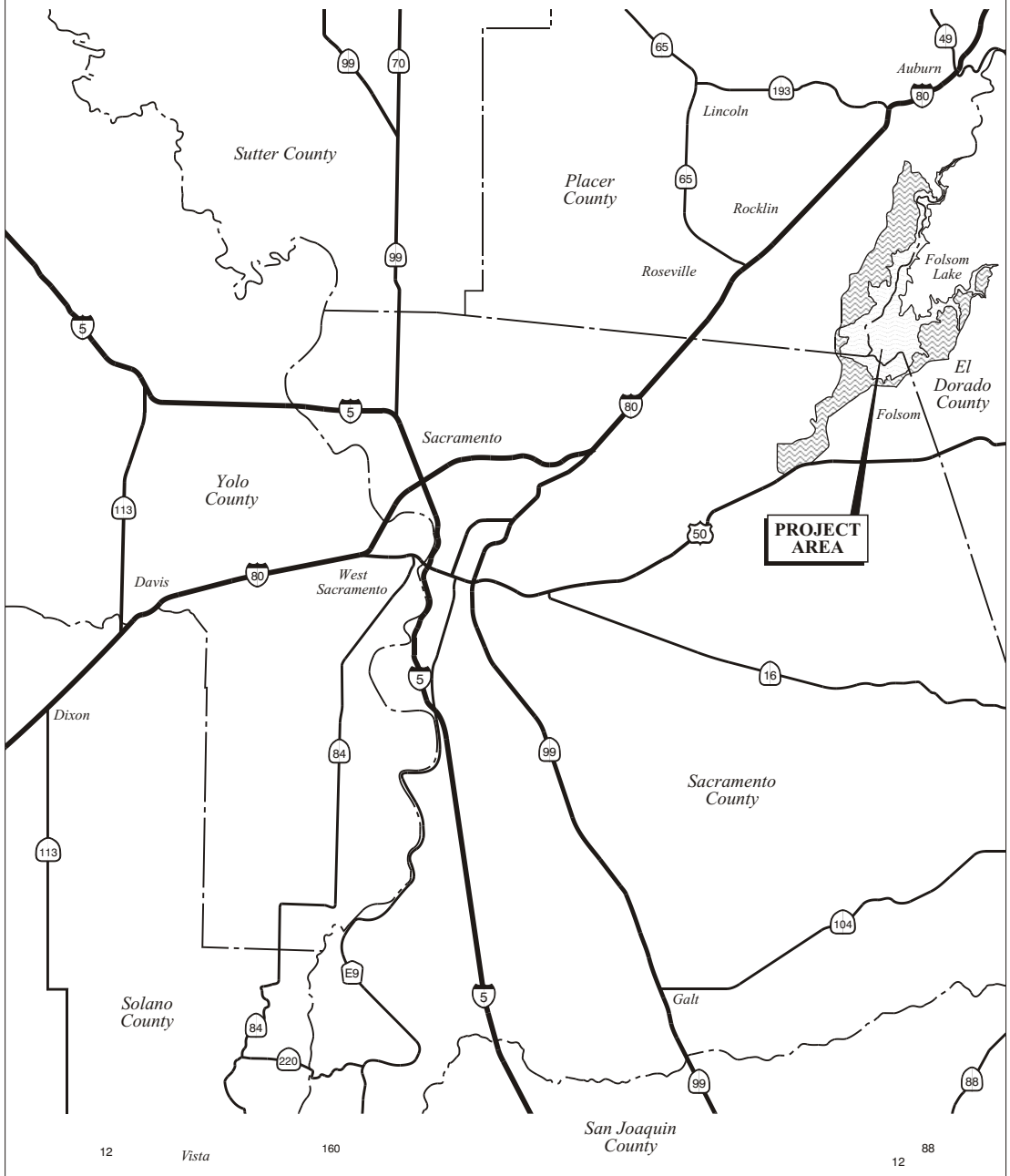
Figure TC-2 illustrates the existing circulation system along with daily traffic volumes in the vicinity of the Unit. A description of key roadways is provided below.

Regional Access Roadways

Regional access in the vicinity of the Unit is provided via the following State Highways:

Interstate 80 – Interstate 80 (I-80) connects the San Francisco area with the Sacramento and Lake Tahoe regions to the east. Within the Unit study area, I-80 is oriented in a north-south direction and provides direct access to the Unit via its interchange at Douglas Boulevard.

US Highway 50 – US Highway 50 connects the Sacramento Area with El Dorado County to the east. Within the Unit study area, US-50 is oriented in an east-west direction and provides direct access to the Unit via its interchange at Folsom Boulevard.





FIGURE

TC-1

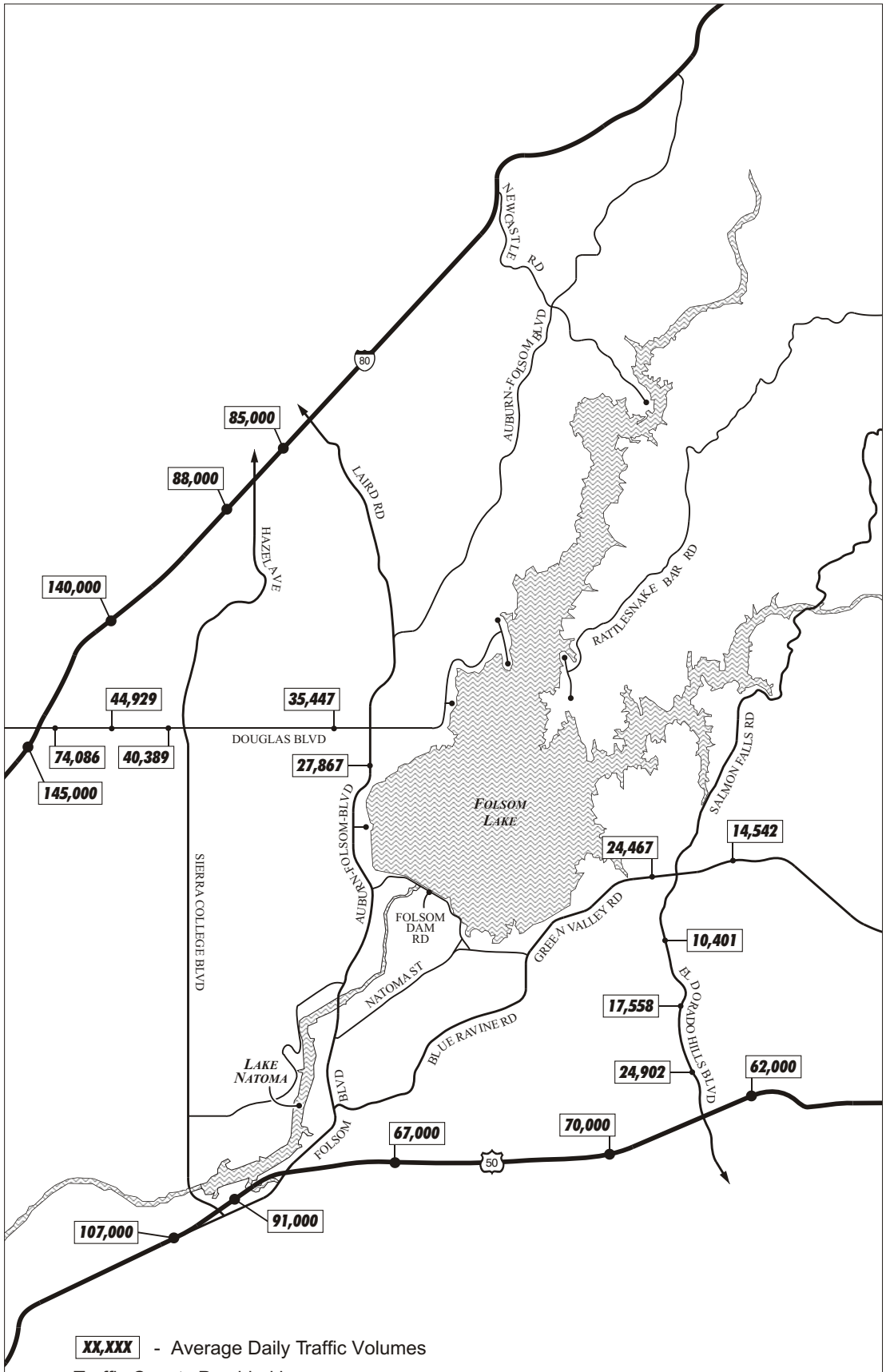
REGIONAL LOCATION

Prepared by LSA Associates, Inc.

SOURCE: LSA Associates, Inc.



FOLSOM LAKE STATE
RECREATION AREA
RESOURCE INVENTORY



XX,XXX - Average Daily Traffic Volumes

Traffic Counts Provided by:
City of Roseville, April 2001
El Dorado County Department of Transportation, Jan. 2001
Placer County Department of Public Works, May 2002
California Department of Transportation, 2001

FOLSOM/LAKE/NATOMA



FIGURE
TC-2

EXISTING DAILY TRAFFIC VOLUMES

Prepared by LSA Associates, Inc.



Local Access Roadways

Local access in the vicinity of the Unit is provided via the roadways discussed below. These roadways encompass a study area that consists of four jurisdictions: City of Folsom, City of Roseville, Placer County, and El Dorado County.

Douglas Boulevard - Douglas Boulevard is an east-west roadway that provides access to the Unit from I-80. From I-80 to Sierra College Boulevard, Douglas Boulevard is a six-lane divided roadway. Between Sierra College Boulevard and Auburn Folsom Road, Douglas Boulevard is a four-lane divided roadway. Douglas Bouelvard becomes a two-lane undivided roadway east of Auburn-Folsom Road.

Auburn-Folsom Road/Folsom Boulevard - Auburn-Folsom Road is a two-lane undivided north-south roadway north of Folsom Dam Road. The road becomes a four-lane undivided roadway south of Folsom Dam Road, and a four-lane divided roadway in the City of Folsom. This roadway is named Folsom Boulevard south of Greenback Lane/Riley Street. Auburn-Folsom Road provides north-south access between the cities of Auburn in the north and Folsom in the south. Auburn-Folsom Road/Folsom Boulevard provides access to the Unit from the City of Auburn to the north and its interchange with US-50 to the south.

Natoma Street - Natoma Street is an east-west roadway in the City of Folsom. From Folsom Boulevard to Stafford Street, Natoma Street is a two-lane undivided roadway. Natoma Street becomes a four-lane undivided roadway from Stafford Street to Fargo Way. East of Fargo Way to Folsom Dam Road, the road is a two-lane undivided roadway. From Folsom Dam Road to Green Valley Road, Natoma Street is a three-lane roadway (two eastbound lanes). Natoma Street also provides local circulation between the various Unit areas.

Green Valley Road - Green Valley Road is a two lane east-west roadway in the City of Folsom and El Dorado County. The roadway varies frequently between a divided and an undivided roadway and provides a two way left turn lane in some areas.

El Dorado Hills Boulevard - El Dorado Hills Boulevard is a four lane, divided, north-south roadway from US-50 to St. Andrews Drive in El Dorado County. North of St. Andrews Drive, El Dorado Hills Boulevard is a two lane undivided roadway. North of Green Valley Road, El Dorado Hills Boulevard becomes Salmon Falls Road, a two lane rural roadway providing access to the Unit.

As stated previously, traffic counts at key locations in the vicinity of the Unit will be taken on a typical summer weekend in June 2003. A level of service (LOS) analysis for these locations will be conducted at that time. Intersection operations and the relationship between capacity and traffic volumes are generally expressed in terms of levels of service. As the amount of traffic moving through a given intersection increases, the conditions that motorists experience rapidly deteriorate as traffic approaches the absolute capacity. Under such conditions, there is general instability in the traffic flow, which means that relatively small incidents (e.g., momentary engine stall) can cause considerable fluctuations in speeds and delays that lead to congestion. This near capacity situation is labeled LOS E (levels of service are designated A through F). Beyond LOS E, capacity has been exceeded and arriving traffic will exceed the ability of the intersection to accommodate it. LOS standards

are established to monitor traffic levels within the community and to establish thresholds for identifying traffic impacts. These standards vary by community, therefore, LOS analyses for key locations in the vicinity of the Unit will have to reflect these different criteria. Roadways providing access to the Unit are subject to the LOS performance standards identified in the General Plans for the City of Folsom, the community of Granite Bay, and the Counties of Placer, Sacramento, and El Dorado. The LOS standards of these agencies are shown below:

City of Folsom – LOS C

Community of Granite Bay – LOS C (except for intersections along Auburn-Folsom Road south of Douglas Boulevard, and along Douglas Boulevard west of Auburn-Folsom Road where the standard is LOS E)

El Dorado County – LOS E

Placer County – LOS C on rural, urban and suburban roadways except within one-half mile of state highways where the standard is LOS D.

Bicycle Facilities

There are existing bicycle lanes on several of roadways in the vicinity of the Unit. A Class II bicycle facility is an on-road, striped bicycle lane, and a Class III bicycle facility is an on-road, signed bicycle route.

Class II Bicycle Facilities

Douglas Boulevard - Bicycle lanes are provided intermittently east of Eureka Road.

Auburn-Folsom Road/Folsom Boulevard - Bicycle lanes are provided in the City of Folsom north of Greenback Lane/Riley Street and south of Sutter Street.

Natoma Street - Bicycle lanes are provided from Folsom Boulevard to east of Mill Street, and between Prison Road and Ranch Drive. The City of Folsom Bikeway Master Plan proposes to connect these two segments so the bicycle lanes will eventually run continuously between Folsom Boulevard and Green Valley Road.

Green Valley Road - Bicycle lanes are provided from north of Natoma Street to the Sacramento County line. The Bikeway Master Plan proposes to connect these bicycle lanes with existing lanes on Blue Ravine Road south of Natoma Street.

Class III Bicycle Facilities

Auburn-Folsom Road - There is a bicycle route between the Sacramento County line and Douglas Boulevard.

Planned Transportation Improvements

The Sacramento Area Council of Governments (SACOG) is designated by the U.S. Department of Transportation (DOT) and the U.S. Environmental Protection Agency (EPA) as the metropolitan planning organization (MPO) for the six-county Sacramento region. As the MPO for this area, SACOG prepares and maintains a federal Metropolitan Transportation

Improvement Program (MTIP). This document lists all transportation-related projects requiring federal funding or other approval by the Federal Highway Administration (FHWA) or Federal Transit Administration (FTA). The MTIP also lists non-federal, regionally significant projects for information and air quality emissions modeling purposes. The MTIP indicates the area's short-term plan for use of federal dollars and other resources for the maintenance, operation, and improvement of the transportation system and the achievement of federal air quality standards.

Review of the Final 2000/01 MTIP and the recently adopted 2003/05 MTIP shows that the following projects are planned in the vicinity of the Unit.

Auburn-Folsom Road. - The City of Folsom plans to widen Folsom-Auburn Road from two to four lanes from Folsom Dam Road north to the Placer County line. The roadway will be widened approximately 3,500 feet and includes Class II (on-road striped) bicycle lanes. This project is anticipated to be completed in 2003. Placer County plans to continue the widening along Folsom-Auburn Road from two lanes to four lanes from the Sacramento County line to Douglas Boulevard. This segment of the Auburn-Folsom Road widening project is anticipated to be completed in 2006. Completion of this project will increase capacity of Auburn-Folsom Road in the vicinity of some major activity areas in the Unit. Specifically, there is the potential for enhanced access to Beals Point and the Granite Bay boat launch area.

Green Valley Road - El Dorado County plans to widen Green Valley Road from two to four lanes from the Sacramento County line to Silva Valley Parkway. The anticipated completion year is 2004. This segment of Green Valley Road provides access to Brown's Ravine/Folsom Marina. This project could provide an opportunity to enhance vehicular access to Brown's Ravine/Folsom Marina from Green Valley Road

El Dorado Hills Boulevard - El Dorado County proposes to widen El Dorado Hills Boulevard to a four lane divided roadway from Governor/St.Andrews Drive to Green Valley Road. In addition, the project would extend El Dorado Hills Boulevard directly north of Crown Hills Drive through Francisco Drive to the existing Green Valley Road/Francisco Drive intersection.

East Natoma Street - The City of Folsom proposes to widen East Natoma Street from Fargo Way to Blue Ravine Road/Green Valley Road from two lanes to four lanes. The anticipated completion year is 2003.

Hazel Avenue - Sacramento County proposes to widen Hazel Avenue from Gold Country Boulevard to Madison Avenue. The Sacramento County Department of Transportation initiated a corridor study to identify project alternatives for Hazel Avenue. This two-year planning process relied heavily on the input of the public and specifically a 17-member Community Advisory Committee (CAC) that represented the interests of stakeholders along the Hazel Avenue corridor. The CAC presented the recommended project to the Board of Supervisors on July 23, 2002. The recommended project is a six-lane parkway with a center median and on-street bike lanes. The recommended project includes improved access to the American River Parkway for pedestrians and bicyclists, as well as provision for U-turns at selected intersections and for implementation of signal synchronization and Intelligent Transportation Systems. One alternative recommendation was presented to the Board by the CAC. This alternative is a widened four-lane roadway with emphasis on bicycle, pedestrian,

and bus transportation. Both alternatives will be evaluated in an Environmental Impact Report. This project currently has some funding programmed in the 2003/05 Metropolitan Transportation Improvement Program (MTIP). This project could present an opportunity to enhance vehicular, bicycle, and pedestrian access to the Lake Overlook.

Sophia Parkway – El Dorado County plans to construct a new four-lane divided roadway with a Class I (off-road) bicycle path. Sophia Parkway will connect Green Valley Road to Russel Ranch Road in Folsom. This project is estimated to be completed in 2005.

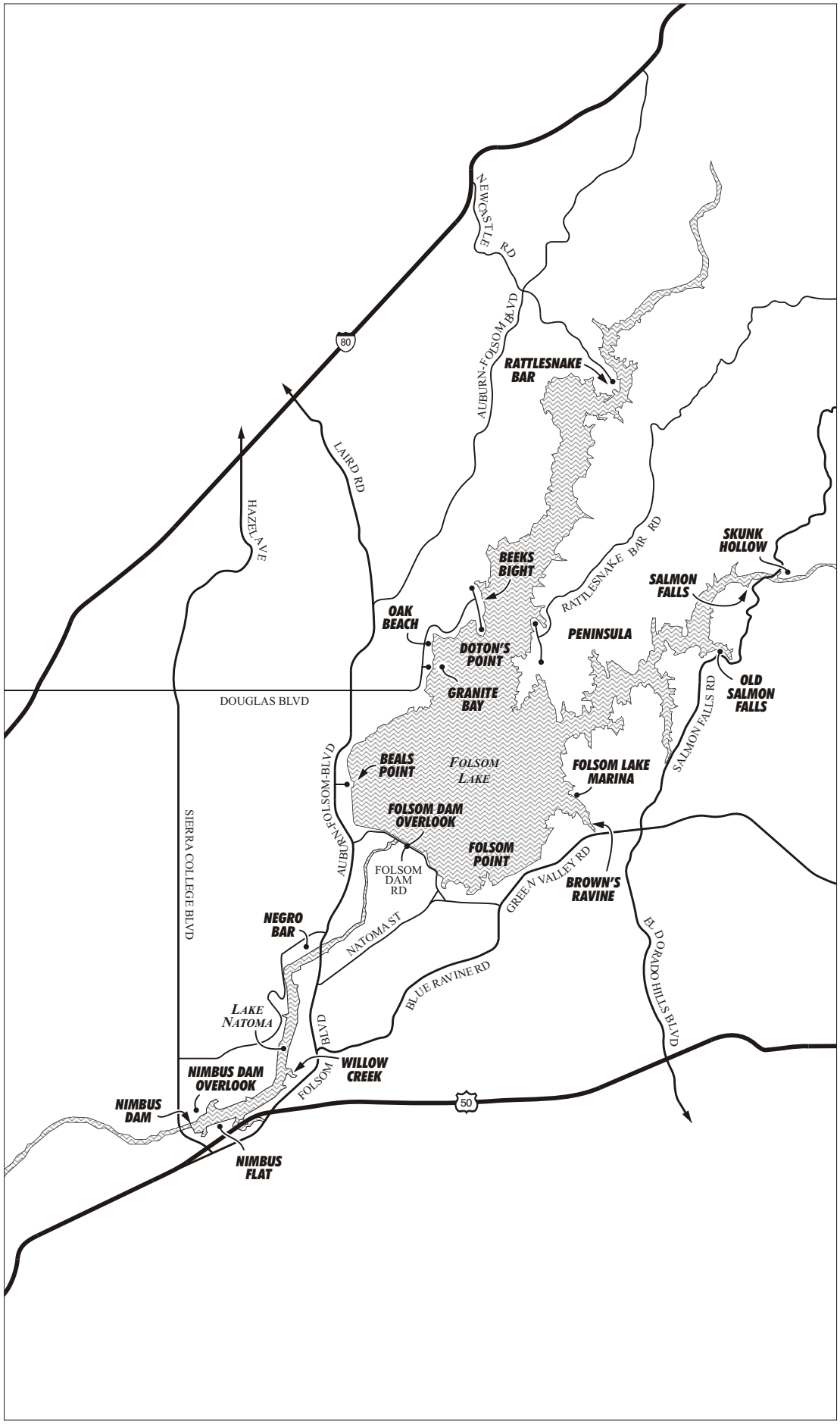
US-50 at El Dorado Hills Boulevard - El Dorado County proposes to reconstruct the US-50 interchange at El Dorado Boulevard. An eastbound off-ramp will be constructed and the westbound off-ramp will be widened. Also, a new two-lane extension of Saratoga Road from Arrowhead to Park Drive will be constructed. El Dorado Hills Boulevard will be widened from five to six lanes from Park Avenue/Saratoga to US-50 westbound ramps. The anticipated completion year is 2006.

Interstate 80 Interchange at Douglas Boulevard - The City of Roseville proposes to modify the interchange to improve the on and off ramps and to provide a new fly over ramp from eastbound Douglas Boulevard to southbound Sunrise Boulevard and a new underpass ramp from northbound Sunrise Boulevard to eastbound Interstate 80. The anticipated completion year is 2005.

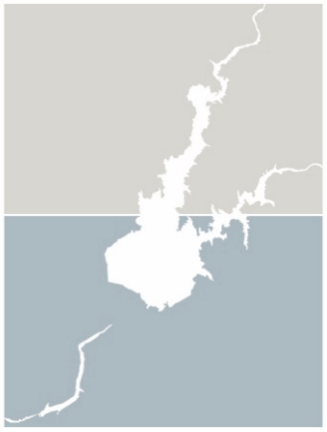
Rainbow Bridge - The City of Folsom has plans to rehabilitate Rainbow Bridge, which crosses the American River at historic Folsom. The purpose of this rehabilitation is to bring the old bridge up to current safety standards, but the number of lanes on the bridge would not change; therefore, this project would not affect access to the Unit.

Unit Circulation

The Unit is made up of many individual recreation areas, which provide access to Folsom Lake and Lake Natoma (American River). These recreation areas offer varied recreational opportunities including boating, camping, picnicking, swimming, hiking, and mountain biking. The location of each recreation area is illustrated in Figure TC-3. Two lane roadways with no curb and gutter characterize the circulation within each recreation area. Some pedestrian sidewalks and walkways are present at each area to direct visitors to major activity areas. Access to the individual recreation areas is provided by the public roadway system surrounding the lake. The major roadways providing access to these recreation areas are Douglas Boulevard, Auburn-Folsom Road, Folsom Dam Road, Green Valley Road and Salmon Falls Road. The text below provides a description of each recreation area's access from the public roads that provide circulation to the Unit. CDPR staff has indicated that



FOLSOM/LAKE/NATOMA



FIGURE

TC-3

PROJECT AREAS

Prepared by LSA Associates, Inc.

SOURCE: LSA Associates, Inc.

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0 1.5 3 MI

traffic congestion occurs at several of the recreation areas during peak summer weekends. At the time of preparation of this Resource Inventory, adequate data as to the existence or extent of this congestion was not collected. As stated previously, existing traffic counts will be collected during a typical summer weekend in June, 2003. At this time, any existing deficiencies will be documented. Without traffic data, it is inadvisable to make any conclusion about existing traffic impacts.

Observation Point

Also known as "Folsom Dam Overlook," this is a large paved parking area located off Folsom Dam Road, with views of Folsom Lake and the Folsom Dam. Observation Point it is currently closed due to security concerns related to the attacks on September 11, 2001 and staffing shortages. It has been proposed that the parking area be used as a potential turnaround for construction traffic from the dam modification project. This proposal could result in the installation of a traffic signal at this location.

When the Folsom Dam was completed in the 1950s, Folsom Dam Road was intended for maintenance use. As the population of the surrounding area increased, Folsom Dam Road became a major transportation artery between Placer and El Dorado Counties. After the bombing of the Murrah Building in Oklahoma City, and the events of September 11, 2001, concerns about security at the dam have increased. Up until March 1, 2003, the road was closed between the hours of 8:00 p.m. and 6:00 a.m. As of March 1, the road has been closed indefinitely.

The US Army Corps of Engineers (ACOE) is planning on raising Folsom Dam seven feet to reduce flood risk to the Sacramento area. A bypass road is also proposed as part of this project. The bypass road would provide for increased security of the dam. Currently a bill is before Congress (H.R. 2301) that would authorize funds to construct a bridge on Federal land west of and adjacent to Folsom Dam. Upon completion, the City of Folsom would assume responsibility for the operation and maintenance of the bridge. This proposal would provide for enhanced security of the Folsom Dam while maintaining and improving access between Placer and El Dorado Counties.

Beal's Point

Beal's Point is a day-use, campground, and boat launch facility. The entry to Beal's Point is the east leg of the signalized intersection of Auburn-Folsom Road/Oak Hill Drive. According to CDPR staff, during peak summer months, Beal's Point experiences high visitor volumes, especially on weekends and holidays and it is not uncommon for the parking areas to operate at capacity. During these times, visitor traffic has the potential to impact Auburn-Folsom Road.

Granite Bay

Granite Bay is a day-use and boat launch facility located at the eastern terminus of Douglas Boulevard. Two lane roadways provide access to the parking and recreation areas within Granite Bay and to the adjacent recreation areas of Oak Beach, Doton's Point, Beek's Bight, and Granite Beach. These day-use facilities are accessed via Granite Bay's internal circulation system and provide swimming areas, picnic areas, group picnic areas, an equestrian staging area and a signed interpretive trail. A 110 foot wide corridor through the

Los Lagos subdivision provides pedestrian, bicycle, and equestrian access to the Granite Bay recreation area. This corridor is located at roughly where the terminus of Rocklin Road would be if extended east from Barton Road. According to Placer County Planning Department staff, this corridor was originally intended to be a roadway providing access to Granite Bay. However, it is unlikely that Rocklin Road will be extended because of funding and environmental issues.

Rattlesnake Bar

Rattlesnake Bar is a day-use and boat launch facility located at the terminus of Rattlesnake Road. Visitors to Rattlesnake Bar access Rattlesnake Road directly from Auburn-Folsom Road or use Newcastle Road. Both Rattlesnake Road and Newcastle Road are narrow two lane rural roadways with sharp turns and rural residential driveways lining each side of the roadway.

Peninsula Campground

Peninsula Campground is a day-use, campground and boat facility accessed via Rattlesnake Bar Road near the community of Pilot Hill. Rattlesnake Bar Road is a narrow two lane rural roadway with sharp turns and some driveways lining each side of the roadway. Visitors to Peninsula Campground can access Rattlesnake Bar Road from Salmon Falls Road or from State Route 49 (Coloma Road).

Salmon Falls/Skunk Hollow

These areas are located on Salmon Falls Road near the crossing with the South Fork of the American River. Both areas are accessed via driveways off of Salmon Falls Road. Facilities for the take-out of private boats and commercial rafts, and parking areas are provided at Salmon Falls and Skunk Hollow. A small upper parking area is located at Skunk Hollow adjacent to the trailhead for the Darrington Trail, which is heavily used by mountain bikers.

Old Salmon Falls

Old Salmon Falls is a day-use facility with a dirt parking lot accessed from a steep, narrow road off of Salmon Falls Road. Ownership of this narrow road is uncertain. An adjacent property owner may own a portion of it. If any further development were to occur that relied on this road for access, the ownership of the road would need to be clarified.

Brown's Ravine/Folsom Marina

Brown's Ravine/Folsom Marina is a day-use facility with several boat launch ramps, a mooring with 685 slips and a large paved parking area. Access to Brown's Ravine/Folsom Marina is provided off of Green Valley Road via the north leg of the Hidden Acres Drive/Green Valley Road intersection. The entry to Brown's Ravine/Folsom Marina is within the limits of the Green Valley Road Widening project, which could create an opportunity to improve access to Brown's Ravine/Folsom Marina. According to CDPR staff, during busy periods, Folsom Marina experiences on-site congestion due to high traffic volumes and inadequate signage.

Folsom Point

Folsom Point is a day-use picnic area with a boat launch facility and paved parking areas. Access to Folsom Point is provided off of Natoma Street via the north leg of the Briggs Ranch Drive East/Natoma Street intersection.

Negro Bar

Negro Bar is a day-use, picnic and swimming area with a group campsite facility. It is accessed from Greenback Lane via a driveway just east of Folsom Boulevard. According to CDPR staff, Negro Bar experiences moderate use and rarely reaches full capacity with the exception of the July 4th holiday.

Lake Overlook

The Lake Overlook is a small, paved parking area and observation point located off of Hazel Avenue just north of Nimbus Dam. Access to the site is provided via a right-in/right-out only driveway off Hazel Avenue. Vehicular access to the Lake Overlook is restricted due to the absence of a full access driveway into the site. The proposed widening of Hazel Avenue may provide an opportunity to improve access to the Lake Overlook.

Nimbus Flat

Nimbus Flat is a day-use, picnic and small, personal watercraft launch facility located adjacent to the California State University Sacramento (CSUS) Aquatic Center with a paved parking lot. Access to Nimbus Flat is provided via an unsignalized access road located off Hazel Avenue, southeast of Gold Country Boulevard. This access provides right turn inbound and outbound moves only. No left turns in or out of this driveway are permitted. This route is the only point of access to Nimbus Flat; no vehicular connections between Nimbus Flat and the CSUS Aquatic Center are provided.

CSUS Aquatic Center

The CSUS Aquatic Center contains storage, classroom and administrative buildings as well as its own parking lot. The site experiences heavy visitor use almost all year round from CSUS students and children taking classes at the Aquatic Center. Access to the CSUS Aquatic Center is provided via the east leg of the signalized intersection of Hazel Avenue/Gold Country Boulevard. This route is the only point of access to the CSUS Aquatic Center; no vehicular connections between Nimbus Flat and the CSUS Aquatic Center are provided.

Willow Creek

Willow Creek is a day-use facility with a non-motorized boat launch located off Folsom Boulevard. In the vicinity of the Willow Creek Driveway, the northbound and southbound directions of Folsom Boulevard are physically separated. As a result, access to Willow Creek is only provided via a right turn from southbound Folsom Boulevard. The configuration of Folsom Boulevard in this area restricts driveway movements to right-in/right-out only.

Public Transportation

Public transportation is currently provided to the Unit via bus and light rail service. Bus service to and from the Unit within the City of Folsom, City of Roseville, Sacramento County, and Placer County is primarily provided by Folsom Stage Line, Roseville Transit, Sacramento Regional Transit, and Placer County Transit, while light rail transit is provided by Sacramento Regional Transit. The public transit in the area is described in detail below.

Bus Service

Folsom Stage Line - The primary bus service provider in the vicinity of the Unit is the Folsom Stage Line. Folsom Stage Line serves the City of Folsom and is the bus service provider to the southern region of the Unit. Specifically, the site is served by Route 10 – Main/Madison (Regional Transit Connection). Folsom Stage Line also provides service between the City of Folsom and the Butterfield Light Rail station.

Sacramento Regional Transit - Sacramento Regional Transit does not directly serve the Unit but provides connecting service to routes that directly serve the Unit. Sacramento Regional Transit primarily operates busses and light rail for Sacramento County commuters. Route 24 (Madison – Greenback) connects to the Folsom Stage Line for direct access to the Unit.

Roseville Transit - Roseville Transit does not directly serve the Unit but provides connecting service to routes that directly serve the Unit. Roseville Transit primarily provides bus service to the City of Roseville.

Placer County Transit – Placer County Transit provides a Dial-A-Ride service in Granite Bay for direct access to the Unit.

Rail Service

Sacramento Regional Transit – Sacramento Regional Transit (RT) operates light rail service from Downtown Sacramento to the Mather Field/Mills Station in Rancho Cordova. Regional Transit will begin work on the Amtrak/Folsom Light Rail Project – Folsom Extension in the Spring of 2003. This project will extend light rail service from the Mather Field/Mills Station to Downtown Folsom. This project will add 7.4 miles of light rail to the current line and proposes new stations at Zinfandel Drive, Cordova Town Center, Sunrise Boulevard, Hazel Avenue, Iron Point Road, Glenn Drive/Folsom Boulevard (Silverbrook Station), and in Historic Folsom. Both the Iron Point and Silverbrook Stations will be located on Folsom Boulevard directly across from the Unit boundary and could significantly improve transit access to the Unit. While the new American River Bridge in the City of Folsom was constructed to accommodate light rail, RT currently has no plans to extend the planned Folsom Extension light rail line beyond Historic Folsom.

Amtrak - Amtrak provides intercity passenger rail throughout the country. In the vicinity of the Unit, Amtrak provides passenger rail service from Sacramento and Roseville. Amtrak's Capitol Corridor route provides service to Auburn in the east and San Jose in the south.

Sacramento-Placerville Transportation Corridor (SPTC) – This railroad right-of-way runs 53 miles between 65th Street near Brighton in Sacramento and Forni Road near Apex just west of Placerville. In 1996, the Sacramento-Placerville Transportation Corridor Joint

Powers Authority purchased this right-of-way in order to preserve it for future use as a regional rail transportation corridor while utilizing it in the interim for utility, transportation, trail, and recreational uses. The SPTC Master Plan specifies that all uses should be considered along the entire length of the Corridor, particularly the provision of an unfragmented trail without removing the existing railroad tracks. The ultimate objective is to end up with a continuous viable regional multipurpose transportation corridor linking Sacramento County, the City of Folsom, and El Dorado County. A possible link between the SPTC and the American River Bikeway would open up a myriad of alternative transportation options (bicycle, equestrian, pedestrian) to the southern areas of the Unit.

Recommendations

This section was prepared using current available traffic data from the Caltrans website and traffic data provided by the City of Folsom, City of Roseville, Placer County, and El Dorado County. It should be noted that very few existing peak hour traffic counts at intersections in the vicinity of the Unit were available. The daily traffic volumes on surrounding roadways that were available are illustrated in Figure TC-2.

Once the General Plan has been finalized and the traffic impact study is initiated, it is recommended that public agencies be contacted again to determine whether new daily or peak hour traffic counts have become available. If these counts are not available, it is recommended that new traffic counts be taken at the locations listed below. These locations are subject to change based on public input received during the planning process and the Notice of Preparation (NOP) comment period.

Roadways

- I-80 (Roseville Freeway)
- US-50 (El Dorado Freeway)
- Douglas Boulevard
- Auburn-Folsom Road/Folsom Boulevard
- Natoma Street
- Green Valley Road
- El Dorado Hills Boulevard

Intersections

- Auburn-Folsom Road/Rattlesnake Road
- Auburn-Folsom Road / Douglas Boulevard
- Auburn-Folsom Road /Oak Hill Drive (Beal's Point)
- Folsom-Auburn Road / Folsom Dam Road
- Folsom Boulevard / Greenback Lane-Riley Street
- Folsom Boulevard / Blue Ravine Road
- Folsom Boulevard / Willow Creek Day Use Area entrance
- Folsom Dam Road / Natoma Street
- Hidden Acres Drive (Folsom Marina) / Green Valley Road
- El Dorado Hills Boulevard-Salmon Falls Road / Green Valley Road

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LAND USE, TRAFFIC/CIRCULATION, AND UTILITIES

UTILITIES

Folsom Lake State Recreation Area

April 2003

by

Psomas

2295 Gateway Oaks Drive, Suite 250

Sacramento, CA 95833

List of Figures

Figure U-1a: Utility Easments (Folsom Lake) U-11

Figure U-1b: Utility Easements (Lake Natoma)..... U-12

UTILITIES

Introduction

Psomas prepared this summary to describe the existing utility infrastructure within the Folsom Lake State Recreation Area (Unit). The purpose of this summary is to:

- Document the existing water, sewer, electric, and telephone utilities that service the Unit.
- Identify major non-California Department of Parks and Recreation (CDPR) utility easements throughout the Unit.
- Identify issues and impacts related to the non-CDPR utility easements.

The existing utility infrastructure within the Unit consists of CDPR-owned systems that provide water, sewer, electricity, and telephone service to some of the day use areas, campgrounds, access points, and other CDPR and Bureau of Reclamation (BOR) facilities. In collecting an inventory of the existing CDPR-owned utilities, Psomas staff researched Unit as-builts, field-inspected Unit areas, and interviewed employees from the Gold Fields District. This section contains a general description (as well as approximate locations) of the utilities included in the inventory. Many Unit as-built plans were incomplete or missing; therefore, exact locations, types, and sizes of CDPR-owned utilities could not be verified for most of the Unit facilities.

This section also documents major non-CDPR utility corridors and easements within the Unit. Several companies and agencies [including PG&E, Sacramento Municipal Utility District (SMUD), Western Area Power Association (WAPA), San Juan Water District, El Dorado Irrigation District, the City of Folsom, and the City of Roseville] own utility lines that cross CDPR and BOR properties. This section discusses the approximate location of the utility easements and the impacts of these corridors on the Unit.

Description of Existing Utilities

District Headquarters/Bureau Offices

CDPR Gold Fields District and BOR share a common Headquarters compound. This compound is located at the corner of Folsom Dam Road and Folsom-Auburn Road, and includes maintenance buildings, staff office space, and the American River Water Education Center. If a new bridge and crossing is built to replace the Dam Road as a public roadway, both CDPR and BOR would require the development of a new administration building and other facilities. Preliminary conceptual planning has been conducted on possible locations for such new development. Most CDPR and BOR facilities are currently connected to public utilities (Keith Stallcop. 2002.). Both water and sewer facilities are connected to service lines from the City of Folsom on Folsom-Auburn Road. Electric utilities are provided by SMUD, WAPA and Pacific Gas & Electric (PG&E). Telephone service is also available. No natural

gas connections are provided; however, propane is used to heat water used for showers and restrooms.

Observation Point

Observation Point contains a large parking lot with a kiosk overlooking the dam and lake. The parking lot is used primarily by fishermen. However, since September 11, 2001, the parking lot has been closed due to security reasons, as it is the nearest access point to the dam. Some members of the public have suggested that a restaurant or meeting facility be constructed at Observation Point; however, no plans for such development have yet been established.

Currently, Observation Point has no on-site water, sewer, or telephone utilities (Keith Stallcop. 2002.). If development of this area is proposed, water and sewer utilities could be extended from City of Folsom main lines on Folsom-Auburn Road or East Natoma Road. The parking lot obtains electricity from Western Area Power via lines from Folsom Prison.

Beals Point

Beals Point offers tent and recreational vehicle (RV) camping, with approximately 69 campsites, including 20 RV campsites with electrical hookups. Day use facilities include parking, flush toilets, picnic tables, swimming beaches, and a dirt launch ramp. Food concession and boat rentals are located next to the designated swimming beach.

Beals Point is connected to public utility systems (Keith Stallcop. 2002.). The Placer County system provides sewer service, and the San Juan Water District provides water service. Water and sewer lines extend from Folsom-Auburn Road to the campground's two restrooms and showers, the food concession, the restroom next to the food concession, and the restroom in the day use parking area. PG&E provides electricity. Electric lines extend to the restrooms, the food concession, and the RV campsites. A telephone line extends to the kiosk, the lifeguard tower, and the food concession. No natural gas service exists at the facility. Electric hot water heaters generate hot water for the showers, restrooms, and food concession. Propane gas heaters generate hot water for the RV sites. The site utilizes an existing sewer lift station at the food concession and two existing sewer lift stations in the campground.

Granite Bay (includes Oak Beach, Beeks Bight, Dotons Point)

The most popular day use facility in the Unit is Granite Bay with a series of facilities spread over three distinct subareas. The Main Beach area includes a 1,200-foot-long guarded swim beach, snack bar, beach equipment, concessions, restrooms, picnic areas, activity center, and parking areas. The North Granite area includes an informal beach area at Oak Point, equestrian staging area, Dotons Point, and Beeks Bight. The main boat launch facilities on Folsom Lake are located on Granite Bay, just south of the Main Beach area. These facilities are designed for powerboat, personal watercraft (jetski), and sailboat launching and include paved and demarcated ramp lanes and parking, picnic ramadas and restrooms.

Granite Bay provides several public utility connections (Keith Stallcop. 2002.). Three restrooms at the Main Beach and one restroom at the Stage 4 boat ramp at the Granite Bay Boat Launch are connected to public water system. The San Juan Water District provides water service. The sewer for these facilities connects to a leach field system. CDPR is

currently adding another restroom at the 5 percent boat ramp at the Granite Bay Boat Launch, which will also be connected to the public water and leach field systems. Currently, four sewer lift stations exist in Granite Bay—one for each of three day-use beach restrooms and one for the Stage 4 boat ramp restroom. The 5 percent boat ramp bathroom will also have a new lift station.

Electricity and telephone service exists at the entrance kiosk, residence, shop, and concession stand located near the Main Beach area. The restrooms at the activity center, day-use beach, and Stage 4 boat ramp all have electricity. All of the boat ramps have both electricity and lighting.

The residence, shop, and kiosk bathroom are connected to San Juan Water District services. The sewer for these buildings connects to a septic tank and leach field system, which consists of two leach fields—one north of the residence and one south of the residence.

No public utilities are available at the horse staging area, Oak Beach, Beeks Bight, or Dotons Point. CXT vault toilets are provided at Oak Beach, Beeks Bight and Dotons Point, and a porta-potty is provided at the horse staging area. Since the horse staging area is near a residential area, a restroom constructed at this location could be connected to public utilities. Oak Beach, Beeks Bight, and Dotons Point could be connected to public utilities; however, the sites are remote and would require sewer lift stations and extensive piping.

Horseshoe Bar (Sterling Point, Eden Rock)

The Horseshoe Bar area is an informal access point to the Unit, which does not contain any utilities or restrooms (Keith Stallcop. 2002.). Since neither CDPR nor the BOR own the parcel at the end of Horseshoe Bar Road, this area is not considered a CDPR access point into the Unit.

Rattlesnake Bar

Rattlesnake Bar is used primarily as a boat launch ramp, and no public water or sewer utilities are available (Keith Stallcop. 2002.). CDPR installed a water system (a well plus a 35,000-gallon storage tank) to support a residence formerly in use at this site; however, this system is no longer in operation. Porta-potties and a CXT vault toilet are available in the parking lot. The entrance kiosk includes telephone and PG&E electrical service. Electrical lines also extend to the well and to the lights in the parking lot.

If facility development is proposed for this site, the existing well water system would require renovation. The steep topography in the area limits the possibility for installation of a sewer leach field; however, the old trailer pad by the parking lot may accommodate a smaller leach field.

Peninsula

The Peninsula area is largely undeveloped. The Peninsula facility includes a campground with 104 campsites, five restrooms, two boat ramps, and a small amphitheater for group use. Seasonal housing for four CDPR employees and a small maintenance yard are located nearby. The north launch ramp has a boat launch with day use facilities and a small beach. The Peninsula Campground offers 104 campsites, a boat launch, and flush toilets.

The Boat Launch area does not have a sewer system (Keith Stallcop. 2002.); however, porta-potties are available in the parking lot. Sufficient land area is available in the vicinity of the Boat Launch area for construction of a septic tank and leach field system. Since the groundwater table is high in the area near the lake, the leach field may require a more uphill location. An uphill leach field system would require a sewer lift station and electricity; electrical utilities could be extended from a main line at the Peninsula Campground. If a suitable leach field site is unavailable, waste from the boat launch area could be pumped to the Peninsula Campground system. Pumping would require a lift station, electricity, and a new sewer force main.

The Boat Launch area contains a small well, which supplies irrigation water for parking lot landscaping. This well could possibly be expanded to provide water for flush toilets. A new water main could also be constructed to transport water from the Peninsula Campground.

The Peninsula Campground contains a complete potable (disinfected with chlorination) water system (Keith Stallcop. 2002.). This system, which pumps well water into a 50,000-gallon water storage tank, was revamped in 2002. The system delivers water to five existing restrooms with flush toilets and various drinking fountains throughout the campground.

The Peninsula Campground sewer system consists of a collection system and a leach field. The restroom waste is gravity fed to a lift station. A 3-inch sewer force main conveys the waste from the lift station to a leach field, which is located between the residences and a shop southeast of the campground. In the early 1990s, CDPR renovated a portion of the sewer collection system; however, the sewer lift stations require revamping due to their age and poor condition.

CDPR would like to add showers in the campground if possible. If showers are added, the existing pipes in the water system may require replacement by larger diameter pipes. The sewer leach field system may also require expansion.

Skunk Hollow (Lower Half of the South Fork River)

Skunk Hollow is used primarily by private whitewater boaters (kayaks and rafts) as a river take-out point. Skunk Hollow facilities include a small paved parking area, a raft loading zone with drying rows, a paved path (roughly 15 feet wide) from the river to the parking areas, and several picnic tables.

No public utilities are available at Skunk Hollow. Two CXT vault bathrooms (approximately 4 years old) are provided at the end of the parking lot. If CDPR wants to add a water system, a well could be developed. Although insufficient space exists for construction of a leach field, waste could be gravity fed to Salmon Falls where a leach field could be installed. Electrical utilities could be added, but new lines would extend several miles to the nearest connection.

Salmon Falls (Lower Half of the South Fork River)

Salmon Falls is located just west of Skunk Hollow. This site is primarily used by commercial whitewater boaters, non profit boating organizations, fisherman, and mountain bikers. Facilities include a large area for parking and queuing, informal take-out areas, four vault toilets, and drinking water. The parking area includes two lots;commercial boaters and busses

are restricted to the east parking lot. Both parking lots are old, and CDPR wishes to reconfigure the layout if possible, possibly adding a staging lane for the unloading of boats as well as more parking.

No public water or sewer utilities are available at Salmon Falls. The parking lots contain two CXT vault bathrooms. If CDPR would like to add a water system, a well could probably be developed. A leach field system for flush toilets could possibly be installed; however, space is limited. Electrical utilities could be added, but new lines would have to extend several miles to the nearest connection.

Telephone service is available; however, CDPR has discontinued maintenance of the phone due to frequent vandalism.

Sweetwater Creek

The Sweetwater Creek area is an informal, undeveloped access point to the Unit used as trailhead parking. There are no utilities or restrooms at this site.

Old Salmon Falls (Falcon Crest, Jacks Shack, Monte Vista)

The Old Salmon Falls area includes the old Monte Vista Campground, the Ponderosa pine plantation, a beach access site, and trailhead parking. Informal parking is also located at Falcon Crest, just off Salmon Falls Road. The parking area contains a horse trough and drinking fountain, but no other utilities. This site is informally used as a horse staging area, although it is not a formal CDPR access point to the Unit and actually contains "No Parking" signage.

The old Monte Vista Campground is accessed from the Falcon Crest informal parking lot via a ¼-mile-long dirt trail. CDPR has considered using the old campground area for a group camp or environmental camp.

A partially paved access road off Salmon Falls Road leads down to the Old Salmon Falls parking lot. The lot provides beach and trail access and parking. The lot is unpaved and not well known. The Ponderosa pine plantation is accessed from the Old Salmon Falls parking lot.

The old Monte Vista campground (which is no longer being operated) does have a drinking fountain but no septic system. If development is proposed in this area, electrical and telephone utilities could possibly be extended from El Dorado Irrigation District service lines near the Falcon Crest area. Installation of a septic tank and leach field system would be required.

No public utilities are available at the Old Salmon Falls parking lot; however, a porta-potty is available. Insufficient area exists for installation of a leach field at the site. If development is proposed in this area, water, electric, and telephone utilities could be extended down from the Falcon Crest area. Pumping of sewer waste to a suitable leach field site, possibly near the old Monte Vista Campground, would be required. As the road to the Old Salmon Falls area is privately owned, CDPR would need an easement to construct utility lines at this location.

Browns Ravine

Browns Ravine contains the only Marina on the Lake. Facilities at Browns Ravine include 685 wet slips, 175 dry storage slips, two launch ramps, flush toilets in the restrooms, day use parking, and a small Marina store. The concessionaire wishes to increase the number of boat slips, as a 9- to 10-year waiting list reflects an increased demand. The concessionaire has reported that, because of the proximity of the upper launch ramp to the day use parking, the day use parking entrance is often blocked by the queue for the ramp. Construction of a more effective waiting lane and turnaround could alleviate this conflict. The California Department of Boating and Waterways has determined subsurface storm drains are required to remove standing water in the parking lot. A culvert on the entrance road is also undersized, creating flooding in the parking areas. The concessionaire has proposed the creation of more boat slips, increased parking, and additional restrooms at the Marina to accommodate Unit visitors.

Browns Ravine is connected to public utilities. Water and sewer system lines extend from the El Dorado Irrigation District systems off Green Valley Road. Electrical and telephone service is available; however, natural gas is not available. As mentioned above, two restrooms are provided in the parking lots; however, no showers are provided. If additional restrooms are installed or showers are added, the water and sewer pipes from Green Valley Road may require enlargement.

Mormon Island Wetlands Natural Preserve

The Mormon Island Wetlands Natural Preserve is a dense riparian woodland and wetland area. CDPR is considering ways to facilitate access to the Mormon Island Wetlands as the existing trail is overgrown. Facilities are not provided in the Preserve's informal parking area.

No water or sewer facilities are available at the existing parking area (Keith Stallcop. 2002.). Existing utilities are located adjacent to the existing parking lot. However, CDPR could potentially hook up existing public utilities located on Green Valley Road or a nearby subdivision.

Folsom Point

Folsom Point is a day use area with a swimming beach and a boat launch ramp. Facilities include two CXT vault toilets in the day use area and porta-potties in the launch ramp parking lot. In 2002, the Gold Fields District installed a 3-inch water main and a new sewer line within the entrance road into the Unit (Keith Stallcop. 2002.). These utilities are hooked up to City of Folsom utility lines on East Natoma Road. The new water and sewer lines extend to the kiosk and the new bathrooms currently under construction at the launch ramp. CDPR could extend these lines into the day use area. Since Folsom Point is lower in elevation than the entrance road, sewer lift stations were installed to transport the sewer back to East Natoma Road. Electrical service is provided to the kiosk on the entrance road.

Negro Bar

Facilities at Negro Bar include a swim beach, flush toilets, boat rentals, day use facilities, a group campground, horse staging area, paved parking, trail head access, a small "cottage"

currently used for administrative purposes, and a small boat launch. Paved trails that are part of the American River bike trail system also permit access for emergency vehicles. The Rainbow Rocks area of Negro Bar has a small paved parking area that is currently closed to vehicles.

Potential improvements could include redesign of the facilities near the Rainbow Rocks area and enhancement of facilities in the group campground and boat launch parking areas. The amount of paved parking provided in these areas far exceeds use. CDPR is investigating the interpretative opportunities of the "cottage," including an environmental camp area and a center for African American history and mining in the region.

Public utilities are available at Negro Bar (Keith Stallcop. 2002.). Water and sewer main lines hook up to City of Folsom lines on Greenback Lane. These lines extend to the bathrooms at the swim beach parking lot. The water line also extends to the group campground and the "cottage." The group campground and "cottage" are on leach fields. PG&E electrical service is available to the "cottage," kiosk, and swim beach bathrooms; telephone service is available to the kiosk and "cottage." Natural gas is not available. The cottage has a propane tank.

Public utilities are not available at the Rainbow Rocks swim or boat launch areas. A CXT vault toilet is provided at Rainbow Rocks. A floating vault toilet is provided at the boat launch.

If development is proposed at Negro Bar, public utilities could easily be extended throughout the area. Lift stations currently exist near the swim beach restroom and along the main entrance road. However, lift stations would be required to transmit waste up to the main collection at Greenback Lane. The "cottage," group campground, and other areas would also require sewer lift stations to connect these sites to the public sewer system.

Snipes Pershing Ravine

The Snipes Pershing Ravine, a recent CDPR acquisition, includes most of the watershed of a small creek that empties into Lake Natoma just east of Mississippi Bar. If development is proposed in this areas, CDPR could potentially hook up to existing utilities in the adjacent subdivisions.

Mississippi Bar

Mississippi Bar is an old mining site, used by Teichert Aggregates and dredgers during historic gold mining. Throughout the area, large piles of tailings are interspersed with ponds and pockets of vegetation. The paved bike path along the northwest shoreline of Lake Natoma runs across the Bar, and several dirt trails traverse the area. The Shadow Glen Riding Stable concession is located on the north side of the Bar.

If development is proposed here, CDPR could potentially hook up to utility lines near the Shadow Glen Riding Stable. Well water is already available here and electricity and telephone service is available from new facilities at the Stable. The Stable's sewer system consists of a septic tank and leach field. Sewage would require pumping to the sewer lines of adjacent subdivisions or into a new leach field. A main line owned by the Fair Oaks Water District could provide water service.

Lake Overlook

The Overlook offers views of Lake Natoma, the foothills, and the surrounding valley. Facilities here include a paved parking area, an unpaved parking area (horse staging area and trailhead), and a porta-potty. No water, sewer, or other facilities are available at the Overlook (Keith Stallcop. 2002.). CDPR staff have expressed interest in a plan to better utilize this site.

If development is proposed at this site, CDPR could potentially hook up to utility lines on Hazel Avenue or subdivisions to the north. The Fair Oaks Water District would provide water service. Due to the elevation increase up to the Overlook, a water booster station may be required to transport water to the site. Sacramento County could provide sewer service. According to Sacramento County, the sewer lines in this area are at or near capacity. CDPR would have to provide the County with projected visitation and facility size in order to determine if public sewer service is possible. Alternatively, CDPR could install a leach field.

Nimbus Shoals

Nimbus Shoals is a small site, located just below Nimbus Dam, that is used primarily for fishing. CDPR staff have expressed interest in redesigning the parking area to limit vehicle access on the gravel bar and to protect the riparian vegetation.

No water, sewer, or other facilities are available here. A porta-potty is provided in the parking lot. If development is proposed at this site, CDPR could easily hook up to utilities on Hazel Avenue. However, Sacramento County has indicated that the public sewer system in this area is at or near capacity. CDPR will have to provide the County with projected visitation and facility size in order to determine if public sewer service is possible. Alternatively, CDPR could install a leach field in the vicinity of Nimbus Shoals provided site specific tests were performed to determine an adequate leach field location.

Aquatic Center

The Aquatic Center on Lake Natoma is operated by California State University, Sacramento (CSUS). The Aquatic Center offers a variety of boating classes and boat rentals, and is used by the CSUS rowing teams, high school rowing clubs, and a masters rowing club. Water, sewer, electricity, natural gas, and telephone utilities are available. The Sacramento Municipal Utility District provides electrical service. PG&E provides natural gas service. Pacific Bell provides telephone service.

Arden Cordova Water Service provides water via a 2-inch water line. The Arden Cordova Water Service has stated that the service was only meant to provide water to the Aquatic Center and should not be used for other facilities without special approval (Scott Fort. 2003.). CDPR installed a larger water line after the 2-inch connection; however, the 2-inch point of connection limits its ability to provide adequate service to fire hydrants or to additional facilities. Additional service connections will likely require a service connection larger than the 2-inch tie-in. If CDPR would like to have fire flow at the facility (for un-sprinklered buildings), the installation of a booster station or a separate waterline for fire hydrant connections into the Arden Cordova water main will likely be required.

Sewer service is connected to the Sacramento County system. Sacramento County has indicated that the public sewer system in this area is at or near capacity (Jeff Atterberry.

2003.). CDPR will have to provide the County with projected visitation and facility size in order to determine if additional or expanded public sewer services are possible. The County has expressed concerns that the existing sewer system may not be able to handle the increased sewer flows associated with the use of the site as an Olympic event station. CDPR should consult with Sacramento County on any future facility expansion plans.

Nimbus Flat

Nimbus Flat is a popular day use area located along Lake Natoma near the Aquatic Center. Facilities include two small unguarded beaches, an observation area, personal watercraft dock, two restrooms, and parking. In addition, this area includes two employee residences and a maintenance shop. The two restrooms in the day use area and the bathroom at CDPR maintenance shop are connected to public water and sewer systems. The two residences and mobile home are on well water and septic tank/leach field systems. Electricity and telephone service are available at the site.

CDPR is currently engaged in the process of transferring the residences and mobile home to public water and sewer service. No natural gas is currently available; however, natural gas lines could possibly be extended from PG&E main lines near the Aquatic Center. Propane hot water systems currently rely on propane tanks.

Sacramento County has noted that the sewer service in this area is at or near capacity. CDPR will have to provide the County with projected visitation and facility size in order to determine if additional or expanded public sewer services are possible. The County has expressed concerns that the existing sewer system may not be able to handle the increased sewer flows associated with potential increased use of the site. CDPR should consult with Sacramento County on any future facility expansion plans.

Willow Creek/Museum Flat

The Willow Creek site offers day use facilities, a small boat launch, gravel parking areas, and a vault toilet. Currently, no public utilities are provided at the site. However, CDPR could potentially hook up to nearby public utilities at Folsom Boulevard.

Museum Flat is a relatively level, grassland area located near Highway 50 and Folsom Boulevard. Proposals have been made to locate a State Native American museum at the site. If development is proposed, CDPR could easily hook up to public utilities on Folsom Boulevard.

Folsom Powerhouse State Historic Park

The Folsom Powerhouse is one of the oldest hydroelectric facilities in the world. Facilities include lake access (via a trail), picnic facilities, a museum, a gift shop, and small parking areas. The City of Folsom provides public water and sewer service for the bathrooms at this site. Electricity and telephone service are also available at the site.

Utility Easements Through the Unit

Several companies and agencies own utility lines that pass through the Unit (see Figure U-1a and Figure U-1b). CDPR and the BOR have granted easements for these utilities to the utility owners. Easements provide the utility owners with permanent and guaranteed access to pipelines or transmission lines for maintenance and repair purposes. Typically, CDPR and BOR are not responsible for maintenance of these easements (e.g., clearing overgrown vegetation, making pipe repairs, or other maintenance activities).

Development cannot occur within existing utility easements. With special approval, new roads and utilities can traverse existing easements. The expansion plans of two utility owners—the San Juan Water District and the El Dorado Irrigation District—may affect future Unit land use. Each utility owner adopts its own policy for vegetation removal, tree trimming, and easement maintenance. These policies may not be consistent with those of CDPR. Therefore, CDPR should communicate its policies for vegetation removal, resource protection, and fire fuels management with utility owners.

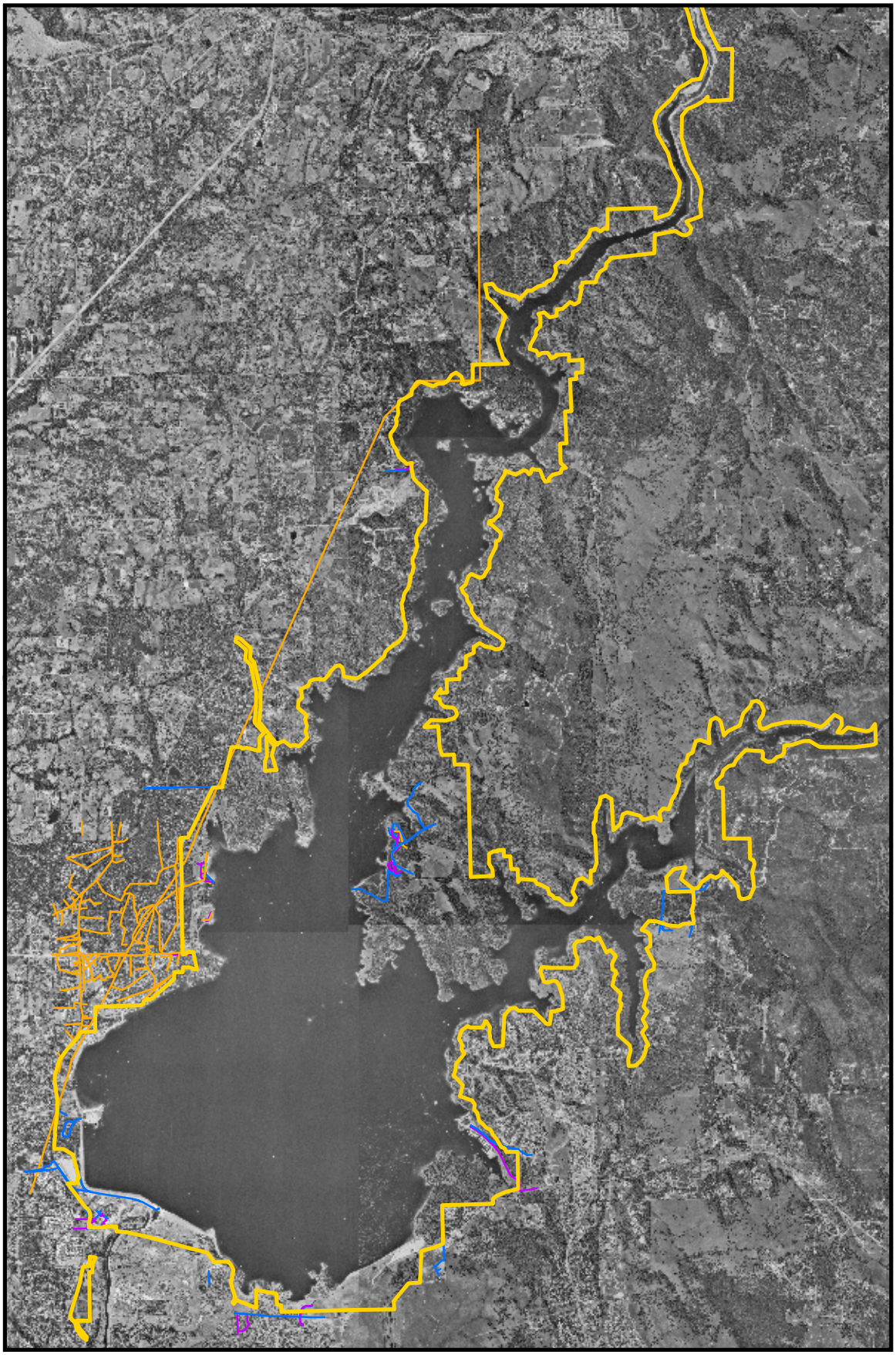
Entities with major utility easements include:

- PG&E
- City of Roseville
- San Juan Water District
- Western Area Power Administration (WAPA)
- Sacramento Municipal Utility District (SMUD)
- El Dorado Irrigation District
- City of Folsom

PG&E Easements

Pacific Gas & Electric Company (PG&E) owns and maintains a 115-killivolt (kV) electric tower line known as the Placer-Goldhill line. This line extends between Folsom Lake and Auburn Folsom Road from north of Rattlesnake Bar Road to the Sacramento area. The 115-kV line passes through the Unit in the Rattlesnake Bar and Granite Bay areas. There are no planned expansions for this line.

PG&E also operates a small hydroplant, the Newcastle Powerhouse, at the end of Newcastle Road off Rattlesnake Road just east of Rattlesnake Bar. The hydroplant generates power using extra water from the Placer County Water Agency raw water canals. PG&E does not operate the plant at full capacity year-round due to limited supply at certain times of the year. PG&E has no plans to expand this plant (Bill Snyder. 2003.).



FOLSOM LAKE STATE RECREATION AREA RESOURCE INVENTORY

Unit Boundary

TYPE OF EASEMENT

- ELECTRIC
- ELECTRIC & TELEPHONE
- SEWER
- WATER

FIGURE

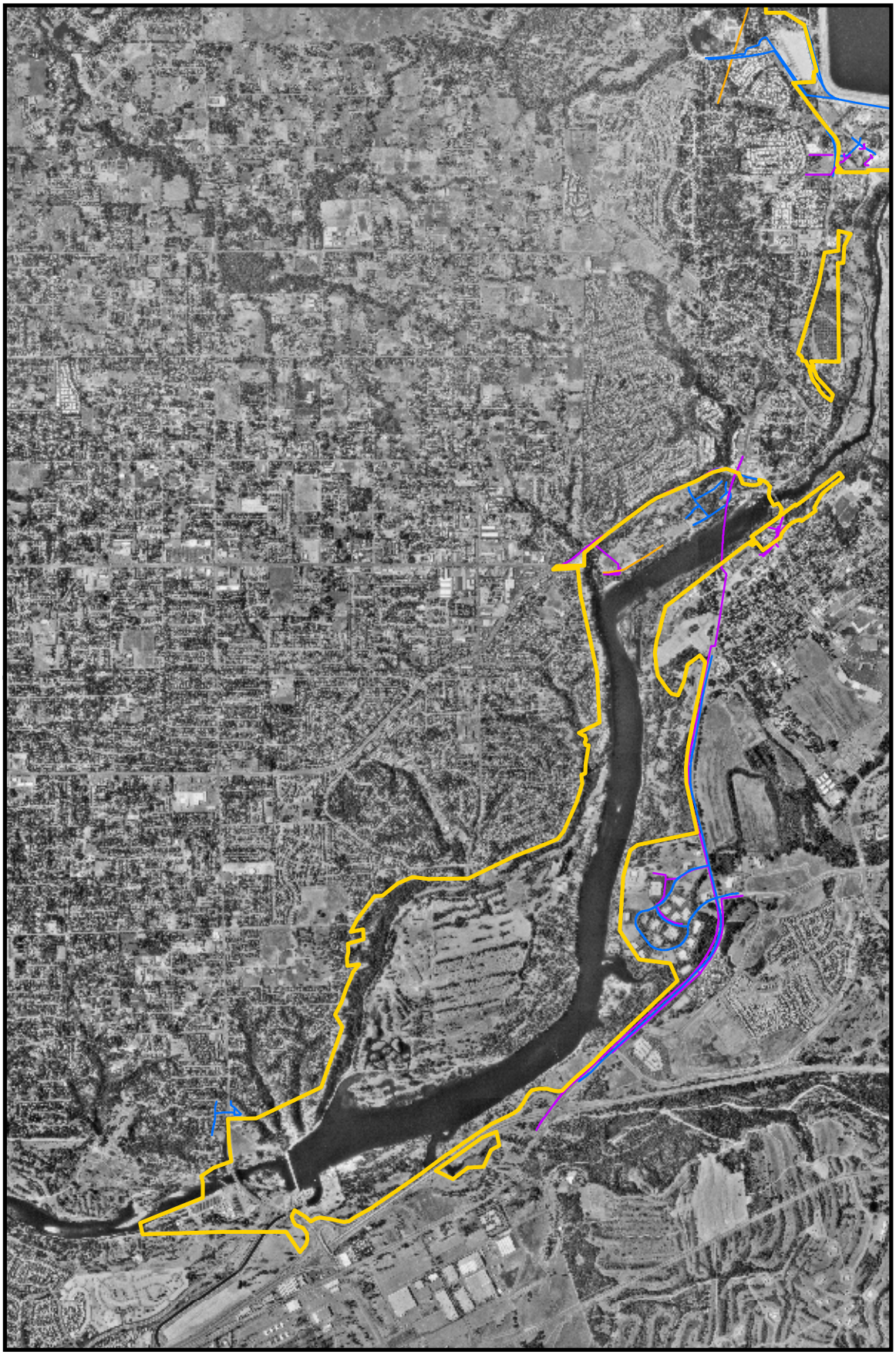
U-1a

UTILITY EASEMENTS FOLSOM LAKE

Prepared by: LSA Associates, Inc.
Source: CDPR, BOR, Psomas

N

0 0.35 0.7 1.4 2.1 2.8 Miles



FOLSOM LAKE STATE RECREATION AREA RESOURCE INVENTORY

Unit Boundary

TYPE OF EASEMENT

- ELECTRIC
- ELECTRIC & TELEPHONE
- SEWER
- WATER

FIGURE

U-1b

UTILITY EASEMENTS LAKE NATOMA

Prepared by: LSA Associates, Inc.
Source: CDPR, BOR, Psomas

N

0 0.15 0.3 0.6 0.9 1.2 Miles

PG&E also has a small distribution line (less than 50kV) that extends from the Placer-Goldhill line down to Rattlesnake Rd. The line crosses Folsom Lake near Rattlesnake Bar and extends down Rattlesnake Bar Road to the Peninsula Campground.

As with most utility easements, CDPR should not site development within these utility corridors. CDPR could possibly build new roads, trails, or utility lines across easements provided special approval is obtained.

PG&E needs vehicular access to all of its facilities for maintenance purposes. Vegetation removal is sometimes necessary for maintenance of power lines, and ground disturbance is sometimes necessary for maintenance of buried utilities. These maintenance activities could potentially impact existing vegetation and animals. Power lines and the hydropower plant visually impact the Unit. The hydropower plant also imparts some low-level noise and human activity in an area that would otherwise be remote.

City of Roseville Easements

The City of Roseville has a large-diameter raw water line that extends from the Folsom Dam. The City shares a portion of the line with the San Juan Water District. The shared 84-inch-diameter pipeline runs along the Dam from the intake at the Folsom Dam Powerhouse toward the San Juan Water District Water Treatment Plant north of Headquarters. The City of Roseville has another 60-inch-diameter pipeline that wyes off of the 84-inch-diameter pipeline just south of the Peterson Water Treatment Plant near Folsom Auburn Road. This wye is known as the Hinkle Wye.

The City of Roseville has a BOR easement for the 60-inch-diameter pipeline to cross through the Unit (Jim Mulligan. 2003.). This raw water line was installed in 2002. The water line passes through the Unit until it reaches Folsom Auburn Road. The water line then parallels Folsom-Auburn Road as it travels north and west to the Water Treatment Plant. The City of Roseville also has a 48-inch-diameter raw water line that runs parallel to the new 60-inch-diameter water line. This water line begins at Folsom-Auburn Road outside of the Unit.

CDPR should not site new development within the 84-inch and 60-inch water line easements. CDPR could possibly build new roads or utility lines across easements provided that special approval is obtained. Since the 84-inch waterline along the Dam is aboveground, it is important to limit public access to the easement. The aboveground pipeline visually impacts these areas, further discouraging development. Ground disturbance is sometimes necessary for maintenance of the buried portions of the water lines.

San Juan Water District Easements

The San Juan Water District has two easements and one parcel lease within the Unit (Ben Martinez. 2003.). As mentioned earlier, the San Juan Water District shares an 84-inch-diameter raw water line with the City of Roseville. This water line runs along the Dam from the intake at the Folsom Dam Powerhouse. The water line provides raw water for the Water District's Peterson Water Treatment Plant just north of CDPR and BOR Headquarters. The San Juan Water District plans to construct a new 84-inch-diameter line parallel to the existing line. Once construction is complete, the existing line would be removed.

The San Juan Water District also has an easement within the Unit for a 51,200-gallon potable water hydropneumatic tank on Mooney Ridge off the end of Skyway Lane. This area is located south of Granite Bay. The easement also covers the 10-inch water line that extends from Skyway Lane to the tank. The hydropneumatic tank is known as the Mooney Ridge Hydropneumatic Tank. There are no plans to expand this tank.

CDPR should not site new development within easements for the hydropneumatic tank, the hydropneumatic tank water supply line, or the 84-inch raw water line along the Dam. CDPR could possibly build new roads or utility lines across water line easements provided special approval is obtained. Since the 84-inch waterline along the Dam is above ground, it is important to limit public access to the easement. The aboveground pipeline visually impacts the area, further discouraging development. Ground disturbance is sometimes necessary for maintenance of the buried portions of the water lines.

The San Juan Water District leases a Unit parcel, Parcel C, on the north end of the Peterson Water Treatment Plant. The Water District obtained the lease of Parcel C from the BOR. The parcel is needed for the Water Treatment Plant expansion. All existing CDPR facilities on this parcel will require relocation or removal.

Western Area Power Administration Easements

The Western Area Power Administration (WAPA) is an electric power wholesaler and marketing agency operated by the federal government. The WAPA obtains power from two facilities within the Unit—the Folsom Powerhouse and the Nimbus Dam Powerhouse. Both of these hydroelectric plants are operated by the BOR. The Folsom Powerhouse provides 215,000 kW of power at peak capacity; the Nimbus Dam Powerhouse provides 17,000 kW at peak capacity.

WAPA has easements through the Unit for two overhead power lines that originate from the Folsom Powerhouse (Jose Vigil. 2003.). One of the lines originates from the Powerhouse and extends west through the Unit toward Folsom-Auburn Road. The second line originates from the Powerhouse and extends south through the Unit along the American River. The second line passes through the Unit in several locations:

- South of the Folsom Dam near the American River
- At Negro Bar where the line crosses Lake Natoma
- South of Willow Creek where the line crosses over Lake Natoma from near Folsom-Auburn Road to Mississippi Bar
- Across the south portion of the Mississippi Bar as the line extends over to the Nimbus Dam Powerhouse

CDPR should not site new development within easements for the WAPA power transmission lines. CDPR could possibly build new roads, trails, or utility lines across the easements provided that special approval from WAPA is obtained.

WAPA requires vehicular access to all of its facilities for maintenance purposes. Vegetation removal is sometimes necessary for maintenance of power lines, and ground disturbance is

sometimes necessary for maintenance of buried utilities. Power lines and hydropower plants do visually impact the Unit. The hydropower plants also impart some low-level noise.

Sacramento Municipal Utility District

Maps locating utility lines have not yet been received from SMUD. Dale Johnson with SMUD will mail the maps.

El Dorado Irrigation District

The El Dorado Irrigation District supplies water and sewer service to customers on the southeast side of Folsom Lake in El Dorado County. The Irrigation District has an easement for a raw water intake facility on the South Fork of the American River. The intake facility includes water intake pipelines, a surge tank, and a building that houses the pump station and electrical controls. The entire facility is located within the Unit on BOR property. The Irrigation District also has an easement for an existing 30-inch raw water line from the intake facility.

The intake structure is located on the South Fork of the American River near Planeta Way. The Irrigation District is planning to expand the intake facility by replacing the existing five separate intake lines with one 9-foot-diameter intake structure (Daryl Noel. 2003.). In addition, the Irrigation District will expand the capacity of the intakes and pumps from 20 million gallons per day (MGD) to 48 MGD. A new 42-inch transmission main will be added parallel to the existing 30-inch transmission main leaving the intake facility.

The intake facility expansion may impact an existing CDPR horse staging area nearby. For security purposes, the Irrigation District may request that CDPR relocate the horse staging area. CDPR should not develop any new facilities near the area in order to limit public access to the site. CDPR should not site new development within the water line easements. With special approval, CDPR may possibly be able to build roads, trails, or utilities across the water line easement, but away from the intake facility.

The intake facility will visually impact the Unit and will impart some low-level noise related to operation of the pumps. The Irrigation District needs vehicular access to the intake facility and the buried pipelines. Ground disturbance is sometimes necessary for maintenance of buried utilities.

City of Folsom

The City of Folsom has an existing 42-inch-diameter raw water intake from the Folsom Dam. As it leaves the dam, this pipeline transitions to a newer 60-inch-diameter raw water pipeline. The City of Folsom does not have any expansion plans that will impact the Unit (Gordon Turnborg. 2003.). As with all easements, CDPR should not site new development within the raw water easement. CDPR can possibly build a new road, trail, or utilities across the easement provided that special approval from the City of Folsom is obtained. Ground disturbance is sometimes necessary for maintenance of buried utilities.

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