Chapter 3
Affected Environment, Impacts Analyses, and Mitigation Measures

Introduction

This chapter presents an assessment of the environmental impacts associated with each of the six alternatives currently being considered for the Folsom DS/FDR, specifically the No Action/No Project Alternative and the five action alternatives described in Chapter 2. This chapter describes the existing physical environment at and about the Folsom DS/FDR site, and delineates the potential impacts that may result from construction of the various improvements proposed under each alternative. Also included is a discussion of mitigation measures, as well as a description of potential cumulative effects associated with implementation of the Folsom DS/FDR and other projects nearby.

Organization of the Chapter

Each of the 19 environmental topics addressed in this chapter is discussed in a separate section using a common organization, as follows:

- The **Affected Environment/Existing Conditions** subsection discusses the affected environment within a defined geographic area (i.e., Area of Analysis) relative to the Folsom DS/FDR site, and includes an overview of pertinent environmental regulations (i.e., Regulatory Setting) and a description of the existing conditions (i.e., Environmental Setting).

- The **Environmental Consequences/Environmental Impacts** subsection presents the analysis of impacts associated with implementation of each alternative. The subsection begins with an explanation of the assessment method(s) used to identify and address potential impacts and then presents the basis and criteria for determining whether the potential impacts are significant. The need for determining whether or not a potential impact is significant is particular to the requirements of CEQA, and provides the basis for subsequently determining, under CEQA, whether mitigation of that impact is warranted (i.e., under CEQA, impacts determined to be less than significant do not require mitigation). Under NEPA, there is not the same emphasis to determine whether the impact is significant or not, but rather the focus is on disclosing the overall nature and magnitude of environmental impacts associated with each of the alternatives considered, which, when compared amongst and between the individual alternatives, will assist decision-makers in choosing a course of action. The impacts analysis presented in this chapter of the Folsom DS/FDR joint

EIS/EIR serves to meet the requirements of both NEPA and CEQA. The analysis presented herein discloses and compares the environmental impacts associated with each of the alternatives, identifies those impacts that are considered significant, and provides recommended mitigation measures where appropriate. The analysis presented in this chapter also meets the requirements of both NEPA and CEQA relative to the baseline from which impacts are measured. Under NEPA, the environmental impacts of each action alternative are measured against the environmental conditions that would otherwise occur if no action was taken (i.e., the impacts of each action alternative are measured from the conditions anticipated for the No Action Alternative). Under CEQA, the impacts of a proposed project are measured against the environmental conditions that currently exist. In the case of the Folsom DS/FDR, no notable changes in existing environmental conditions are anticipated to occur under the No Action Alternative because no substantial improvements to the Folsom Facility are expected to occur under that scenario (see Chapter 2). As such, the impacts associated with each action alternative as measured from the No Action Alternative would be the same as measured from existing conditions.

- The **Comparative Analysis of Alternatives** subsection is based on the conclusions of the analysis described above and focuses on how certain impacts associated with the subject environmental topic are greater, less, or the same between the individual alternatives.

- The **Mitigation Measures** subsection provides recommended mitigation measures based on the results and conclusions of the impacts analysis.

- The **Cumulative Effects** subsection addresses the impacts of the project in conjunction with past, present, and probable future projects (under CEQA), or reasonably foreseeable future projects (under NEPA), in or near the area. In general, the environmental impacts of the project may be individually minor, but collectively significant when considered in conjunction with other projects or other environmental effects of the project. Of particular note relative to CEQA is whether the project's contribution to such impacts is cumulatively considerable. Chapter 5 provides the more detailed explanation of how cumulative effects are addressed in this EIS/EIR, and describes the other projects, which in conjunction with the proposed Folsom DS/FDR, form the basis of the cumulative projects. Those other projects include: (1) construction of the New Folsom Bridge downstream of the Folsom Main Concrete Dam; (2) the Future Redundant Water Supply Intake and Pipeline for Roseville, Folsom, and San Juan Water District, which is a new 84-inch-diameter inlet water pipe connected to the proposed Auxiliary Spillway side approach channel; (3) the Folsom Dam Road Closure, which occurred in 2003; (4) the L.L. Anderson Dam, which will widen the spillway of French Meadows Reservoir; (5) the Lower American River Common Features Project, which includes a number of levee stabilization projects; (6) the

Long-Term Reoperation of Folsom Dam and Reservoir, which would provide for reoperation of Folsom Reservoir, the specifics of which would be defined and addressed as part of a separate future EIS/EIR; and (7) the Sacramento Municipal Utility District 230 kV Transmission Line Relocation, which calls for relocation of existing electricity transmission lines and towers due to the construction of the New Folsom Bridge.

3.1 Hydrology, Water Quality, and Groundwater

This section discusses the effects that construction of any of the Folsom DS/FDR alternatives may have on hydrology, water quality, groundwater resources, and jurisdictional wetlands in the construction area.

3.1.1 Affected Environment/Existing Conditions

This section describes the hydraulic features and hydrologic conditions, including the groundwater setting and jurisdictional wetlands, in the construction area. Existing hydrologic conditions and groundwater resources potentially affected by the alternatives are also identified in this section, along with regulatory settings and regional information pertaining to hydrologic and groundwater resources in the area of analysis.

3.1.1.1 Area of Analysis

The area of analysis for this section includes Folsom Reservoir and the area surrounding the reservoir. Lake Natoma is evaluated as a receiving body of water in regards to water quality impacts.

3.1.1.2 Regulatory Setting

Federal Regulations

The Clean Water Act (CWA) establishes the basic structure for regulating discharges of pollutants into the waters of the U.S. and gives the USEPA the authority to implement pollution control programs such as setting wastewater standards for industries (USEPA 2002). In certain states such as California, the USEPA has delegated authority to state agencies.

Section 303(d) of the 1972 CWA requires states, territories and authorized tribes to develop a list of water quality-impaired segments of waterways. The list includes waters that do not meet water quality standards necessary to support the beneficial uses of that waterway, even after point sources of pollution have installed the minimum required levels of pollution control technology.

The law requires that these jurisdictions establish priority rankings for water on the lists and develop action plans, called Total Maximum Daily Loads (TMDLs), to improve water quality (USEPA 2002). A TMDL is a tool for implementing water quality standards and is based on the relationship between pollution sources and in-stream water quality conditions. The TMDL establishes the allowable daily pollutant loadings or other quantifiable parameters (e.g., pH or temperature) for a waterbody and thereby provides the basis for the establishment of water quality-based controls. These controls should provide the pollution reduction necessary for a waterbody to meet water quality standards. A TMDL is the sum of the allowable loads of a single pollutant from all contributing point and nonpoint sources. The calculation for establishment of TMDLs for each waterbody must include a margin of safety to ensure that the waterbody can be used for the purposes the State has designated. Additionally, the calculation also must account for seasonal variation in water quality (USEPA 2002).

Sedimentation/siltation impacts are the primary water quality parameters of concern with construction of the alternatives. The lower American River and Folsom Reservoir are not listed on the Central Valley Regional Water Quality Control Board (CVRWQCB) 2002 303(d) list of water quality impaired segments for sedimentation/siltation. Therefore, there has not been a TMDL developed for this area concerning sediment impacts.

Water quality of waters of the United States subjected to a discharge of dredged or fill material is regulated under Section 401 of the CWA. These actions must not violate federal or state water quality standards. Specifically in the State of California, the applicable Regional Water Quality Control Board (RWQCB) administers Section 401 and either issues or denies water quality certifications depending upon whether the proposed discharge or fill material complies with applicable State and Federal laws. In addition, policies and regulations governing the protection of the beneficial uses of the State's water resources must also be followed.

In addition to complying with state and federal water quality standards, all point sources that discharge into waters of the United States must obtain a National Pollutant Discharge Elimination System (NPDES) permit under provisions of Section 402 of the CWA. In California, the State Water Resources Control Board (SWRCB) and RWQCBs are responsible for the implementation of the NPDES permitting process at the state and regional levels, respectively.

The NPDES permit process also provides a regulatory mechanism for the control of non-point source pollution created by runoff from construction and industrial activities, and general and urban land use, including runoff from streets. Projects involving construction activities (e.g., clearing, grading, or excavation) involving land disturbance greater than one acre must file a Notice of Intent (NOI) with the CVRWQCB to indicate their intent to comply with the State General Permit for Storm Water Discharges Associated with Construction Activity (General Permit). The General Permit establishes conditions to minimize sediment and pollutant loadings and requires preparation and implementation of a Storm Water Pollution Prevention Plan (SWPPP) prior to construction. The SWPPP is intended to help identify the sources of sediment and other pollutants, and to establish Best Management Practices (BMPs) for storm water and non-storm water source control and pollutant control.

The CWA also requires that a permit be obtained from the USEPA and the Corps when discharge of dredged or fill material into wetlands and waters of the United States occurs. Section 404 of the CWA requires the USEPA and Corps to issue individual and general permits for these activities. When performing its own civil works projects, the Corps does not issue itself these permits, rather, the Corps must apply the guidelines and requirements of Section 404 as stated in Corps regulations.

The federal Safe Drinking Water Act (SDWA) was established to protect the quality of drinking water in the United States. This law focuses on all waters actually or potentially designated for drinking use, whether from above ground or underground sources. The SDWA authorized the USEPA to establish water quality standards and required all owners or operators of public water systems to comply with primary (health-related) standards. State governments, which assume this power from the USEPA, also encourage attainment of secondary standards (nuisance-related). Contaminants of concern in a domestic water supply are those that either pose a health threat or in some way alter the aesthetic acceptability of the water. These types of contaminants are currently regulated by the USEPA as primary and secondary maximum contaminant levels (MCLs). As directed by the SDWA amendments of 1986, the USEPA has been expanding its list of primary MCLs. MCLs have been proposed or established for approximately 100 contaminants.

The federal Surface Water Treatment Rule (SWTR) became effective on June 19, 1989. The California Surface Water Treatment Rule (California's SWTR), which implements the federal SWTR within the state, became effective in June 1991. The California SWTR satisfies the following 3 specific requirements of the SDWA:

- Establishes criteria for determining when filtration is required for surface waters;
- Defines minimum levels of disinfection for surface waters; and
- Addresses *Giardia lamblia*, viruses, *Legionella*, turbidity, and heterotrophic plate counts by establishing treatment techniques in lieu of MCLs due to high treatment costs and technological requirements in measuring these contaminants.

State Regulations

The Porter-Cologne Water Quality Control Act of 1970 established the SWRCB and nine RWQCBs within the State of California. These groups are the primary state agencies responsible for protecting California water quality to meet present and future beneficial uses and regulating appropriative surface rights allocations. The preparation and adoption of water quality control plans, or Basin Plans, and statewide plans, is the responsibility of the SWRCB. State law requires that Basin Plans conform to the policies set forth in the California Water Code beginning with Section 13000 and any State policy for water quality control. These plans are required by the California Water Code (Section 13240) and supported by the Federal CWA. Section 303 of the CWA requires states to adopt water quality standards which "*consist of the designated uses of the navigable waters involved and the water quality criteria for such waters based upon such uses.*" According to Section 13050 of the California Water Code, Basin Plans consist of a designation or establishment for the waters within a specified area of beneficial uses to be protected and water quality objectives to protect those uses. Adherence to Basin Plan water quality objectives protects continued beneficial uses of waterbodies.

Because beneficial uses, together with their corresponding water quality objectives, can be defined per Federal regulations as water quality standards, the Basin Plans are regulatory references for meeting the State and Federal requirements for water quality control (40 Code Federal Regulations [CFR] 131.20).

One significant difference between the State and Federal programs is that California's Basin Plans establish standards for groundwater in addition to surface water. The Basin Plans include provisions to prevent degradation and require clean up of groundwater quality problems. These provisions address local problems such as underground storage tanks and associated issues. Basin Plans also address groundwater degradation due to elevated nitrate and salt concentrations caused by leaching from nearby urban developments, agricultural fields, confined animal feeding operations, and municipal sources.

Basin Plans are adopted and amended by regional water boards under a structured process involving full public participation and State environmental review. Basin Plans and amendments thereto, do not become effective until approved by the SWRCB and regulatory provisions must be approved by the Office of Administrative Law (OAL). Adoption or revision of surface water standards is subject to the approval of the USEPA. It is the intent of the SWRCB and the RWQCBs to maintain Basin Plans in an updated and readily available edition that reflects the current water quality control program. This is accomplished by reviewing water quality standards for each Basin Plan every three years.

The CVRWQCB Water Quality Control Plan for the Sacramento River and San Joaquin River Basins (CVRWQCB Basin Plan) regulates waters of the state located within the area of analysis for the Folsom DS/FDR. The CVRWQCB Basin Plan covers an area including the entire Sacramento and San Joaquin River basins, involving an area bound by the crests of the Sierra Nevada on the east and the Coast Range and Klamath Mountains on the west. The area covered in the CVRWQCB Basin Plan extends some 400 miles, from the California – Oregon border southward to the headwaters of the San Joaquin River.

Local Regulations

General Plans for El Dorado, Placer, and Sacramento Counties each have provisions aimed at protecting local water resources for future and current use. The El Dorado County General Plan establishes a county-wide water resources program to conserve, enhance, manage, and protect water resources and their quality from degradation. These objectives consist of the following: ensuring an adequate quantity and quality of water is available; protection of critical watersheds, riparian zones, and aquifers; improvement and subsequent maintenance of the quality of both surface water and groundwater; wetland area protection; utilization of natural drainage patterns; and encouraging water conservation practices including re-use programs for applicable areas such as agricultural fields (El Dorado County 2004).

The Placer County General Plan’s main goal pertaining to local water resources states that the natural qualities of its streams, creeks and groundwater should be protected and enhanced. To accomplish this goal, the County has enacted policies such as requiring various setbacks and easements from sensitive habitat areas or creek corridors, requiring mitigation measures for developments encroaching waterbodies, implementing BMPs to protect streams from runoff during construction activities or due to agricultural practices, and protecting groundwater resources from contamination (Placer County 1994).

The Conservation Element of Sacramento County’s General Plan contains measures to implement water conservation and to protect surface water supplies, surface water quality, and groundwater resources. Specific goals include the following: conjunctive use of surface water and groundwater to ensure long-term supplies exist for residents while providing recreational and environmental benefits; protecting surface water quality for both public use and support of aquatic environment health; maintaining quality and quantity of groundwater for the benefit of humans and the natural environment; and promoting water conversation and reuse measures.

Besides the three individual Counties’ General Plan stipulations, groundwater in the construction area may also be regulated by local groundwater management plans and county ordinances. These plans typically involve provisions to limit or prevent groundwater overdraft, regulate transfers, and protect groundwater quality. Assembly Bill 3030 (AB3030), Water Code Section 10750 (commonly referred to as the Groundwater Management Act) encourages local water agencies to establish local Groundwater Management Plans. Subsequent legislation has amended this chapter to make the adoption of a management program mandatory if an agency is to receive public funding for groundwater projects, creating an incentive to implement plans. The act lists various elements that should be included within the plans to ensure efficient use, good groundwater quality, and safe production of water (State Water Code, Section 10753).

Beneficial Uses

Beneficial uses are critical to water resource management in California. State law defines beneficial uses of California's waters that may be protected against quality degradation to include (but not limited to) "...domestic; municipal; agricultural and industrial supply; power generation; recreation; aesthetic enjoyment; navigation; and preservation and enhancement of fish, wildlife, and other aquatic resources or preserves" (Water Code Section 13050(f)). Protection and enhancement of existing and potential beneficial uses are primary goals of water quality planning. Significant points concerning the concept of beneficial uses are:

- All water quality problems can be stated in terms of whether there is water of sufficient quantity or quality to protect or enhance beneficial uses (Regional Water Quality Control Board Central Valley Region (RWQCB) 1998).
- Beneficial uses do not include all of the reasonable uses of water. For example, disposal of wastewaters is not included as a beneficial use. This is not to say that disposal of wastewaters is a prohibited use of waters of the State; it is merely a use, which cannot be satisfied to the detriment of beneficial uses. Similarly, the use of water for the dilution of salts is not a beneficial use although it may, in some cases, be a reasonable and desirable use of water (RWQCB 1998).
- The protection and enhancement of beneficial uses require that certain quality and quantity objectives be met for surface and ground waters (RWQCB 1998).
- Fish, plants, and other wildlife, as well as humans, use water beneficially.

3.1.1.3 Environmental Setting

This section describes the hydrology and hydraulic features, water quality, groundwater setting, and jurisdictional wetlands within the construction area.

Hydrology

The American River Basin covers an area of approximately 2,100 square miles, and has an average annual unregulated runoff of 2.7 million acre-feet; however, annual runoff has varied in the past from 900,000 acre-feet to 5,000,000 acre-feet. The major tributaries in the American River system include the North Fork American River, Middle Fork American River, and South Fork American River. These tributaries drain the upper watershed carrying runoff from precipitation and snowmelt into Folsom Reservoir. Figure 3.1-1 shows the hydrology of Folsom Reservoir including tributaries and streams.

Folsom Dam and Reservoir is a multipurpose water project constructed by the Corps and operated by Reclamation as part of the Central Valley Project (CVP). At an elevation of 466 feet above mean sea level (msl), Folsom Reservoir is the principal reservoir on the American River impounding runoff from a drainage area of approximately 1,875 square miles. Folsom Reservoir has a normal full-pool storage capacity of approximately 975,000 acre-feet, with a seasonally designated flood management storage space of 400,000 acre-feet. An interim agreement between the SAFCA and Reclamation provides variable flood storage ranging from 400,000 to 670,000 acre-feet.

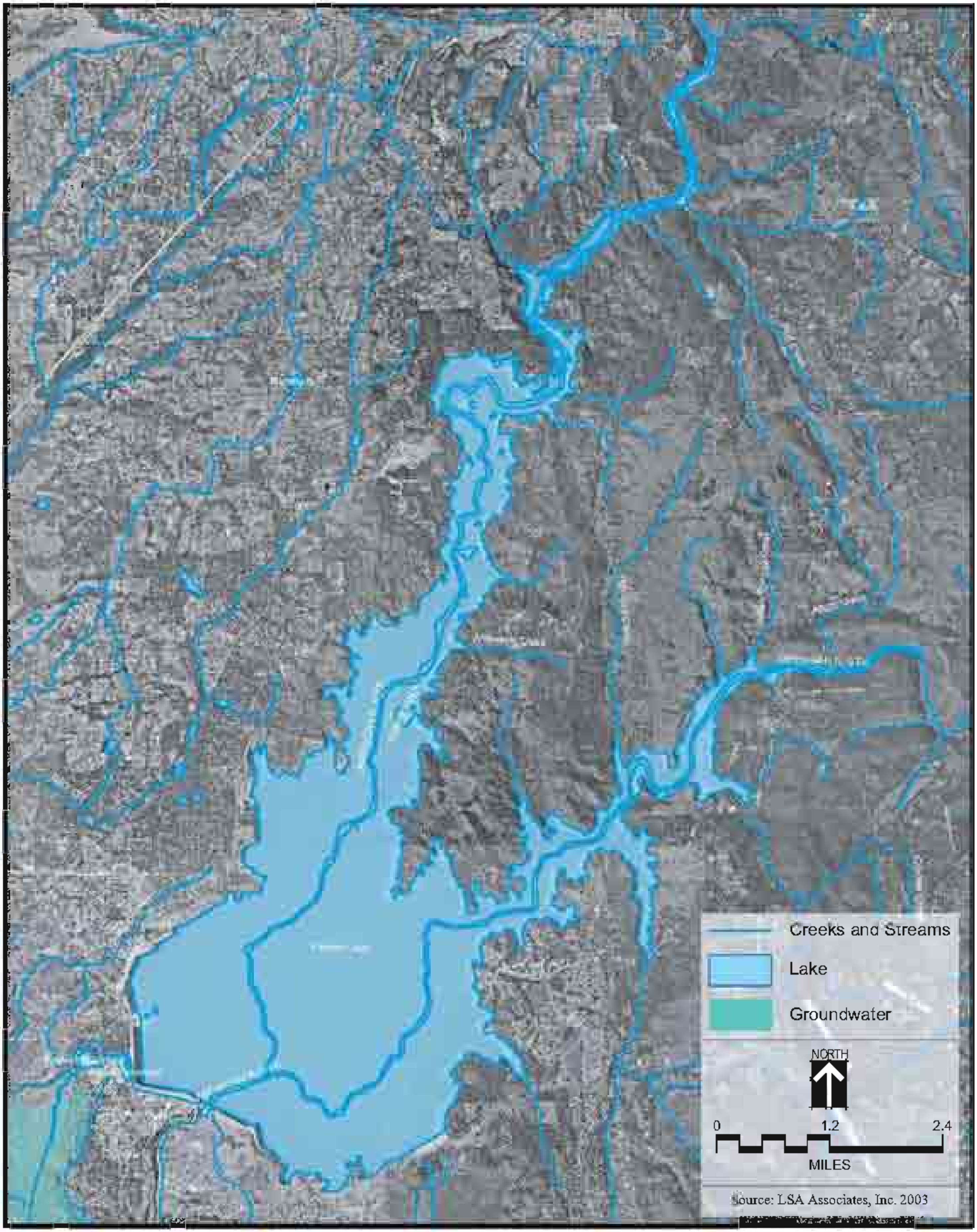


Figure 3.1-1
Hydrology of Folsom Reservoir

CDM

Flood-producing runoff occurs primarily during the months of October through April and is usually most extreme between November and March. From April to July, runoff is primarily generated from snowmelt from the upper portions of the American River watershed. Runoff from snowmelt usually does not result in flood-producing flows; however, it is normally adequate to fill Folsom Reservoir's available storage. Approximately 40 percent of the runoff from the watershed results from snowmelt.

Lake Natoma is downstream of Folsom Dam and serves as an afterbay to Folsom Reservoir. Formed and controlled by Nimbus Dam, the lake is operated to re-regulate the daily flow fluctuations created by the Folsom Powerplant. Consequently, water surface elevations in Lake Natoma may fluctuate between four and seven feet daily. Lake Natoma has a storage capacity of approximately 9,000 acre-feet and a surface area of 500 acres. Nimbus Dam, combined with Folsom Dam, regulates water releases to the lower American River.

The lower American River extends 23 miles from Nimbus Dam to the confluence with the Sacramento River. The upper reaches of the lower American River are unrestricted by levees and are hydrologically controlled by natural bluffs and terraces. Downstream, the river is leveed along its north and south banks for approximately 13 miles from the Sacramento River to the Mayhew drain on the south and to the Carmichael Bluffs on the north.

Hydraulics

Folsom Dam's current configuration has three general types of outlet structures including: 1) three power penstocks, 2) eight gated outlets (four upper and four lower), and 3) eight spillway gates (five operational service gates and three emergency gates). Reservoir releases are restricted by both the capacity of the discharge structures and regulatory limits on the increases in release rates. The maximum capacity of the low-level outlets is 34,000 cfs (8,000 cfs total capacity through the three power penstocks and 26,000 cfs maximum total capacity through the eight gated river outlets). During a flood event, releases are made through the low-level outlets until water levels in the reservoir reach the spillway crest and releases can be made from the main spillway gates. Once water is above the spillway crest, releases can then be raised incrementally to 115,000 cfs (design release), which represents the maximum safe carrying capacity of the lower American River. The maximum rate of increase in flows is limited to 15,000 cfs per hour until outflow reaches 115,000 cfs. As inflows continue to increase, more water is released from the spillways to protect the dam. A maximum of 160,000 cfs can be released on a limited emergency basis without causing a downstream levee failure and flooding in the Sacramento area. The three emergency spillway gates may not be used unless the total outflow from the dam exceeds 300,000 cfs. This restriction makes the emergency gates unusable for normal flood management purposes and limits the use of the gates to dam safety outflows.

During a flood event with a 1 in 2 chance of occurring in any 1 year (e.g., 2-year recurrence interval), flows would be expected to reach 25,000 cfs under existing conditions and 40,000 cfs if unregulated. Flows during flood events with between a 1 in 18 and 1 in 120 chance of occurring in any 1 year would peak at approximately 115,000 cfs under existing conditions and would range between 160,000 cfs and 375,000 cfs if unregulated.

Water Quality

As stated above, snowmelt and precipitation from the upper American River Watershed discharges water into Folsom Reservoir. In general, runoff from the relatively undeveloped watershed is of very high quality, rarely exceeding the State of California's water quality objectives (Wallace, Roberts, and Todd et al. 2003). The following beneficial uses have been defined by the CVRWQCB for Folsom Reservoir and Lake Natoma: municipal and domestic water supply; irrigation; industrial power; water contact and non-contact recreation; warm and cold freshwater habitat, warm freshwater spawning habitat; and wildlife habitat, along with potential beneficial uses for industrial service supply (RWQCB1998). Water quality within Folsom Reservoir and Lake Natoma is generally acceptable to meet the beneficial uses currently designated for these waterbodies. However, in the past, occasional taste and odor problems have occurred in municipal water supplies diverted from Folsom Reservoir. Blue-green algal blooms that occasionally occur in the reservoir due to elevated water temperatures were identified as the cause of these problems.

Water Quality Data for Construction Area

This section presents data describing general water quality parameters including pH, turbidity, dissolved oxygen (DO), total organic carbon (TOC), nitrogen, phosphorus, electric conductivity, total dissolved solids (TDS), and fecal coliform for Folsom Reservoir.

The minimum, maximum, and average levels of pH, turbidity, DO, TOC, nitrogen, phosphorous, and electric conductivity within Folsom Reservoir are presented in Table 3.1-1. All of the data were collected over a six year period from 1992 to 1998; 104 samples were taken for both pH and turbidity; 47 samples were taken for TOC; and 101 samples were taken for electric conductivity (Larry Walker Associates, 1999).

Table 3.1-1
Water Quality Parameters Sampled at Folsom Reservoir – 1992 to 1998

Water Quality Parameter	***Minimum***	***Maximum***	***Average***
pH (standard units)	5.82	8.46	7.09
Turbidity (mg/L)	1	68	1.2
DO (mg/L)	6.1	13.6	10.3
TOC (mg/L)	2.0	3.5	N/A
Nitrogen (mg/L)	N/A	N/A	N/A
Phosphorus (mg/L)	N/A	N/A	N/A
Electric Conductivity (µS/cm)	18.5	123	52.2

Source: Larry Walker Associates 1999; N/A – Not Available

Table 3.1-2 presents the minimum, maximum, and average levels of pH, electric conductivity, DO, turbidity, TOC, nitrogen, phosphorus, and TDS within Folsom Reservoir. The pH, electric conductivity, DO, and turbidity data were collected on June 28, 2005; a total of 47 samples were taken. The TOC data were collected on June 11, 2003; a total of 6 samples were taken. The nitrogen, phosphorus, and TDS data were collected over a 13-month period from February 2001 to February 2002; 5 samples were taken for each of these parameters.

Table 3.1-2
Water Quality Parameters Sampled at Folsom Reservoir – 2001 to 2005

Water Quality Parameter	***Minimum***	***Maximum***	***Average***
pH (standard units)[1]	6.60	8.23	6.94
Turbidity (NTU)[1]	1.0	126.9	8.4
DO (mg/L)[1]	4.95	7.93	6.88
TOC (mg/L)[2]	1.5	1.8	1.6
Nitrogen (mg/L)[3]	<0.050	0.110	0.062
Total Phosphorus (mg/L)[3]	<0.010	<0.050	0.0212
TDS (mg/L)[3]	39	44	41.8
Electric Conductivity (µS/cm)[1]	32.5	61.6	46.2

Sources: Reclamation 2005d[1]; MWH 2003[2]; Wallace, Roberts and Todd et. al. 2003[3]

Fecal coliform bacteria levels within Folsom Reservoir are presented in Table 3.1-3. The values for Granite Bay and Beal's Point represent data collected over a five-month period (May 2003 to September 2003); 19 samples were taken at each location. The values for Folsom Dam represent data collected over a 13-month period from February 2001 to February 2002; 5 samples were taken (Reclamation 2003; Wallace, Roberts and Todd et al. 2003).

Table 3.1-3
Folsom Reservoir Coliform Sampling – 2001 to 2003
Fecal Coliform Concentrations (MPN/100mL)

Site	***Minimum***	***Maximum***	***Geometric Mean***
Granite Bay[1]	2	300	9
Beal's Point[1]	2	900	18
Folsom Dam[2]	2	30	12.2

Sources: Reclamation 2003[1]; Wallace, Roberts, and Todd et. al. 2003[2]
MPN: Most Probable Number

In general, water released from Lake Natoma is of good quality and meets California Basin Plan standards. Table 3.1-4 summarizes water quality data in Lake Natoma from February 2001 to February 2002.

Table 3.1-4
Water Quality Parameters Sampled at Lake Natoma – 2001 to 2002

Water Quality Parameter	***Units***	***Minimum***	***Maximum***	***Average***
Fecal Coliform	MPN/100mL	4	300	75
Nitrate & Nitrite as N	mg/L	<0.050	0.08	0.05
Total Phosphorus as P	mg/L	<0.010	0.18	0.05
Tot. Dissolved Solids	mg/L	34	39	36.6
Mercury (dissolved)	µg/mL	<0.005	<0.005	<0.005
MTBE	µg/mL	<3	<3	<3

Source: Wallace, Roberts and Todd et. al. 2003

Water Quality Objectives for Construction Area
The CVRWQCB Basin Plan defines specific water quality objectives that should be attained in order to protect and maintain the beneficial uses of Folsom Reservoir as described above. As indicated prior, although not required under the CWA, the CVRWQCB Basin Plan also presents objectives for all groundwater in the Sacramento and San Joaquin River Basins. Groundwater regulations do not encompass as many constituents as surface water in the CVRWQCB Basin Plan, but do include bacteria, chemical constituents, radioactivity, tastes and odors, and toxicity.

The following section presents surface water objectives for bacteria, TDS, DO, turbidity, and pH, and groundwater objectives for bacteria for the construction area. Although data from Folsom Reservoir were previously presented for various parameters, only bacteria, TDS, DO, turbidity, and pH are discussed in relation to their particular water quality objectives as stated in the CVRWQCB Basin Plan.

There are no available groundwater data associated with the construction area; therefore, only the groundwater quality objective for bacteria is presented below.

Bacteria
The CVRWQCB Basin Plan has established fecal coliform bacteria standards for Folsom Reservoir that are twice as rigorous as other waters designated for water contact recreation. For Folsom Reservoir, the fecal coliform concentration is based on a minimum of not less than five samples for any 30-day period, should not exceed a geometric mean of 100 Most Probable Number (MPN)/100 ml, nor should more than ten percent of the total number of samples taken during any 30-day period exceed 200/100 ml. For groundwater used for municipal or domestic supply, the fecal coliform most probable number should be less than 2.2/100 ml over any seven-day period. As indicated in Table 3.1-3, the geometric mean for bacteria for all three surface water locations is below the water quality objective of not exceeding 100/100 ml.

Total Dissolved Solids
Total dissolved solids in Folsom Reservoir should not exceed 100 mg/l (90th percentile) as per the CVRWQCB Basin Plan. TDS data are acceptable in the reservoir as shown in Table 3.1-2 which indicates levels are between 39 and 44 mg/L.

Dissolved Oxygen
For Folsom Reservoir, the CVRWQCB Basin Plan requires the monthly median of the mean daily DO concentration should not fall below 85 percent of saturation in the main water mass, and the 95th percentile concentration should not fall below 75 percent of saturation. In addition, the DO concentrations should not be reduced below 7.0 mg/l at any time in waters designated to support cold water ecosystems and spawning, reproduction and/or early development beneficial uses, or 5.0 mg/l in water designated to support warm water ecosystems. Data in Table 3.1-2 indicate that DO levels from samples taken from Folsom Reservoir between 2001 and 2005 are minimum 4.95 mg/L and maximum 7.93 mg/L.

Turbidity
Turbidity should be less than or equal to 10 Nephelometric Turbidity Unit (NTUs) in Folsom Reservoir, except for periods of storm runoff according to the CVRWQCB Basin Plan. Average turbidity readings as shown in Table 3.1-2 are 8.4 NTU, below CVRWQCB Basin Plan objectives. The Folsom DS/FDR could increase sedimentation in Lake Natoma from construction activities. Water quality samples from January 2001 through June 2002 in Lake Natoma show 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.

pH

The CVRWQCB Basin Plan states that pH levels should not be less than 6.5 nor above 8.5. In fresh waters with designated cold water or warm water habitat beneficial uses, changes in normal ambient pH levels should not exceed 0.5 (RWQCB 2004). All pH data are within objectives as presented in Table 3.1-2. From 2001 to 2005 in Folsom Reservoir, minimum pH was 6.60, maximum pH was 8.23, and average pH was 6.94.

As indicated by the above data, water quality in Folsom Reservoir meets the requisite Basin Plan objectives. Sedimentation/siltation within local tributaries due to construction is one of the primary potential water quality concerns. Construction activities also have the potential of releasing hazardous or other chemicals into surrounding waters, thus impacting water quality.

Other Water Quality Issues

Abandoned Mines

An old abandoned chromium mine exists on the Peninsula just north of Flagstaff Hill. The Pillikin Mine contained the largest known chromite deposit in the Sierra Nevada. The mine began ore production during World War I and became inactive in April of 1955 (El Dorado County Public Library website 2002).

Four abandoned limestone quarries also exist north of the Peninsula. The Alabaster Cave quarries are located approximately one mile east of Rattlesnake Bridge, just five miles south of Auburn at an elevation above 600 ft. These quarries were owned by various companies and were mined from the 1860s until the 1950s (El Dorado County website 2003, Perazzo 2006).

Both mines are located well above the elevation of the reservoir and would not cause any water quality effects with the implementation of any of the Folsom DS/FDR alternatives. According to Reclamation, there has never been any detection of chromium in the water tested (Sherer 2006c).

Mercury and Metals

The sediments in Folsom Reservoir may contain elemental mercury and metals from historic mining or those naturally occurring within the bedrock of the American River drainage. Mercury is toxic to both aquatic life and human health.

Groundwater

Folsom Reservoir is located at the eastern edge of the Sacramento Valley Groundwater Basin, in the North American and South American subbasins. The area surrounding Folsom Reservoir primarily consists of bedrock formations of the Sierra Nevada foothill complex. Although groundwater is not a major resource in the vicinity of the Folsom DS/FDR site, small amounts of groundwater are typically found in granitic fissures and cracks. Figure 3.1-2 indicates the areas where groundwater exists surrounding Folsom Reservoir and Lake Natoma. Bedrock is close to, or in some areas, at the surface; therefore, high water tables exist in a few locations. Due to the presence of the impermeable material near the surface, natural drainage cannot regularly occur, thus low areas frequently become water-logged.

Because fractured aquifer systems are typically low yielding, surface water sources are primarily used for drinking water or irrigation water sources rather than wells. However, a few groundwater wells are being used to provide water within the construction area. These wells are located at Rattlesnake Bar, the Peninsula campground and boat launch, Nimbus Flat residences, and Shadow Glen stables (Wallace, Roberts, and Todd et al. 2003).

Jurisdictional Wetlands

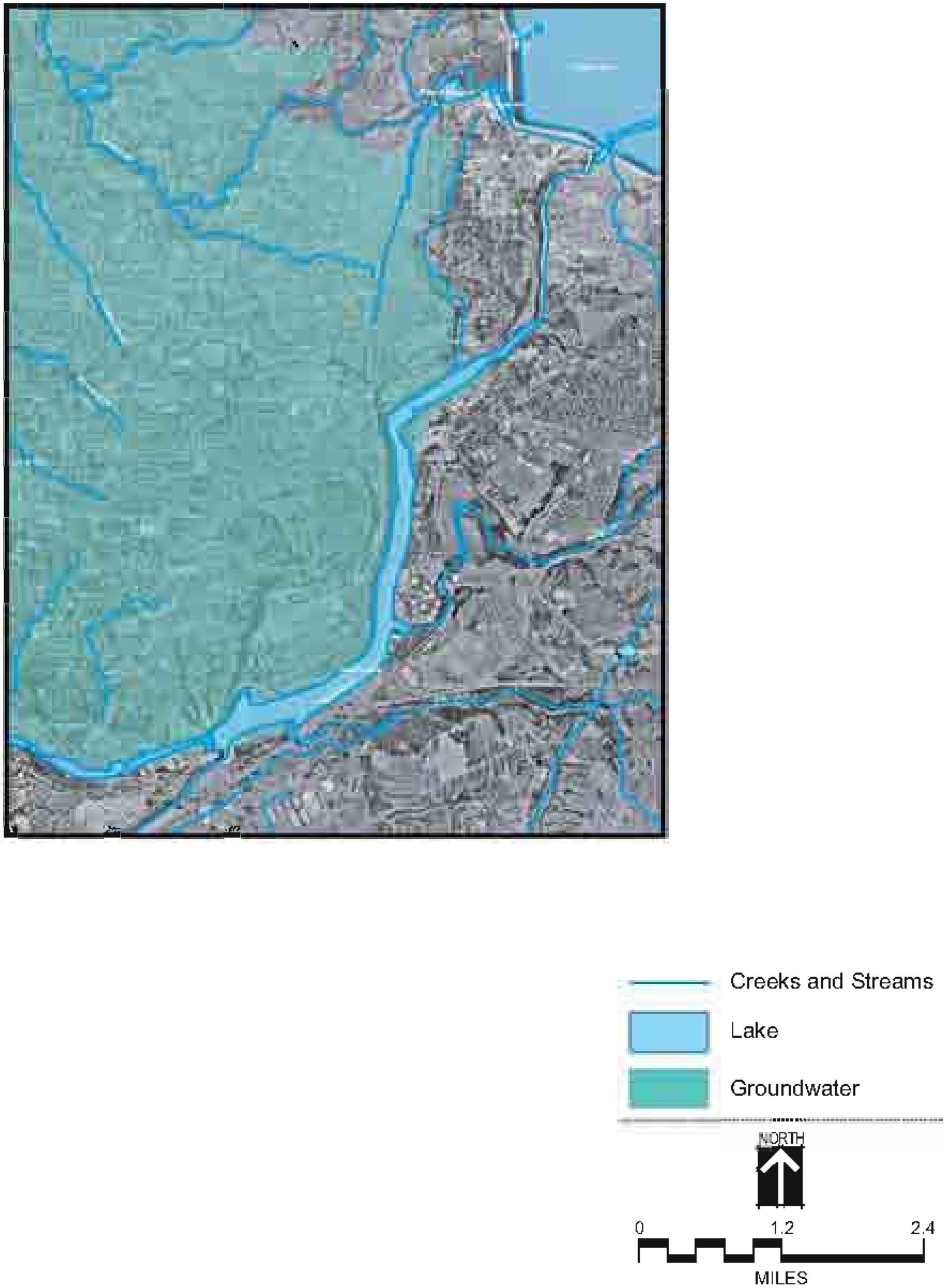
Regulated or jurisdictional waters include all adjacent wetlands in addition to navigable waters, interstate waters, and their tributaries. Therefore, any discharge of dredged or fill material into these jurisdictional wetlands would also be subject to compliance under Section 404 and 401 of the CWA. Project construction related to impacts to jurisdictional wetlands would be subject to regulations stated within these permits.

Seasonal wetlands and freshwater marshes exist in the construction area typically within or adjacent to streams, swales, or other drainages. Furthermore, groundwater upwelling is creating a wetland near Dike 5 on the western side of the reservoir.

For more specific information on wetlands found in the construction area, including recent acreage estimates of various wetlands and vegetative and terrestrial community composition, see Section 3.5, Terrestrial Vegetation and Wildlife, and Appendix C.

Mormon Island Wetland Preserve

The Mormon Island Wetland Preserve contains a series of wetlands that exist downstream of MIAD, above and below Green Valley Road. Reclamation completed a literature review of prior investigations into the connectivity between the reservoir and the wetlands. In the 2006 report entitled *MIAD Hydrogeology Draft Report*, Reclamation determined that data collected throughout the downstream foundation area suggests no reservoir connection to local groundwater levels (Reclamation 2006b). There does, however, appear to be a hydraulic connectivity in the dredged alluvium downstream of MIAD in the area between the dam toe and the preserve.



Source: LSA Associates, Inc. 2003

Figure 3.1-2
Groundwater Surrounding
Folsom Reservoir and Lake Natoma

CDM

Additionally, it is believed that the water source for the wetlands located in the north-central part of the preserve, just south of Green Valley Road, could be from seepage of the MIAD embankment. The source of this seepage is not the reservoir but a combination of bank storage of precipitation and seepage via joints in the foundation bedrock. This seepage collects in a drain and then eventually flows through a culvert under Green Valley Road and into the preserve (Reclamation 2006b). The source of water in the preserve in an area of deciduous trees in the dredged alluvium is believed to originate from the higher hillsides to the east due to release of bank storage and surface water runoff following precipitation events (Reclamation 2006b).

3.1.2 Environmental Consequences/Environmental Impacts

In this section, the assessment methods, significance criteria, and effects of the alternatives on surface water and groundwater resources, water quality conditions, and jurisdictional wetlands in the vicinity are evaluated. In regards to wetlands, this section focuses on the hydrologic effects to wetlands due to construction activities. Additional information on jurisdictional wetland impacts, specifically loss of wetland areas and habitat quality, are described in Section 3.5, Terrestrial Vegetation and Wildlife.

3.1.2.1 Assessment Methods

Potential impacts associated with each alternative were assessed through a qualitative evaluation. Information presented in the existing conditions as well as construction practices and materials, location, and duration of construction were evaluated during the assessment process.

3.1.2.2 Significance Criteria

Based on CEQA Guidelines, effects on hydrologic resources and water quality conditions would be significant if construction would:

- Expose people or structures to a significant risk of loss, injury, or death involving flooding, including flooding as a result of the failure of a levee or dam;
- Violate any water quality standards or waste discharge requirements or substantially degrade water quality; or
- Substantially deplete groundwater supplies or interfere substantially with groundwater recharge such that there would be a net deficit in aquifer volume or a lowering of the local groundwater table level.

Additionally, thresholds of significance for wetland resources under CEQA have been used in the following evaluation. Impacts were significant if they would:

- Have a substantial adverse effect on federally protected wetlands as defined by Section 404 of the CWA (including, but not limited to, marsh, vernal pool, coastal, etc.) through direct removal, filling, hydrological interruption, or other means.

Section 3.5 contains additional thresholds of significance under CEQA for biological resources related to wetlands and riparian habitat, their related impacts and associated mitigation measures.

3.1.2.3 Environmental Consequences/Environmental Impacts

Environmental Consequence/Environmental Impacts of the No Action/No Project Alternative

The No Action/No Project Alternative would not result in increased dam safety and flood damage reduction.

The No Action/No Project Alternative assumes no action would be taken by any agency. If modifications to Folsom Dam are not completed to improve dam safety and flood damage reduction, public safety would be at risk due to the potential of dam and dike failure associated with seismic, static, and hydrologic concerns. Without the Folsom DS/FDR, the reservoir does not have sufficient capacity to safely contain and release large amounts of flood water. This could result in flood-related loss of life, economic losses, and infrastructure damage.

This impact would be potentially significant. Based on the analysis presented above, it is anticipated that the environmental impact of the No Action/No Project Alternative (i.e., future environmental conditions if no action is taken relative to the Folsom DS/FDR) would exceed the significance criteria defined herein. However, unlike a significant impact associated with an action alternative, no mitigation can be required for significant impacts associated with the No Action/No Project (i.e., within the regulatory framework of NEPA and CEQA, a project applicant cannot be required to mitigate the impacts that would result from taking no action). As such, the impact identified above for the No Action/No Project Alternative is considered to be significant, adverse, and unmitigable.

Environmental Consequences/Environmental Impacts of Alternative 1

Construction of Folsom Facility modifications would degrade water quality.

Construction of Folsom Facility modifications associated with Alternative 1 would result in impacts to water quality caused by earth moving operations, storage and handling of construction materials on site, and operation and maintenance of construction equipment and vehicles.

Soil erosion associated with excavating material and re-grading would transport sediment into local tributaries or directly into the reservoir thus affecting water quality. Significant earth moving operations would occur at sites immediately adjacent to Folsom Reservoir as part of Alternative 1. Approximately 5.8 million cubic yards of earthen material would be handled as part of construction. Earthen material would be removed from the Beal's Point borrow and processing site adjacent to the reservoir up to depths of 30 feet to construct improvements to the Right Wing Dam and Dikes 4, 5, and 6. Additionally, the excavated soils with low permeability that exist at the D2 borrow site would be used for reinforcement of the MIAD core material under Alternative 1.

During haul road construction and use, sediment would be transported directly into local tributaries or directly into the reservoir. Internal haul road construction includes alignments within the reservoir boundary between Beal's Point and the Right Wing Dam, and the Left Wing Dam and MIAD. The primary road surface would consist of an earthen road base material. Other general construction materials including solvents, paints, waste materials, and oil and gas associated with operation and maintenance of construction equipment present on-site would introduce hazardous or toxic materials and silt and debris into surrounding waters. All of the elements and factors presented above could contribute to degradation of water quality in receiving waters as part of construction of Alternative 1.

This impact would be potentially significant. Mitigation Measures HWQ-1 through HWQ-3 and HWQ-9 would reduce impacts to a less than significant level.

Construction of Folsom Facility modifications would subject population to risk of dam or embankment failure.

Construction of Folsom Facility modifications associated with Alternative 1 would occur during times that the structures retained water. This could risk the integrity of the structures. However, all construction work would occur on the downstream side and would not involve the core of the structures. Therefore, there would be no potential for facility failure impacts to local population.

No impact due to risk of facility failure during construction.

Jet grouting at the downstream foundation of MIAD would affect water quality.

Under this alternative, the agencies would jet grout portions of the foundation of MIAD at the toe of the downstream embankment to reduce seismic risks. The jet grout is a stabilizer, usually a neat cement grout, which would be injected at high pressures into the subsurface alluvium. When the jet grout is injected, the potential exists for the grout to migrate through the spaces between alluvial rocks and gravels. The migration of grout into source waters or into the wetlands area would alter water quality.

The curing of jet grout in the subsurface and in the waste pits at the surface would have the potential of producing alkaline water of pH 12. Many biological processes, such as reproduction, cannot operate in alkaline waters. Elevated pH levels can also lead to increased nutrient loading.

Mercury and other metals, historically found in the dredged alluvium deposits, could also be released due to jet grouting processes and subsequent generation of slurry waste materials. These metals could potentially mobilize and move downstream, adversely affecting water quality and aquatic life.

This impact would be potentially significant. Mitigation Measures HWQ-4 through HWQ-8 would reduce impacts to a less than significant level.

Jet grouting at the downstream foundation of MIAD would reduce the water source for a portion of the wetlands.

Alternative 1 would require jet grouting the downstream foundation at MIAD. As discussed in Section 3.1.1.3, one water source for a portion of the wetlands downstream of MIAD could be seepage from the MIAD embankment. Jet grouting would solidify materials at the foundation and could reduce seepage, thereby resulting in a reduction in water to a portion of the wetlands in the preserve.

This impact would be potentially significant. Mitigation Measure HWQ-5 would reduce impacts to a less than significant level.

Construction actions would cause effects to groundwater or groundwater supplies.

With the exception of the potential groundwater effects due to jet grouting at MIAD, construction activities would not affect groundwater resources. Mitigation measures for jet grouting (HWQ-4 through HWQ-8) will be employed to minimize groundwater effects due to jet grouting.

This impact would be potentially significant. Mitigation Measures HWQ-4 through HWQ-8 would reduce this impact to a less than significant level.

Construction actions would cause mobilization of mercury and metals into the water column in the reservoir.

Construction of the Auxiliary Spillway and construction activities at MIAD could lead to the mobilization of sediment into the water column or released into the American River downstream. Reclamation completed sediment sampling to determine if it would be a hazard to downstream aquatic life if allowed to flow downstream. Results of the sediment chemical analyses are presented in Appendix J. In 2006, Reclamation sampled a total of 18 sites and none of the samples exceeded the threshold for mercury of 0.2 mg/kg. Additionally, of all the samples analyzed for metals, no results met or exceeded any of the sediment standards and as a result would be suitable for unconfined aquatic disposal. However, mitigation measures would be implemented to prevent any potential mobilization of sediment.

This impact would be potentially significant. Mitigation Measures HWQ-12 and HWQ-13 would reduce this impact to a less than significant level.

Excess material placed in the reservoir would cause adverse water quality effects.

Excess material excavated from the auxiliary spillway site that does not meet the specifications for shell or filter may be placed in areas inside the reservoir. If this material is placed within or near the water line, erosion could occur from wave action or runoff and could increase turbidity in the reservoir. This could also introduce soluble pollutants associated with the materials into the water column or could lead to a release of insoluble pollutants if materials are place in deeper locations. During the placement material in the reservoir, there may also be temporary water quality impacts resulting from the dripping and leakage of fuels and oils from the use of construction equipment along the shoreline.

This impact would be potentially significant. Mitigation Measures HWQ-1 through HWQ-3, HWQ-9, and HWQ-14 would reduce impacts to a less than significant level.

Construction of Alternative 1 would not affect downstream water quality.

Alternative 1 is primarily a stand alone Dam Safety alternative and was designed to pass the Probable Maximum Flood and address the seismic and static risks. The Main Concrete Dam will retain all of its current capabilities. If this alternative was implemented, it is anticipated that the features would only be operated once every 300 years or greater. The fuseplug and Auxiliary Spillway would only operate at a point when over 500,000 cfs was already being released downstream through the existing spillway. The fuseplug spillway in conjunction with the existing spillway could release a total discharge between 850,000 and 900,000 cfs.

All operations-related impacts would have already occurred downstream before the fuseplug would operate. All habitat within the Lower American River Parkway and the river channel itself would already be adversely impacted. Therefore, this alternative would not have significant downstream water quality impacts.

This alternative would not have adverse impacts to the coldwater pool or downstream temperatures (water quality). The fuseplug would be reconstructed as soon as the event has passed. Stockpiles of the material required to rebuild the fuseplug would be available for this purpose. Timely replacement of the fuseplug would ensure that there are no adverse water quality impacts to the coldwater pool, or downstream conditions.

Downstream impacts from reservoir operations and flood releases would be less than significant for Alternative 1.

Environmental Consequences/Environmental Impacts of Alternative 2
<u>Construction would degrade water quality.</u>

Similar to Alternative 1, construction-related activities associated with Alternative 2 related to earth moving operations, storage and handling of construction materials on site, and operation and maintenance of construction equipment and vehicles could impact water quality within the reservoir or small local tributaries that discharge directly into the reservoir.

Soil erosion associated with excavating material and re-grading may transport sediment into local tributaries or directly into the reservoir, thus affecting water quality. Earth moving operations would occur adjacent to Folsom Reservoir as part of Alternative 2, and approximately 11.9 million cubic yards of material would be handled. With the exception of boring the Auxiliary Spillway tunnel, similar activities would occur as part of Alternative 2 as for Alternative 1. However, the potential for erosion would be increased as part of Alternative 2 due to the potential earthen raises of all dikes, wing dams and MIAD.

The potential water quality impacts of Alternative 2 are primarily related to haul road construction and use, storage and handling of construction materials, and operation and maintenance of equipment. All of these activities could contribute to degradation of water quality during construction.

This impact would be potentially significant. Mitigation Measures HWQ-1 through HWQ-3 and HWQ-9 would reduce impacts to a less than significant level.

<u>*Dewatering at the downstream foundation of MIAD would reduce the water source for a portion of the wetlands.*</u>

Dewatering around the area of the downstream foundation at MIAD would be required prior to excavation of the foundation. Because there is likely a hydraulic connectivity in the dredged alluvium downstream of MIAD in the area between the dam toe and the preserve, dewatering could reduce water levels in the area of the preserve.

This impact would be potentially significant. Mitigation Measure HWQ-10 would reduce impacts to a less than significant level.

<u>*Actions to excavate and replace the downstream foundation of MIAD would reduce the water source for a portion of the wetlands.*</u>

Alternative 2 would involve excavation and replacement of the downstream foundation at MIAD. As discussed in Section 3.1.1.3, one water source for a portion of the wetlands downstream of MIAD is likely seepage from the MIAD embankment. Excavation and replacement of the MIAD foundation with high strength material including cement-modified soil could reduce seepage. The water source for the wetlands in the preserve could be reduced.

This impact would be potentially significant. Mitigation Measure HWQ-5 would reduce any impacts to a less than significant level.

Construction actions would cause effects to groundwater or groundwater supplies.

With the exception of the potential groundwater effects due to excavation and replacement of the downstream foundation at MIAD, construction activities would not affect groundwater resources. Mitigation Measure HWQ-10 will be employed to minimize groundwater effects.

This impact would be potentially significant. Mitigation Measure HWQ-10 would reduce this impact to a less than significant level.

Construction actions including in-reservoir dredging would cause adverse water quality effects from mercury and metals in the reservoir.

Impacts would be similar to those described above for Alternative 1.

This impact would be potentially significant. Mitigation Measure HWQ-12 would reduce this impact to a less than significant level.

Excess material placed in the reservoir would cause adverse water quality effects.

Impacts would be similar to those described above for Alternative 1.

This impact would be potentially significant. Mitigation Measures HWQ-1 through HWQ-3 and HWQ-9 would reduce impacts to a less than significant level.

Construction of Alternative 2 would affect downstream water quality.

Alternative 2 is a Flood Damage Reduction alternative and was designed to pass the Probable Maximum Flood. Under this alternative, it is anticipated that the features would be operated infrequently to pass the design flood. The principle features of Alternative 2 would include a fuseplug Auxiliary Spillway with an underlying tunnel and a raise of up to 4 feet.

The fuseplug spillway features of this alternative would only operate at a point when over 500,000 cfs was already being released downstream, as described in Alternative

1. The tunnel would provide a substantially lower level of discharge capacity, allowing for the initiation of earlier releases, and maintaining flows at 160,000 cfs or below for duration's equivalent to the 1 in 200 year event.

All operations-related impacts would have already occurred downstream before the fuseplug would operate. All habitat within the Lower American River Parkway and the river channel itself would already be adversely impacted. Therefore, this alternative would not have significant downstream impacts to water quality.

Alternative 2 would not have adverse impacts to the coldwater pool, or downstream temperatures (water quality). The fuseplug would be reconstructed as soon as feasible once the event has passed. Stockpiles of the material required to rebuild the fuseplug would be available for this purpose. Timely replacement of the fuseplug would ensure no adverse water quality impacts to the coldwater pool, or downstream conditions.

Construction and utilization of the features in Alternative 2 would not substantially alter current Folsom Reservoir operations and, in general, would decrease downstream hydraulic impacts during a severe storm event.

Downstream impacts from reservoir operations and flood releases for Alternative 2 would be less than significant.

Environmental Consequence/Environmental Impacts of Alternative 3
Construction would degrade water quality.

Construction-related activities associated with Alternative 3 related to earth moving operations, storage and handling of construction materials on site, and operation and maintenance of construction equipment and vehicles could affect water quality within the reservoir or small local tributaries that discharge directly into the reservoir. In addition, the construction involved with extending the Stilling Basin under Alternative 3 poses further water quality impacts due to the dewatering processes necessary to complete this work.

Soil erosion associated with excavating material and re-grading may transport sediment into local tributaries or directly into the reservoir, thus affecting water quality. Under Alternative 3, 3.6 million cubic yards of material would be handled. Similar activities would occur as part of Alternative 3 as was described above for Alternative 2, including the potential construction of new embankments in low elevation areas to retain water temporarily stored during emergency flood flow events. In addition, excavation activities would occur at either or both the D1 and D2 sites to develop borrow sites for use in strengthening the core of MIAD.

Similar water quality impacts would exist as part of Alternative 3 as was described above for Alternatives 1 and 2 regarding haul road construction and use, storage and handling of construction materials, and operation and maintenance of equipment. All of these factors could contribute to degradation of water quality in receiving waters as part of construction of Alternative 3.

This impact would be potentially significant. Mitigation Measures HWQ-1 through HWQ-3 and HWQ-9 would reduce impacts to a less than significant level.

Jet grouting at the downstream foundation of MIAD would affect water quality.

This impact would be similar to Alternative 1.

This impact would be potentially significant. Mitigation Measures HWQ-4 through HWQ-8 would reduce impacts to a less than significant level.

Jet grouting at the downstream foundation of MIAD would reduce the water source for a portion of the wetlands.

This impact would be similar to Alternative 1.

This impact would be potentially significant. Mitigation Measure HWQ-5 would reduce impacts to a less than significant level.

Construction actions including in-reservoir dredging would cause adverse water quality effects from mercury and metals in the reservoir.

Alternative 3 would involve construction activities within the reservoir, including dredging, to construct the approach channel to the Auxiliary Spillway. Impacts would be similar to Alternative 1.

This impact would be potentially significant. Mitigation Measures HWQ-12 and HWQ-13 would reduce this impact to a less than significant level.

Excess material placed in the reservoir would cause adverse water quality effects.

Impacts would be similar to those described above for Alternative 1.

This impact would be potentially significant. Mitigation Measures HWQ-1 through HWQ-3, HWQ-9, and HWQ-14 would reduce impacts to a less than significant level.

Dewatering of the Stilling Basin would affect water quality downstream in Lake Natoma and the lower American River.

The water quality of the Stilling Basin is generally good and comparable to the water quality of Folsom Reservoir. Previous dewatering of the basin in 2004 by the Corps did not result in any downstream impacts. Best management practices would be employed when dewatering occurs. It is not expected that this action would result in any downstream water quality impacts.

This impact would be less than significant.

Construction of Alternative 3 would not affect downstream water quality.

Under Alternative 3, Folsom Dam would have four methods of releasing flows from the reservoir: three power penstocks, eight flood control outlets (four upper tier and four lower tier, all 5 ft x 9 ft), tainter/radial spillway gates set near the main spillway crest (five service and three emergency), and six submerged tainter gates in the proposed Auxiliary Spillway. In general, utilization of the features described in Alternative 3 would involve greater releases earlier in a major hydrologic event that closely match downstream channel capacity.

The JFP Auxiliary Spillway would allow the objective release of 115,000 cfs to be achieved sooner in a flood event, and would lessen peak flows fore large, infrequent hydrologic events. A maximum flood release of 160,000 cfs, which is the emergency downstream channel capacity, would be made through the Auxiliary Spillway when necessary based on observed and anticipated reservoir inflows. Emergency releases of 160,000 cfs or above would not be made any sooner with the JFP spillway features than under existing conditions.

Variations in releases utilizing the Folsom DS/FDR features would not be any larger than those allowed under existing conditions. Under this alternative, the amount of water that would ultimately be released would be the same as existing conditions and the No Action/No Project Alternative (due to operational constraints), but operators would have the ability to release water sooner in a hydrologic event. Features of this alternative would be operated under existing operating criteria; therefore, the implementation of Alternative 3 would not have adverse impacts to downstream water quality.

Downstream impacts from reservoir operations and flood releases for Alternative 3 would be less than significant.

Environmental Consequences/Environmental Impacts of Alternative 4
Construction would degrade water quality.

Construction-related activities associated with Alternative 4 pertaining to earth moving operations, storage and handling of construction materials on site, and operation and maintenance of construction equipment and vehicles could impact nearby water quality. In addition, the construction involved with extending the Stilling Basin under Alternative 4 poses further water quality impacts due to the dewatering processes necessary to complete this work.

Soil erosion associated with excavating material and re-grading may transport sediment into local tributaries or directly into the reservoir, thus affecting water quality. Alternative 4 involves earth moving operations adjacent to Folsom Reservoir where 6.5 million cubic yards of material would be handled to construct the new Auxiliary Spillway and raise embankments. Similar activities would occur as part of Alternative 4 as was described above for Alternative 2 and 3, including the construction of new embankments. In addition, excavation activities would occur at Granite Bay, Beal's Point and other borrow sites (e.g., D1 and D2) to develop borrow for the earthen raise of the facilities.

Similar water quality impacts would occur as part of Alternative 4 as was described above for Alternatives 1 through 3 regarding haul road construction and use, storage and handling of construction materials, and operation and maintenance of equipment. All of these factors could contribute to degradation of water quality in local tributaries or within the reservoir as part of construction of Alternative 4.

This impact would be potentially significant. Mitigation Measures HWQ-1 through HWQ-3 and HWQ-9 would reduce impacts to a less than significant level.

Jet grouting at the downstream foundation of MIAD would affect water quality.

This impact would be similar to Alternative 1.

This impact would be potentially significant. Mitigation Measures HWQ-4 through HWQ-8 would reduce impacts to a less than significant level.

Jet grouting at the downstream foundation of MIAD would reduce the water source for a portion of the wetlands.

This impact would be similar to Alternative 1.

This impact would be potentially significant. Mitigation Measure HWQ-5 would reduce impacts to a less than significant level.

Construction actions including in-reservoir dredging would cause adverse water quality effects from mercury and metals in the reservoir.

Impacts would be similar to those described above for Alternative 3 resulting from construction of the approach channel to the Auxiliary Spillway within the reservoir.

This impact would be potentially significant. Mitigation Measures HWQ-12 and HWQ-13 would reduce this impact to a less than significant level.

Excess material placed in the reservoir would cause adverse water quality effects.

Impacts would be similar to those described above for Alternative 1.

This impact would be potentially significant. Mitigation Measures HWQ-1 through HWQ-3, HWQ-9, and HWQ-12 would reduce impacts to a less than significant level.

Dewatering of the Stilling Basin would affect water quality downstream in Lake Natoma and the lower American River.

The water quality of the Stilling Basin is generally good and comparable to the water quality of Folsom Reservoir. Previous dewatering of the basin in 2004 by the Corps did not result in any downstream impacts. Best management practices would be employed when dewatering occurs. It is not expected that this action would result in any downstream water quality impacts.

This impact would be less than significant.

Construction of Alternative 4 would not affect downstream water quality.

Alternative 4 would provide Folsom Dam with the same four methods of discharging water as Alternative 3. In general, utilization of the features described in Alternative 4 would involve greater releases earlier in a major hydrologic event that closely match downstream channel capacity. The new Auxiliary Spillway would allow the objective release of 115,000 cfs to be achieved sooner in a flood event, and would lessen peak flows fore large, infrequent hydrologic events. A maximum flood release of 160,000 cfs, which is the emergency downstream channel capacity, would be made through the new Auxiliary Spillway when necessary, based on observed and anticipated reservoir inflows.

Emergency releases of 160,000 cfs or above would not be made any sooner with the Folsom DS/FDR features than under existing conditions. Variations in releases utilizing Folsom DS/FDR features would not be any larger than those allowed under the existing conditions and the No Action/No Project Alternative. Under this alternative, the amount of water that would ultimately be released would be the same as existing conditions and the No Action/No Project Alternative (due to operational constraints), but operators would have the ability to release water sooner in a hydrologic event. The features would be operated under existing operating criteria; therefore, there would be no adverse impacts to water quality.

Downstream impacts from reservoir operations and flood releases for Alternative 4 would be less than significant.

Environmental Consequences/Environmental Impacts of Alternative 5

<u>Construction would degrade water quality.</u>

Construction-related activities associated with Alternative 5 pertaining to earth moving operations, storage and handling of construction materials on site, and operation and maintenance of construction equipment and vehicles would impact nearby water quality. Dewatering of shallow groundwater would be necessary to complete excavation and replacement of the downstream foundation at MIAD, further increasing the potential for local surface water quality degradation.

Soil erosion associated with excavating material and re-grading would transport sediment into local tributaries or directly into the reservoir, thus affecting water quality. Alternative 5 would involve the greatest amount of borrow excavation within the reservoir because the Auxiliary Spillway would not be built. However, similar activities would occur as part of Alternative 5 for other excavation activities as was described above for Alternatives 1 through 4, but at a greater extent due to the raising of all facilities by 17 ft. Private properties surrounding the reservoir would be protected by construction of new embankments or would be acquired. Construction of the new embankments would pose the same water quality effects as would construction of the main facilities. Similar to Alternative 4, excavation activities would occur at either or both the D1 and D2 sites to develop borrow sites for use in the 17 foot earthen raise at MIAD.

Similar water quality impacts would occur as part of Alternative 5 as was described above for Alternatives 1 through 4 regarding haul road construction and use, storage and handling of construction materials, and operation and maintenance of equipment. All of these factors could contribute to degradation of water quality in local tributaries or within the reservoir as part of construction of Alternative 5.

This impact would be potentially significant. Mitigation Measures HWQ-1 through HWQ-3 and HWQ-9 would reduce impacts to a less than significant level.

<u>*Dewatering at the downstream foundation of MIAD would reduce the water source for a portion of the wetlands.*</u>

Impacts would be similar to those discussed under Alternative 2.

This impact would be potentially significant. Mitigation Measure HWQ-10 would reduce impacts to a less than significant level.

<u>*Actions to excavate and replace the downstream foundation of MIAD would reduce the water source for a portion of the wetlands.*</u>

Impacts would be similar to those discussed under Alternative 2.

This impact would be potentially significant. Mitigation Measure HWQ-5 would reduce impacts to a less than significant level.

Actions to excavate and replace the downstream foundation of MIAD would adversely affect groundwater and groundwater resources.

Impacts would be similar to those discussed under Alternative 2.

This impact would be potentially significant. Mitigation Measure HWQ-10 would reduce impacts to a less than significant level.

Construction actions would cause adverse water quality effects from mercury and metals in the reservoir.

Excavation of material from the approach channel could suspend sediment containing mercury in the water column. Fish and invertebrates could be exposed to higher levels of mercury, which could lead to bioaccumulation. Fish in Folsom Reservoir are known to have elevated levels of mercury, many timed above background levels. The amount of sediment suspended and mercury methylated would be reduced with water quality mitigation measures and physical means, such as silt curtains.

This impact would be potentially significant. Mitigation Measure HWQ-12 and HWQ-13 would reduce this impact to a less than significant level.

Excess material placed in the reservoir would cause adverse water quality effects.

Impacts would be similar to those described above for Alternative 1.

This impact would be potentially significant. Mitigation Measures HWQ-1 through HWQ-3, HWQ-9, and HWQ-14 would reduce impacts to a less than significant level.

Construction of Alternative 5 would not affect downstream water quality.

The 17 foot raise would be designed to contain a large storm event and pass it without overtopping the downstream levees. Variations in releases utilizing Folsom DS/FDR features would not be any larger than those allowed under existing conditions and the No Action/No Project Alternative. In addition, the top of the flood control pool would be raised to increase the flood storage space. Alternative 5 would allow the reservoir to hold more flood water and would allow a substantially larger timeframe for the evacuation of downstream communities.

Downstream impacts would remain the same as existing conditions and the No Action/No Project Alternative. The implementation of Alternative 5 would not have adverse downstream impacts to water quality. Releases would be made according to the Interim Flood Control Diagram.

Downstream impacts from reservoir operations and flood releases for Alternative 5 would be less than significant.

3.1.3 Comparative Analysis of Alternatives

None of the alternatives would change the hydrology of Folsom Reservoir, but the alternatives could result in better management of hydrologic flows and conditions. Additionally, none of the alternatives would have adverse downstream water quality effects associated with operation because the new features of each alternative would be operated according to existing operating criteria. Potential water quality impacts associated with construction of Alternatives 1 through 5 would be potentially significant. Impacts would be mitigated by implementing Mitigation Measures HWQ-1 through HWQ-12. Besides the No Action/No Project Alternative which would pose no increased threat to hydrologic resources, varying degrees of potential impacts to water quality, water levels, and viability of wetlands are associated with each alternative, as discussed below.

Alternatives 1 and 3 would pose the least potential to impact water resources. This is because both alternatives would have the smallest amount of excavation that would occur during construction, including the least borrow development within the reservoir. The possibility of impacts to water resources would be lower because there is less chance for soil erosion and subsequent transport into the reservoir. Furthermore, less earthmoving and construction equipment would be necessary to perform this work, and associated with it, less operations and maintenance of the equipment, and subsequent storage and handling of construction material.

Jet grouting of the downstream foundation at MIAD would also occur under Alternatives 1, 3, and 4, potentially affecting water quality and potentially reducing the water source for a portion of the wetlands.

Alternative 2 would involve greater potential for water quality impacts than Alternatives 1 and 3 because it requires more construction activities and excavation to occur. Alternative 2 is the only alternative that includes construction of an Auxiliary Spillway tunnel. Alternative 2 would result in a greater potential for impacts than Alternative 1 to water quality due to the increased area of construction and volume of material excavated and related chances for erosion and sedimentation to occur in local tributaries or directly into the reservoir. In addition, while this alternative does not involve jet grouting, dewatering would be required when excavation and replacement of the foundation downstream of MIAD occurs, thus possibly reducing the water source for a portion of the wetlands.

Alternative 3 would have similar potential for impacts to water quality as Alternative 1. Similar to Alternative 1, Alternative 3 would require jet grouting at MIAD which could introduce water quality problems and water source issues for a portion of the wetlands. In addition, under Alternative 3, extending the Stilling Basin would require dewatering with potential water quality impacts as a result of discharge. The potential impacts of Alternative 3 are less than those of Alternatives 4 and 5 because the required earth-moving and excavation quantities are less for Alternative 3 than those for Alternatives 4 and 5.

Alternative 4 would pose greater potential water quality impacts than Alternatives 1 and 3 because it requires more excavation and construction activities. Alternative 4 would result in potential impacts to water resources due to the increased area of construction and volume of material excavated and related chances for erosion and sedimentation to occur in local tributaries or directly into the reservoir. In addition, Alternative 4 requires extending the Stilling Basin, which would require dewatering, as well as jet grouting of the downstream foundation of MIAD. Therefore, additional water quality and wetland impacts could be introduced. The potential impacts of Alternative 4 are less than those of Alternative 5 due to the fact that excavation quantities are less for Alternative 4 than those for Alternative 5.

Alternative 5 would have the greatest overall potential for impacts to water quality, wetlands, and groundwater and surface water levels compared to Alternatives 1 through 4 because it requires the most construction activities and excavation to occur. Additionally, Alternative 5 involves dewatering for both the excavation and replacement of the downstream foundation at MIAD. Alternative 5 has the greatest potential for water quality effects because it involves the largest construction area and the greatest volume of material excavated and dewatering processes. These processes increase the potential for erosion and sedimentation to occur in local tributaries or directly into the reservoir, water levels in both surface water and groundwater to potentially fluctuate, and wetland water sources to be affected.

3.1.4 Mitigation Measures

Implementation of Mitigation Measures HWQ-1 through HWQ-12 would reduce the significant impact on water quality, wetlands, and water levels to a less than significant level. Compliance and evaluation as part of the provisions stated for the various permits discussed below would serve to minimize and mitigate potential hydrologic impacts due to construction activities.

HWQ-1: An NPDES permit will be obtained prior to construction activities, commencing by filing a Notice of Intent (NOI) with the CVRWQCB and preparing a SWPPP. As required under the General Permit, the SWPPP will identify implementation measures necessary to mitigate potential water quality degradation as a result of construction. These measures will include BMPs and other standard pollution prevention actions such as erosion and sediment control measures, proper control of non-stormwater discharges, and hazardous spill prevention and response. The SWPPP will also include requirements for BMP inspections, monitoring, and maintenance.

The NOI indicates the intent to comply with the General Permit which outlines conditions to minimize sediment and pollutant loading.

The following items are examples of BMPs that will be implemented during construction to avoid causing water quality degradation:

- Erosion control BMPs such as use of mulches or hydroseeding to prevent detachment of soil following guidance presented in the California BMP Handbooks – Construction (CASQA 2003). A detailed site map will be included in the SWPPP outlining specific areas where soil disturbance may occur, and drainage patterns associated with excavation and grading activities. In addition, the SWPPP will provide plans and details for the BMPs to be implemented prior, during and after construction to prevent erosion of exposed soils and to treat sediments before they are transported offsite.

- Sediment control BMPs such as silt fencing or detention basins that trap soil particles.

- Construction staging areas designed so that stormwater runoff during construction will be collected and treated in a BMP such as a detention basin.

- Management of hazardous material and wastes to prevent spills.

- Vehicle and equipment fueling BMPs so these activities occur only in designated staging areas with appropriate spill controls.

- Maintenance checks of equipment and vehicles to prevent spills or leaks of liquids of any kind.

As described in Chapter 2, specific staging areas for construction-related activities will be located near the Main Concrete Dam, Granite Bay, Beal’s Point, Folsom Point, and MIAD. Haul roads will be constructed to connect Beal’s Point with Granite Bay, and the LWD with MIAD. Only designated areas and roads will be used during construction processes to minimize water quality impacts.

HWQ-2: Measures to control on-site spills will be included in the SWPPP. In addition to the spill prevention and control BMPs presented above, the SWPPP will contain a visual monitoring program and a chemical monitoring program for pollutants that are non-visible to be implemented if there is a failure of BMPs. Proper storage and handling of materials and equipment servicing will only occur in designated areas. Should a spill occur, appropriate steps will be taken to inform local regulatory agencies as well as implementation of a spill response program as outlined in the SWPPP.

HWQ-3: Permits prepared by the responsible Federal agency will be obtained and abided by as stated in Section 401 and Section 404 of the CWA regarding dredging or filling of waters of the United States, and activities involving discharging into those waters, which include wetlands, respectively. Construction activities related to temporary or permanent alteration of any water body within the construction area will be subject to regulation pursuant to these permits. Compliance under these permit provisions will serve to minimize construction activity impacts on water quality.

HWQ-4: Prior to implementing the full jet grouting action, Reclamation will perform jet grouting tests at MIAD including the monitoring for any grout leakages as well as the testing of groundwater and surface water levels and quality. If Reclamation determines that leakages are expected to occur and could cause adverse water quality effects, they will construct a cutoff wall before they jet grout the foundation at MIAD that will eliminate the migration of the grout, metals released from sediments, and pH 12 water impacts to surrounding waters.

HWQ-5: Reclamation will monitor surface and groundwater levels and water quality prior to, during, and after jet grouting or excavation and replacement of MIAD.

- If any well or wetlands within 200 feet of jet grout construction are found to have an elevated pH, then construction will cease until the pH returns to normal (as determined by pre-construction water quality monitoring).
- If the pH does not return to normal within 30 minutes, then a Reclamation biologist or hazardous materials specialist will be notified.

HWQ-6: If jet grout daylights more than 50 feet from the point of construction, then work will cease until it can be determined that the grout will remain localized.

HWQ-7: During jet grout injection, all wetlands that could be impacted by construction will be visually inspected for the presence of grout every 15 to 30 minutes.

HWQ-8: All temporary jet grout solidification areas will be lined with a material that does not allow the migration of any construction-related materials.

HWQ-9: Guidance will be obtained from the CVRWQCB for testing earthen materials before constructing work area platforms within or adjacent to the reservoir to ensure any potentially associated pollutants will not be introduced into the reservoir that would violate water quality standards or substantially degrade existing water quality. Fill material will be placed in the reservoir during periods of lower water elevation, when possible. Best management practices will be adhered to in order to minimize water quality impacts during the placement of fill in the reservoir.

HWQ-10: Reclamation will monitor groundwater and surface water levels in wetlands downstream of MIAD and within the Mormon Island Wetland Preserve during dewatering of the MIAD foundation for excavation and replacement. If water levels decrease because of dewatering, the water obtained from dewatering will be tested and treated to meet surface water standards prior to being pumped back into the wetlands.

HWQ-11: The Corps will obtain a dewatering permit from CVRWQCB and will implement applicable water quality monitoring during dewatering of the existing Stilling Basin.

HWQ-12: Mitigation measures to minimize water quality impacts due to construction within and along the reservoir shoreline will be developed in consultation with CVRWQCB staff. These measures may include placement of a silt curtain surrounding the construction zone or construction of coffer dams. If appropriate, routine water samples will be collected at the start and completion of each dredging and/or blasting period.

HWQ-13: During the process of dredging material to construct the approach channel for the Auxiliary Spillway, sediment containing mercury will be controlled using a variety of methods, including, but not limited to, silt curtains, silt fences, as well as other BMPs and construction methods approved by the CVRWQCB. Dredged material will be placed on the downstream side of the reservoir in a contained area for drying and processing. The dredged material will then be contained either in the MIAD overlay or transported to a permanent disposal site outside of the reservoir.

HWQ-14: A water quality monitoring plan will be developed for review by the CVRWQCB prior to any in reservoir construction work. The plan will address sampling requirements during dredging, blasting, excavation, and placement of fill within the reservoir. If turbidity readings exceed action level values established by the CVRWQCB, corrective actions will be implemented in accordance with the plan.

3.1.5 Cumulative Effects

This section discusses the cumulative impacts associated with the Folsom DS/FDR. Related past, present, and probable future projects considered in this cumulative discussion are presented in Table 5-1.

Construction would result in increased dam safety and flood damage reduction. This impact would be beneficial and therefore does not require mitigation. For those alternatives that incorporate flood damage reduction as part of their modifications, the Lower American River Common Features Project and Long-Term Reoperation of Folsom Dam and Reservoir have the potential to collectively increase the flood damage reduction in even greater amounts. These projects would culminate in beneficial impacts for flood damage reduction and dam safety.

Construction of the Folsom DS/FDR, in combination with existing and probable future projects, could affect water quality, wetland areas, and groundwater and surface water levels. This cumulative impact would be significant but mitigation such as contained within Mitigation Measures HWQ-1 through HWQ-12 would reduce these impacts to a less than significant level. Folsom DS/FDR construction activities could potentially influence water quality, change the viability of wetlands, and alter groundwater and surface water levels. When combined with construction of the New Folsom Bridge; Future Redundant Water Pipeline for Roseville, Folsom, and San Juan Water Districts; and the Lower American River Common Features Project, there is a possibility that water resources would be affected. However, each project's associated SWPPPs, BMPs, pertinent permits, and appropriate monitoring and testing would ensure that measures are implemented to avoid hydrologic resource impairment including water quality degradation, changing water levels, and detrimental effects to wetlands. This would result in effective mitigation of significant cumulative impacts.

3.2 Water Supply

This section discusses the potential impacts of construction of the various alternatives on water supplies.

3.2.1 Affected Environment/Existing Conditions

This section briefly describes the area of analysis, regulatory setting relevant to this resource, and the existing condition of this resource.

3.2.1.1 Area of Analysis

The area of analysis for this section includes Folsom Reservoir and surrounding counties: El Dorado, Sacramento, and Placer. Additionally, the water supply portion of Folsom Reservoir for both Central Valley Project (CVP) contractors and local water purveyors is also part of the area of analysis.

3.2.1.2 Regulatory Setting

Federal Regulations

Section 10 of the Rivers and Harbors Act of 1899 regulates alteration of (and prohibits unauthorized obstruction of) any navigable waters of the United States. Construction of any bridge, dam, dike or causeway over or in navigable waterways of the U.S. is prohibited without Congressional approval. Construction plans for a bridge or causeway must be submitted to and approved by the Secretary of Transportation, while construction plans for a dam or dike must be submitted to and approved by the Chief of Engineers and Secretary of the Army. Excavation or fill within navigable waters requires the approval of the Chief of Engineers and the Secretary of the Army. Under the reauthorization of the Rivers and Harbor Act of 1937, Reclamation took responsibility for the operation of the CVP. The Act authorized $12 million for construction of the CVP and made the improvement of navigation, regulation, and flood protection on the San Joaquin and Sacramento Rivers the first priority. Reclamation's primary purpose of supplying water for domestic use and irrigation were second priority and power generation was designated last priority. Reclamation currently manages water contracts and the majority of dams, reservoirs, canals, and other infrastructure connected with the CVP, which includes Folsom Reservoir.

The Central Valley Project Improvement Act (CVPIA) of 1992 amended previous authorizations of the CVP to include fish and wildlife protection, restoration, and mitigation on equal priority with irrigation and domestic uses. The CVPIA reallocated 800,000 acre-feet of CVP water from farmers in the Central Valley for the restoration of fisheries. In dry years 600,000 acre-feet is reallocated. The CVPIA also limited renewed agricultural water contracts to twenty-five years.

State Regulations

DWR and nine California Regional Water Quality Control Boards oversee water service. State regulation of water utilities also encompasses water supply planning and water quality.

DWR manages California's water resources in accordance with several pieces of legislation:

- Urban Water Management Planning Act – This Act addresses water supply availability and requires urban water suppliers to provide an Urban Water Management Plan (UWMP) to DWR every five years.

- Senate Bill (SB) 221 (Keuhl, Chapter 642, Statues of 2001) Certification of Sufficient Water Supply – This Bill requires local agencies to provide written verification that sufficient water supply is available before approving plans for new development.

- SB 610 (Costa, Chapter 643, Statues of 2001) Water Supply Planning – This Bill requires an urban water supplier to include in its UWMP a description of all water supply projects and programs that may be undertaken to meet total projected water use when groundwater is identified as a source of water available to the supplier (DWR 2004).

In addition, DWR is responsible for the development and management of the State Water Project (SWP), including planning, design, construction, operation and maintenance.

The State Water Resources Control Board (SWRCB) oversees the quality of the state's water resources, and ensures proper allocation and beneficial use. The SWRCB's Division of Water Rights administers the permitting and licensure of water rights as well as enforcement and the adjudication of water right disputes (SWRCB 1999).

Local Regulations

The Water Forum Agreement (Agreement) is an agreement among community leaders and water experts in Sacramento County to address anticipated water shortages, environmental degradation, groundwater contamination, threats to groundwater reliability, and limits to economic prosperity if action is not taken (Water Forum 1999). The Agreement provides assurances that as each signatory meets its responsibilities, other signatories will be fulfilling their commitments. One of the main objectives is to "provide a reliable and safe water supply for the region's economic health and planned development to the year 2030" (Water Forum 1999). Elements that directly pertain to water supplies include increased surface water diversions, action to meet customers' needs while reducing diversion impacts in drier years, water conservation, and groundwater management. Neither Reclamation nor the Corps is a signatory to this Agreement.

3.2.1.3 Environmental Setting

Folsom Reservoir is one of the larger facilities of the CVP. The CVP is a network of 20 reservoirs and over 500 miles of major canals that provides approximately 7 million acre-feet to the San Francisco Bay Area as well as to the Central Valley for agricultural, urban, and wildlife uses. Folsom Reservoir consists of approximately 10 percent of the total CVP storage (Reclamation 2005a).

Folsom Reservoir is the largest reservoir in the American River basin. By law, the Folsom Facility is operated as part of the CVP for flood control, irrigation water supply, municipal and industrial (M&I) water supply, hydropower generation, fish and wildlife, navigation and water quality purposes. The dams and dikes impound approximately 977,000 acre-feet; the average monthly storage ranges from 838,100 acre-feet in June to 472,900 acre-feet in November (Reclamation 2005a). Reservoir releases are generally highest from May through September.

Total annual M&I demand for Folsom Reservoir storage is about 140,000 acre-feet (Corps 2002). The reservoir meets the majority of water demands of the City of Roseville, the City of Folsom, the San Juan Water District, and the Folsom Prison. The San Juan Water District provides water to the City of Folsom, Orangevale Water Company, Fair Oaks Water District, and Citrus Heights Water District. Placer County Water Agency and El Dorado Irrigation District also receive water from Folsom Reservoir (Reclamation 2005a).

Water is conveyed from Folsom Reservoir to the City of Folsom and California Department of Corrections water treatment plants, and the Corps' Resident Office fire protection system through the Natomas Pipeline. This is a 42-inch above ground pipeline that is approximately 2,800 feet in length. The pipeline exits the dam at Adit 4 to the Folsom standpipe. The San Juan Water District receives its water supply from the same pipe which then delivers water to the San Juan Water District's water treatment plant.

3.2.2 Environmental Consequences/Environmental Impacts

3.2.2.1 Assessment Methods

Potential impacts associated with each alternative were assessed qualitatively. Information presented in the existing conditions as well as the following factors were considered during the evaluation process:

- Reservoir operations during construction;
- Changes to infrastructure that would impact deliveries to local water purveyors; and

- Changes to water supply capacity within the reservoir.

3.2.2.2 Significance Criteria

Under criteria based on the CEQA Guidelines and agency guidance, the Folsom DS/FDR would be considered to have a significant impact on water supply if it would:

- Result in delivery interruptions, reductions, or changes in timing of deliveries to CVP contractors; or
- Result in new or expanded entitlements or other water resources and supplies.

3.2.2.3 Environmental Consequences/Environmental Impacts

The following discussion evaluates impacts associated with each alternative.

Environmental Consequence/Environmental Impacts of the No Action/No Project Alternative

The No Action/No Project Alternative would not result in adverse effects associated with water supply.

The No Action/No Project Alternative assumes that no action would be taken by any agency and there would be no changes to the existing and future water supply.

The No Action/No Project Alternative would have no effect on water supply resources.

Environmental Consequences/Environmental Impacts of Alternative 1

Alternative 1 would not result in adverse effects associated with new or expanded entitlements or other water resources and supplies.

Alternative 1 would improve the safety of the Folsom Facility, but would not involve the raising of the Folsom Facility for additional flood storage purposes. The storage capacity of the reservoir would remain the same as existing conditions. During construction and post-construction, water allocations to CVP contractors would remain the same as existing conditions.

Alternative 1 would have no adverse effects associated with new or expanded entitlements.

The placement of excess material in the reservoir could reduce storage at Folsom Reservoir.

Under Alternative 1, excess borrow material would be placed in the reservoir. Approximately 65 percent of this material could be placed below the elevation of 466 feet. Assuming a 15 percent void ratio, the excess material placed in the reservoir could reduce storage by approximately 883 acre-feet (See Table 3.2-1).

This impact would be less than significant because it would involve less than one percent of available water storage. Mitigation would not be required.

Table 3.2-1
Decreases in Storage from Excess Material

Alternative	***Excess Material (Cubic Yards)***	***Excess Material (Cubic Feet)***	***Excess Material (Acre-Feet)***	***Assume 65% in Reservoir (below 466ft)***	***Assume 15% Void Ratio***	***Reduction in Storage (Acre-Feet)***
ALT 1	2,579,109	69,635,938	1,598	1,039	155	883
ALT 2	3,629,655	98,000,678	2,249	1,462	219	1,243
ALT 3	3,395,702	91,683,948	2,104	1,368	205	1,163
ALT 4	2,727,600	73,645,195	1,690	1,098	164	934
ALT 5	0	0	0	0	0	0

Source: (Lessard 2006).

Alternative 1 would result in adverse effects associated with the interruption of water supplies to local purveyors.

Reservoir operations during and post-construction would be operated in a manner to ensure that the timing and delivery of water to CVP contractors would not be altered from existing conditions. However, construction of the Auxiliary Spillway would potentially affect local water purveyors during construction. The chute alignment of the Auxiliary Spillway would cross a portion of the Natomas Pipeline. As discussed in Section 3.2.1.3, this raw water pipeline supplies water to the City of Folsom and California Department of Corrections water treatment plants, and the Corps' Resident Office fire protection system. Approximately 300 feet of the pipeline would need to be replaced with an above ground pipeline and would temporarily interrupt water supplies. In order to minimize the amount of time water supplies are interrupted, the above ground pipeline would be constructed prior to disconnecting the 300 foot portion of the existing pipeline for replacement. The interruption of supplies would be for a duration of less than one work day. The chute would be excavated below the above ground pipeline. In addition to the Natomas pipeline, an 8-inch diameter fire protection pipeline and metering station for the Corps’ Resident Office would need to be relocated.

This impact would be potentially significant. Mitigation Measure WS-1 would reduce impacts to a less than significant level. All other impacts associated with the interruption of water supplies to CVP contractors would be less than significant.

Environmental Consequences/Environmental Impacts of Alternative 2

Alternative 2 would not result in adverse effects associated with new or expanded entitlements or other water resources and supplies.

Although the proposed raise of the structures at the Folsom Facility would increase the storage capacity of the reservoir, this additional capacity would be used for flood storage, not for additional storage of water supplies. During construction and post-construction, water allocations to CVP contractors would remain the same as existing conditions.

Alternative 2 would have no adverse effects associated with new or expanded entitlements.

The placement of excess material in the reservoir could reduce storage at Folsom Reservoir.

Under Alternative 2, excess borrow material would be placed in the reservoir. Approximately 65 percent of this material could be placed below the elevation of 466 feet. Assuming a 15 percent void ratio, the excess material placed in the reservoir could reduce storage by approximately 1,243 acre-feet (See Table 3.2-1).

This impact would be less than significant because it would involve less than one percent of available water storage. Mitigation would not be required.

The remaining potential water supply impacts are the same as Alternative 1. There would be no impacts associated with expanded entitlements. During construction and post-construction, water allocations and timing of deliveries to CVP contractors would remain the same as existing conditions. However, there could be impacts associated with the interruption of water supplies for water users that rely on the Natomas Pipeline. Mitigation Measure WS-1 would reduce impacts to a less than significant level.

Environmental Consequence/Environmental Impacts of Alternative 3

The placement of excess material in the reservoir could reduce storage at Folsom Reservoir.

Under Alternative 3, excess borrow material would be placed in the reservoir. Approximately 65 percent of this material could be placed below the elevation of 466 feet. Assuming a 15 percent void ratio, the excess material placed in the reservoir could reduce storage by approximately 1,163 acre-feet (See Table 3.2-1).

This impact would be less than significant because it would involve less than one percent of available water storage. Mitigation would not be required.

The potential water supply impacts would be the same as Alternative 2. There would be no impacts associated with new or expanded entitlements. During construction and post-construction, water allocations and timing of deliveries to CVP contractors would remain the same as existing conditions. However, there would be impacts associated with the interruption of water supplies for water users that rely on the Natomas Pipeline. Mitigation Measure WS-1 would reduce impacts to a less than significant level.

Environmental Consequences/Environmental Impacts of Alternative 4

<u>The placement of excess material in the reservoir could reduce storage at Folsom Reservoir.</u>

Under Alternative 4, excess borrow material would be placed in the reservoir. Approximately 65 percent of this material could be placed below the elevation of 466 feet. Assuming a 15 percent void ratio, the excess material placed in the reservoir could reduce storage by approximately 934 acre-feet (See Table 3.2-1).

This impact would be less than significant because it would involve less than one percent of available water storage. Mitigation would not be required.

The potential water supply impacts would be the same as Alternative 2. There would be no impacts associated with new or expanded entitlements. During construction and post-construction, water allocations and timing of deliveries to CVP contractors would remain the same as existing conditions. However, there would be impacts associated with the interruption of water supplies for water users that rely on the Natomas Pipeline. Mitigation Measure WS-1 would reduce impacts to a less than significant level.

Environmental Consequences/Environmental Impacts of Alternative 5

<u>The placement of excess material in the reservoir could reduce storage at Folsom Reservoir.</u>

Alternative 5 requires such a large quantity of material for a potential raise to the dams and dikes that it is unlikely to result in a large amount of excess material. Any excess material would be placed at an elevation that would not reduce water storage at Folsom Reservoir.

This impact would be less than significant.

Because an Auxiliary Spillway would not be constructed for this alternative, water supplies would not be interrupted. Similar to Alternative 1, there would be no impacts associated with new or expanded entitlements and timing of deliveries to CVP contractors would remain the same as existing conditions.

3.2.3 Comparative Analysis of Alternatives

None of the alternatives would result in new or expanded entitlements or other water resources and supplies. Under Alternatives 1 through 4, excess material would be placed in the reservoir. Alternative 2 would likely have the most excess material and could reduce storage by approximately 1,243 acre-feet. This would represent less than one percent of the reservoir storage and would be a less than significant impact.

Alternatives 1, 2, 3, and 4 would result in potentially significant impacts associated with the interruption of water supplies to local water purveyors. A portion of the Natomas Pipeline would need to be replaced with an above ground pipeline along the chute alignment of the Auxiliary Spillway. This would temporarily interrupt water supplies to the City of Folsom and California Department of Corrections water treatment plants, and the Corps' Resident Office fire protection system. In addition to the Natomas Pipeline, an 8-inch diameter fire protection pipeline and metering station for the Corps' Resident Office would need to be relocated. The No Action/No Project Alternative and Alternative 5 would not result in any water supply impacts.

3.2.4 Mitigation Measures

Implementation of Mitigation Measure WS-1 would reduce the significant impact on water supply interruption to a less than significant level.

WS-1: As discussed in Section 3.2.2.3, for Alternatives 1, 2, 3, and 4, the relocation of a 300-ft segment of the Natomas Pipeline to an above ground pipeline would temporarily interrupt water supplies to the City of Folsom and California Department of Corrections water treatment plants. The Corps' Resident Office fire protection system would also be affected. These impacts to the City of Folsom and California Department of Corrections will be mitigated through a temporary, scheduled disruption, using a bypass pipeline that will sufficiently meet water demands until construction of the above ground pipeline is complete. The 8-inch diameter fire protection pipeline and metering station for the Corps' Resident Office will need to be relocated prior to construction of the chute alignment of the Auxiliary Spillway.

3.2.5 Cumulative Effects

Of the projects identified in Table 5-1 only the Long-term Reoperation of Folsom Reservoir would potentially affect water supply. Impacts of reoperation are unknown and would be addressed in separate environmental compliance documentation; however, for this cumulative analysis, the impact is assumed to be less than significant after mitigation. Other projects in Table 5-1 would not have any effects on water supplies. The Folsom DS/FDR could potentially reduce reservoir storage by approximately 0 to 1,243 acre-feet which would be considered less than significant. No other known projects would reduce reservoir storage; therefore, the Folsom DS/FDR's incremental contribution to the cumulative condition would be less than significant.

3.3 Air Quality

This section presents the air quality impact analysis conducted for the Folsom DS/FDR alternatives. The analysis includes discussions of the affected environment and existing conditions, significance thresholds, analysis of impacts for each of the Folsom DS/FDR alternatives, mitigation measures, and cumulative effects.

3.3.1 Affected Environment/Existing Conditions

This section describes the area studied in the air quality analysis, as well as the regulatory and environmental setting. The regulatory setting is described in terms of federal, state and local requirements. The environmental setting is described in terms of climate and atmospheric conditions, and air pollutant sources and existing concentrations.

3.3.1.1 Area of Analysis

The air quality impact analysis evaluates the existing conditions and impacts in Sacramento, Placer and El Dorado counties. These three counties share a common boundary point near the center of the Folsom Facility. The Folsom DS/FDR construction equipment, haul trucks, and employee traffic would generate emissions in each of these three counties. As discussed below in Section 3.3.1.2, the general region of concern when analyzing air quality impacts in the Sacramento region also includes Yolo County and portions of Sutter and Solano Counties. Figure 3.3-1 shows the air quality area of analysis.

Figure 3.3-1
Air Quality Area of Analysis

3.3.1.2 Regulatory Setting

Air quality management and protection responsibilities exist in federal, state, and local levels of government. The primary statutes that establish ambient air quality standards and establish regulatory authorities to enforce regulations designed to attain those standards are the federal Clean Air Act (CAA) and California Clean Air Act (CCAA).

Air Quality Management at the Federal Level

The federal CAA, as amended in 1990, is currently comprised of six titles:

- Title I – Air Pollution Prevention and Control
- Title II – Emission Standards for Moving Sources
- Title III – General
- Title IV – Acid Deposition Control
- Title V – Permits
- Title VI – Stratospheric Ozone Protection

Titles I and V contain the provisions that typically address construction projects and stationary source emissions. Title I requirements include, among others, requirements (a) to establish National Ambient Air Quality Standards (NAAQS) for air pollutants that protect human health with an adequate margin of safety as well as protect public welfare, (b) to limit emissions from new stationary sources, (c) to prevent significant deterioration of air quality in regions with air quality that is already better than the NAAQS, and (d) to develop State Implementation Plans (SIPs) that establish the steps to be taken to bring areas with air quality that is worse than the NAAQS back into attainment of the NAAQS by mandated attainment dates. As part of Title I, federal agencies cannot engage in, support in any way or provide financial assistance for, license or permit, or approve any activity which does not conform to an approved SIP.

Title V requires that major stationary sources obtain operating permits and pay fees that are based on the quantity of pollutants emitted. Title III of the CAA gives authority to the U.S. Environmental Protection Agency (USEPA) to promulgate regulations that implement the CAA requirements.

National Ambient Air Quality Standards

As required by the Federal CAA, the USEPA has established and continues to update the NAAQS for specific “criteria” air pollutants: ozone (O_3), carbon monoxide (CO), nitrogen dioxide (NO_2), sulfur dioxide (SO_2), inhalable particulate matter (PM_{10}), fine particulate matter ($PM_{2.5}$), and lead (Pb). The NAAQS for these pollutants are listed in Table 3.3-1 and represent the levels of air quality deemed necessary by USEPA to protect the public health and welfare with an adequate margin of safety. The health effects associated with these pollutants are summarized in Table 3.3-2.

Table 3.3-1
National and California Ambient Air Quality Standards

		Standard, as parts per million by volume (ppmv)		Standard, as micrograms per cubic meter ($\mu g/m^3$)		Violation Criteria	
Pollutant	**Avg Time**	**California**	**National**	**California**	**National**	**California**	**National**
Ozone (O_3)	8 hours	0.07	0.08	137	157	If exceeded	If exceeded on more than 3 days in 3 years
	1 hour	0.09	N/A	180	N/A	If exceeded	N/A
Carbon monoxide (CO)	8 hours	9.0	9	10,000	10,000	If exceeded	If exceeded on more than 1 day per year
	1 hour	20	35	23,000	40,000	If exceeded	If exceeded on more than 1 day per year
Nitrogen dioxide (NO_2)	Annual	N/A	0.053	N/A	100	N/A	If exceeded
	1 hour	0.25	N/A	470	N/A	If exceeded	N/A
Sulfur dioxide (SO_2)	Annual	N/A	0.03	N/A	80	N/A	If exceeded
	24 hours	0.05	0.14	131	365	If exceeded	If exceeded on more than 1 day per year
	3 hours	N/A	0.5	N/A	1300	N/A	If exceeded on more than 1 day per year
	1 hour	0.25	N/A	665	N/A	If exceeded	N/A
Hydrogen sulfide (H_2S)	1 hour	0.03	N/A	42	N/A	If equaled or exceeded	N/A
Vinyl chloride	24 hours	0.010	N/A	26	N/A	If equaled or exceeded	N/A
Inhalable particulate matter (PM_{10})	Annual	N/A	N/A	20	50	If exceeded	If exceeded
	24 hours	N/A	N/A	50	150	If exceeded	If exceeded on more than 1 day per year
Fine particulate matter ($PM_{2.5}$)	Annual	N/A	N/A	12	15	If exceeded	If exceeded
	24 hours	N/A	N/A	N/A	65	N/A	If exceeded on more than 1 day per year
Sulfate particles	24 hours	N/A	N/A	25	N/A	If equaled or exceeded	N/A
Lead particles (Pb)	Calendar quarter	N/A	N/A	N/A	1.5	N/A	If exceeded
	30 days	N/A	N/A	1.5	N/A	If equaled or exceeded	N/A

Source: CARB 2005.

Table 3.3-2
Criteria Pollutants

Pollutant	Characteristics	Health Effects	Major Sources
Ozone	A highly reactive photochemical pollutant created by the action of sunshine on ozone precursors (reactive organic gasses and oxides of nitrogen).	• Eye irritation. • Respiratory function impairment.	Combustion sources, such as factories and automobiles, and evaporation of solvents and fuels.
Carbon Monoxide	Odorless, colorless gas that is highly toxic. Formed by the incomplete combustion of fuels.	• Impairment of oxygen transport in the bloodstream. • Aggravation of cardiovascular disease. • Fatigue, headache, dizziness.	Automobile exhaust, combustion of fuels, and combustion of wood in woodstoves and fireplaces.
Nitrogen Dioxide	Reddish-brown gas formed during combustion.	• Increased risk of acute and chronic respiratory disease.	Automobile and diesel truck exhaust, industrial processes, and fossil-fueled powerplants.
Sulfur Dioxide	Colorless gas with a pungent odor.	• Increased risk of acute and chronic respiratory disease.	Diesel vehicle exhaust, oil-powered powerplants, industrial processes.
PM_{10} and $PM_{2.5}$	Small particles that measure 10 microns or less are termed PM_{10} (fine particles less than 2.5 microns are $PM_{2.5}$). Solid and liquid particles of dust, soot, aerosols, smoke, ash, and pollen and other matter that are small enough to remain suspended in the air for a long period.	• Aggravation of chronic disease and heart/lung disease symptoms.	Dust, erosion, incinerators, automobile and aircraft exhaust, and open fires.

The USEPA recently approved changes to the O_3 and PM_{10} NAAQS. In place of the 1-hour ozone standard, the USEPA approved an 8-hour standard of 0.08 parts per million (ppm). In addition to the current PM_{10} standard, the USEPA approved a standard for suspended particulate matter less than or equal to 2.5 micrometers ($PM_{2.5}$). Although these changes have been approved, implementation of the new standards and monitoring of ambient conditions relative to these new standards is an ongoing process.

The Federal CAA requires states to classify air basins (or portions thereof) as either "attainment" or "non-attainment" with respect to criteria air pollutants, based on whether the NAAQS have been achieved, and to prepare air quality plans containing emission reduction strategies for those areas designated as "non-attainment." The Lower Sacramento Valley Air Basin, in which the Folsom DS/FDR is located, is designated as non-attainment for the O_3 NAAQS, and Sacramento County is designated as non-attainment for the PM_{10} NAAQS, as listed in Table 3.3-3.

Table 3.3-3
Federal and State Attainment Status

Pollutant	***State Status***	***Federal Status***
O_3	Nonattainment	Nonattainment, serious for 8-hour average(1)
PM_{10}	Nonattainment	Nonattainment, moderate(2)
$PM_{2.5}$	Attainment	Attainment
CO	Attainment	Attainment/Maintenance
NO_2	Attainment	Attainment
SO_2	Attainment	Attainment

(1) On June 15, 2005, the USEPA revoked the 1-hour ozone standard in lieu of the 8-hour standard.
(2) For Sacramento County only, all other counties in the area are unclassifiable/attainment for the PM_{10} NAAQS.

Sources: SMAQMD 2006a; 40 CFR 81.305; 70 FR 71776; 70 FR 19844; 70 FR 944.

State Implementation Plans

Counties or regions that are designated as federal non-attainment areas for one or more criteria air pollutants must prepare a SIP that demonstrates how the area will achieve attainment of the standards by the federally mandated deadlines. In addition, those areas that have been redesignated as attainment will have maintenance plans that show how the area will maintain the standard.

The currently approved SIP for the O_3 non-attainment area was published in 1994 for the 1-hour O_3 NAAQS. Three progress updates have been published since then, one in 1999, one in 2002, and the latest in 2006. While these SIP milestone and rate-of-progress reports describe the changes in emission inventories that have occurred since the 1994 SIP was developed, the budgets for the O_3 precursors[1] nitrogen oxides (NO_x) and volatile organic compounds (VOC)[2] have not been updated. The next O_3 SIP is currently under development and should be published no later than 2007. This new SIP will need to demonstrate attainment of the 8-hour O_3 NAAQS by 2013. The extent of the non-attainment area for the 8-hour O_3 NAAQS is identified in Figure 3.3-2, and includes all of Sacramento and Yolo Counties, and parts of El Dorado, Placer, Solano, and Sutter Counties.

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1 O_3 is a secondary pollutant, meaning that it is not directly emitted from sources, but is formed from atmospheric reactions of the precursor compounds NOx and VOC. NOx and VOC are directly emitted from various mobile and stationary sources. For SIP purposes, NOx and VOC emissions are controlled to reduce the ambient O_3 concentrations.

2 EPA uses the definition of VOC to incorporate those compounds that are sufficiently reactive in the atmosphere to form O_3; the State of California has defined reactive organic gases (ROG) for the same purpose. Although minor variations exist in the definitions of VOC and ROG, for most sources of concern in this document these variations are negligible and the terms are interchangeable.

Figure 3.3-2
Federal 8-Hour Ozone Sacramento Non-attainment Area

On November 30, 2005, USEPA published in the Federal Register (70 FR 71776) its direct final rule approving ten CO Maintenance Plans in California, including the Sacramento Urbanized Area CO Maintenance Plan. This plan provides the CO budgets for the next 10 years that will demonstrate continued attainment of the CO NAAQS.

Although the area is designated as non-attainment for the PM_{10} NAAQS, no approved SIP for PM_{10} currently exists. The area has achieved the PM_{10} NAAQS, but the Sacramento Metropolitan Air Quality Management District (SMAQMD) must request redesignation to attainment and submit a maintenance plan to be formally designated as attainment.

General Conformity
Section 176 (c) of the Clean Air Act (42 U.S.C. 7506(c)) requires any entity of the federal government that engages in, supports, or in any way provides financial support for, licenses or permits, or approves any activity to demonstrate that the action conforms to the applicable SIP required under Section 110 (a) of the Federal CAA (42 U.S.C. 7410(a)) before the action is otherwise approved. In this context, conformity means that such federal actions must be consistent with a SIP's purpose of eliminating or reducing the severity and number of violations of the NAAQS and achieving expeditious attainment of those standards. Each federal agency must determine that any action that is proposed by the agency and that is subject to the regulations implementing the conformity requirements will, in fact, conform to the applicable SIP before the action is taken. The Folsom DS/FDR is subject to the

General Conformity Rule since it is sponsored and supported by multiple federal agencies.

On November 30, 1993, USEPA promulgated final general conformity regulations at 40 CFR 93 Subpart B for all federal activities except those covered under transportation conformity. The general conformity regulations apply to a proposed federal action in a non-attainment or maintenance area if the total of direct and indirect emissions of the relevant criteria pollutants and precursor pollutants caused by the proposed action equal or exceed certain de minimis amounts, thus requiring the federal agency to make a determination of general conformity. The de minimis amounts for the region covering Folsom Dam are presented in Table 3.3-4.

Table 3.3-4
General Conformity de minimis Thresholds

Pollutant	***Federal Status***	***De minimis (TPY)***
VOC (as an Ozone Precursor)	Nonattainment, serious 8-hour Ozone	50
NO_x (as an Ozone Precursor)	Nonattainment, serious 8-hour Ozone	50
PM_{10}	Nonattainment, moderate	100
CO	Attainment, Maintenance	100

TPY = tons per year
Sources: SMAQMD 2006a; 40 CFR 93.153.

Regardless of the proposed action's exceedance of de minimis amounts, if this total represents 10 percent or more of the area's total emissions of that pollutant, the action is considered regionally significant and the federal agency must make a determination of general conformity. By requiring an analysis of direct and indirect emissions, USEPA intended the regulating federal agency to make sure that only those emissions that are reasonably foreseeable and that the federal agency can practicably control subject to that agency's continuing program responsibility will be addressed.

Direct emissions are those that are caused or initiated by the federal action, and occur at the same time and place as the federal action. Indirect emissions are reasonably foreseeable emissions that are further removed from the federal action in time and/or distance, and can be practicably controlled by the federal agency on a continuing basis (40 CFR 93.152). A federal agency can indirectly control emissions by placing conditions on federal approval or federal funding. An example would be controlling emissions by limiting the size of a parking facility or by making employee trip reduction requirements (USEPA 1994).

The general conformity regulations incorporate a stepwise process, beginning with an applicability analysis. According to USEPA guidance (USEPA 1994), before any approval is given for a proposed action to go forward, the regulating federal agency must apply the applicability requirements found at 40 CFR 93.153(b) to the proposed action and/or determine the regional significance of the proposed action to evaluate whether, on a pollutant-by-pollutant basis, a determination of general conformity is required. The guidance states that the applicability analysis can be (but is not required to be) completed concurrently with any analysis required under NEPA. If the regulating federal agency determines that the general conformity regulations do not apply to the proposed action (meaning the proposed action emissions do not exceed the *de minimis* thresholds and are not regionally significant), no further analysis or documentation is required.

If the general conformity regulations do apply to the proposed action, the regulating federal agency must next conduct a conformity evaluation in accord with the criteria and procedures in the implementing regulations, publish a draft determination of general conformity for public review, and then publish the final determination of general conformity. For a required action to meet the conformity determination emissions criteria, the total of direct and indirect emissions from the action must be in compliance or consistent with all relevant requirements and milestones contained in the applicable SIP (40 CFR 93.158(c)), and in addition must meet other specified requirements, such as:

- For any criteria pollutant, the total of direct and indirect emissions from the action is specifically identified and accounted for in the applicable SIP's attainment or maintenance demonstration (40 CFR 93.158(a)(1)); or

- For ozone or nitrogen dioxide, the total of direct and indirect emissions from the action is determined and documented by the State agency primarily responsible for the applicable SIP to result in a level of emissions which, together with all other emissions in the non-attainment (or maintenance) area, would not exceed the emissions inventory specified in the applicable SIP (40 CFR 93.158(a)(5)(i)(A)); or

- For ozone or nitrogen dioxide, the total of direct and indirect emissions from the action is determined by the State agency responsible for the applicable SIP to result in a level of emissions which, together with all other emissions in the non-attainment (or maintenance) area, would exceed the emissions inventory specified in the applicable SIP and the State Governor or the Governor's designee for SIP actions makes a written commitment to USEPA for specific SIP revision measures reducing emissions to not exceed the emissions inventory (40 CFR 93.158(a)(5)(i)(B)); or

- For ozone or nitrogen dioxide, the total of direct and indirect emissions from the action is fully offset within the same non-attainment (or maintenance) area through a revision to the applicable SIP or a similarly enforceable measure that affects emission reductions so that there is no net increase in emissions of that pollutant (40 CFR 93.158(a)(2)).

Air Quality Management at the State Level

The CCAA substantially added to the authority and responsibilities of the State's air pollution control districts. The CCAA establishes an air quality management process that generally parallels the federal process. The CCAA, however, focuses on attainment of the California Ambient Air Quality Standards (CAAQS) that, for certain pollutants and averaging periods, are more stringent than the comparable NAAQS. The CAAQS are included in Table 3.3-1.

The CCAA requires that air districts prepare an air quality attainment plan if the district violates CAAQS for CO, SO_2, NO_2, or O_3. Table 3.3-3 shows that the Sacramento area is classified as a non-attainment area for the O_3 and PM_{10} CAAQS. No locally prepared attainment plans are required for areas that violate the PM_{10} CAAQS.

The CCAA requires that the CAAQS be met as expeditiously as practicable, but does not set precise attainment deadlines. Instead, the act established increasingly stringent requirements for areas that will require more time to achieve the standards.

The air quality attainment plan requirements established by the CCAA are based on the severity of air pollution problems caused by locally generated emissions. Upwind air pollution control districts are required to establish and implement emission control programs commensurate with the extent of pollutant transport to downwind districts.

Air pollution problems in Sacramento County are primarily the result of locally generated emissions. However, Sacramento's air pollution occasionally includes contributions from the San Francisco Bay Area or the San Joaquin Valley. In addition, Sacramento County has been identified as a source of ozone precursor emissions that occasionally contribute to air quality problems in the San Joaquin Valley Air Basin and the Northern Sacramento Valley Air Basin. Consequently, the air quality planning for Sacramento County must not only correct local air pollution problems, but must also reduce the area's effect on downwind air basins.

The California Air Resources Board (CARB) is responsible for developing emission standards for on-road motor vehicles and some off-road equipment in the state. In addition, CARB develops guidelines for the local districts to use in establishing air quality permit and emission control requirements for stationary sources subject to the local air district regulations.

Air Quality Management at the Local Level

Multiple air quality management districts (AQMDs) and air pollution control districts (APCDs) have jurisdiction over the O_3 and PM_{10} non-attainment areas. Each county in the area has its own AQMD or APCD. The SMAQMD manages air quality in Sacramento County and coordinates with the other districts to develop SIP updates. The other districts most likely to be impacted by the Folsom DS/FDR are the Placer County APCD, El Dorado County AQMD, and Feather River AQMD. The Folsom DS/FDR site may have some operations occurring in Placer and El Dorado Counties as well as Sacramento County. Transportation of sand/gravel for filter material from the Marysville area would require haul trucks to travel through the Feather River AQMD.

In addition to permitting and rule compliance, air quality management at the local level is also accomplished through AQMD/APCD imposition of mitigation measures on project environmental impact reports and mitigated negative declarations developed by project proponents under CEQA. Specific to project construction emissions, CEQA requires mitigation of air quality impacts that exceed certain significance thresholds set by the local AQMD/APCD. In the SMAQMD, the construction significance thresholds are 85 lbs/day for NO_x emissions, and 50 $\mu g/m^3$ for PM_{10} ambient concentrations.

If project construction NO_x emissions exceed 85 lbs/day, then a standard set of construction mitigation measures must be incorporated into the Draft EIR and mitigation monitoring and reporting program (MMRP). The inclusion of these measures allows the applicant to assume a 20 percent reduction in NO_x emissions from construction activities. If the mitigated NO_x emissions still exceed 85 lbs/day, SMAQMD’s policy is to charge a mitigation fee of $14,300/ton of excess (greater than 85 lbs/day) NO_x emissions.

3.3.1.3 Environmental Setting

Climate and Atmospheric Conditions

Sacramento County is located at the southern end of the Sacramento Valley, which is bounded by the Coast and Diablo Ranges on the west and the Sierra Nevada on the east. The county is about 50 miles northeast of the Carquinez Strait, a sea-level gap between the Coast Range and the Diablo Range. The prevailing winds are from the south, primarily because of marine breezes through the Carquinez Strait, although during winter the sea breezes diminish and winds from the north occur more frequently.

The area of analysis experiences episodes of poor atmospheric mixing caused by inversion layers. Inversion layers form when temperature increases with elevation above ground or when a mass of warm dry air settles over a mass of cooler air near the ground. Surface inversions (0 to 500 feet) occur most frequently during the winter, while subsidence inversions (1,000 to 2,000 feet) occur most frequently during the summer. Inversion layers limit vertical mixing in the atmosphere, trapping pollutants near the surface.

Existing Air Quality Conditions

The existing air quality conditions for a project area are typically the result of meteorological conditions and existing emission sources in an area.

Emission Sources

Table 3.3-5 presents estimates of existing emissions in Sacramento County. There are two main categories of emission sources in any area: stationary and mobile.

On-road motor vehicles are the major source of VOC, CO, and NO_x emissions in Sacramento County. Other (off-road) mobile vehicles and equipment are the major source of SO_2 emissions, and contribute substantially to VOC, CO, and NO_x emissions. Fugitive dust primarily from construction sites, paved and unpaved roadways, and farming operations is the major source of PM_{10} and $PM_{2.5}$, with substantial contributions from residential fuel combustion (all of these sources are summarized in the Area-Wide Miscellaneous Processes in Table 3.3-5).

Table 3.3-5
Sacramento County 2004 Emission Inventories

Source Type	Category	Average Emissions in tons per day (TPD)					
		VOC/ROG	CO	NO_X	SO_2	PM_{10}	$PM_{2.5}$
Stationary	Fuel Combustion	0.59	3.02	3.19	0.04	0.93	0.91
Stationary	Waste Disposal	0.24	0.14	0.04	0	0.01	0.01
Stationary	Cleaning and Surface Coatings	5.35	0	0	0	0	0
Stationary	Petroleum Production and Marketing	4.11	0	0	0	0	0
Stationary	Industrial Processes	0.88	0.50	0.28	0.03	1.22	0.59
Area-Wide	Solvent Evaporation	13.45	0	0	0	0.01	0.01
Area-Wide	Miscellaneous Processes	4.17	40.69	3.17	0.16	38.29	11.79
Mobile	On-Road Motor Vehicles	29.30	276.07	54.86	0.46	1.75	1.19
Mobile	Other Mobile Sources	12.06	91.23	25.62	0.54	1.77	1.59
	Total	70.15	411.65	87.16	1.23	43.98	16.09

Source: CARB 2006a.

Monitoring Data – Criteria Pollutants

Air quality data from monitoring stations near the area of analysis are summarized in Table 3.3-6. Because many of the stations do not monitor all pollutants, a distinct set of monitoring stations was chosen for each pollutant that would best represent conditions at the area of analysis, or in the case of ozone, the regional conditions.

Table 3.3-6 ***Summary of Pollutant Monitoring Data in Sacramento***			
Criteria Air Pollutant And Station Location	***Yearly Monitoring Data***		
	2003	***2004***	***2005***
Carbon Monoxide			
Sacramento – Del Paso Manor			
Highest 8-hour concentration (ppm)	4.27	3.15	3.09
Days above CAAQS [(1)]	0	0	0
Ozone 1-hour			
Sacramento – Del Paso Manor			
1st High (ppm)	0.134	0.11	0.134
2nd High (ppm)	0.132	0.105	0.124
Days above CAAQS [(2)]	21	6	14
Days above NAAQS	2	0	1
Ozone 8-hour			
Sacramento – Del Paso Manor			
1st High (ppm)	0.113	0.089	0.117
2nd High (ppm)	0.099	0.087	0.109
Days above NAAQS [(3)]	13	3	10
PM_{10}			
Sacramento – Del Paso Manor			
Highest 24-hour concentration (ug/m^3) [(4)]	54/55	49/52	59/77
Arithmetic mean (ug/m^3) [(4)]	20.6/21.8	22.1/22.7	N/A/23.1
Calculated number of days above CAAQS [(5)]	2	1	5
Calculated number of days above NAAQS	0	0	0
$PM_{2.5}$			
Sacramento – Del Paso Manor			
Highest 24-hour concentration (ug/m^3)	65	51	44
Annual mean (ug/m^3)	12.2	11.5	N/A
Number of days above standard [(6)]	0	0	N/A

(1) Days above standard = days above 8-hour CAAQS of 9 ppm.
(2) Days above standard = days above 1-hour CAAQS of 0.09 ppm.
(3) Days above standard = days above 8-hour NAAQS of 0.08 ppm.
(4) Different methods of analyzing monitored data for PM_{10} are used by USEPA and CARB; therefore, both data are provided, respectively, separated by "/".
(5) Days above standard = days above 24-hour CAAQS of 50 ppm. Most PM_{10} measurements are taken every 6 days; therefore, the number of days over the 24-hour standard in any year is calculated.
(6) Days above standard = days above 24-hour NAAQS of 65 ppm.

N/A = not available

Source: CARB 2006b

Monitored CO levels have been trending down over the last several years. The downward trend is primarily a result of the use of oxygenated gasoline during the winter CO season. The 8-hour CO CAAQS and NAAQS were last exceeded in the early 1990s. The area has attained the standards since then, and Sacramento County was re-designated an attainment/maintenance area for the CO NAAQS in March 1998.

The 1-hour O_3 CAAQS had been exceeded up to 30 times each year at the individual monitoring stations shown on Table 3.3-6. The recorded 8-hour O_3 concentrations exceeded the NAAQS up to 26 times in 2003. Substantial year-to-year variations in monitored O_3 levels are common. However, no clear trend in O_3 levels is demonstrated by monitoring results from the 1990s through 2004.

The 24-hour and annual PM_{10} and annual $PM_{2.5}$ CAAQS were exceeded during the monitoring period. However, the PM_{10} and $PM_{2.5}$ NAAQS were not exceeded, as shown in Table 3.3-6.

Monitoring Data – Toxic Air Contaminants

Existing toxic air contaminant (TAC) concentrations are presented in Table 3.3-7 for pollutants typically associated with mobile sources. The data were collected at the Roseville monitoring station located at 151 North Sunrise Avenue. Most of the TAC concentration trends for the past three years are either flat or declining. From the concentrations of all TACs monitored at the Roseville station, the estimated lifetime cancer risk for existing conditions (without considering diesel particulate matter) was approximately 112 per million in 2005. The TACs that are the top contributors to this risk level are carbon tetrachloride, benzene, 1,3-butadiene, and formaldehyde.

Table 3.3-7
Summary of Toxic Air Contaminant Monitoring Data in Sacramento (Roseville)

Toxic Air Contaminant	***Annual Average (Mean) Concentration***		
	2003	***2004***	***2005***
Acetaldehyde (ppbv)	0.93	0.87	0.89
Acrolein (ppbv)	2.5 (1)	1.7 (1)	0.43
Benzene (ppbv)	0.363	0.278	0.244
1,3-Butadiene (ppbv)	0.078	0.054	0.051
Ethyl benzene (ppbv)	0.12	0.18	0.11
Formaldehyde (ppbv)	3.23	2.12	2.07
Methyl ethyl ketone (ppbv)	0.07	0.07	0.07
Methyl tert-butyl ether (ppbv)	0.33	0.15(1)	N/A
Styrene (ppbv)	0.05	0.05	0.05
Toluene (ppbv)	0.80	2.15	0.80
meta- and para-Xylene (ppbv)	0.41	0.48	0.32
Ortho-Xylene (ppbv)	0.15	0.15	0.10
Benzo(a)pyrene (ng/m^3)	0.156	0.135	N/A
Benzo(b)fluoranthene (ng/m^3)	0.199	0.167	N/A
Benzo(k)fluoranthene (ng/m^3)	0.091	0.076	N/A
Benzo(g,h,i)perlyene (ng/m^3)	0.270	0.234	N/A
Dibenz(a,h)anthracene (ng/m^3)	0.041	0.034	N/A
Indeno(1,2,3-cd)pyrene (ng/m^3)	0.209	0.154	N/A
Chromium (hexavalent) (ng/m^3)	0.053	0.060	0.058

(1) Reported maximum value.

N/A = not available
ng/m^3 = nanograms per cubic meter

Source: CARB 2006b.

3.3.2 Environmental Consequences/Environmental Impacts

3.3.2.1 Significance Criteria

Ozone Precursor Significance Thresholds

For CEQA analyses, the SMAQMD has established O_3 precursor emission thresholds for NO_x and VOC. The thresholds are based on daily emission rates from both construction and operational conditions. If any of the thresholds shown in Table 3.3-8 are exceeded, then the Folsom DS/FDR action would be considered significant for that pollutant. Only the NO_x construction thresholds are applicable since the Folsom DS/FDR would have no operational emissions once completed.

Table 3.3-8
Ozone Precursor Significance Thresholds

Pollutant	***Pounds per Day***
Construction Oxides of Nitrogen (NO_x)	85
Operational Reactive Organic Gases (ROG)	65
Operational Oxides of Nitrogen (NO_x)	65

Source: SMAQMD 2004

Other Criteria Pollutants

Unlike ozone precursors, other criteria pollutants, such as CO, PM_{10}, and $PM_{2.5}$ do not have daily significance thresholds; rather, the pollutants are compared against the CAAQS (CEQA) and NAAQS (NEPA). A project would have a significant adverse air quality impact if it either causes of an exceedance of a standard (for pollutants in attainment) or makes a substantial contribution to an existing exceedance of an air quality standard (for pollutants in non-attainment). For the purposes of a CEQA evaluation, a "substantial" contribution is defined as five percent or more of an existing exceedance.

Offensive Odors

Specific significance thresholds are not available for offensive odors; however, a project would be considered to have significant adverse air quality impacts if it causes detriment, nuisance, or annoyance to a considerable number of persons. Since the Folsom DS/FDR is not expected to have any short- or long-term impacts associated with offensive odors, no further analysis was conducted.

Toxic Air Contaminants

If the proposed action would emit TACs, such as diesel particulate matter from diesel-fueled construction equipment, then the health risk associated with these compounds must be assessed. The California Air Pollution Control Officers Association (CAPCOA) and CARB have developed TAC health risk assessment (HRA) guidelines that must be followed to judge the impacts associated with TAC emissions. If a complete HRA is not completed, then emissions from mobile and stationary sources may be conservatively considered to be significant and unavoidable. The recommended significance thresholds for TACs include:

- Lifetime probability of contracting cancer is greater than 10 in one million;
- Ground-level concentration of non-carcinogenic toxic air pollutants would result in a Hazard Index of greater than 1.

3.3.2.2 Assessment Methods

This section describes the methodology used to develop the emission inventories and the comparison of the analysis results to the significance thresholds discussed above.

Emission Calculation Methodology

In general, the construction emissions were estimated from various emission models and spreadsheet calculations, depending on the source type and data availability. The CARB Urban Emissions Model (URBEMIS) - Version 8.7 and EMFAC2002 (on-road vehicle emission factor model) were used along with emission factors obtained from USEPA AP-42 and SMAQMD/El Dorado APCD CEQA guidelines. URBEMIS was developed to estimate emissions from a variety of projects such as residential, commercial and industrial developments. However, URBEMIS does not include specific features associated with dam construction and much of the emission calculation relied on other methods to estimate construction emissions. Daily and annual emissions for each year of construction were estimated from appropriate emission factors, number of facilities and features being worked and the associated schedules. The following construction sources and activities were analyzed for emissions:

- On-site demolition and grading (cut/fill) fugitive dust – based on URBEMIS modeling.
- On-site construction equipment and haul truck engine emissions (all pollutants) – based on SMAQMD/El Dorado APCD CEQA guideline emission factors and estimated equipment schedules.
- Off-site haul truck engine emissions (all pollutants) – based on EMFAC2002 and estimated vehicle miles traveled.
- On-site and off-site haul truck fugitive dust emissions for paved and unpaved road travel – based on AP-42 and estimated vehicle miles traveled.
- On-site material processing plants (assumed to be primarily crushing and sorting operations) – based on AP-42 and number of facilities operating simultaneously.

- On-site concrete batch plants – based on AP-42 and number of facilities operating simultaneously.

- On-site blasting emissions – based on methodology provided in the Blue Rock Quarry Draft Environmental Impact Report (Sonoma County 2005) and approximate size of area subject to blasting activity.

- Off-site worker vehicle trips to and from the site, including paved road dust – based on EMFAC2002 (engine emission factors), Midwest Research Institute (MRI 1996, paved road dust emission factors), and estimated vehicle miles traveled.

The following sections provide additional discussion of emission estimation methodologies used for each source group.

On-Site Demolition, Grading, and Asphalt Paving
The URBEMIS model was developed to estimate construction emissions from land development projects. It treats construction in three phases: Phase 1 – demolition, Phase 2 – site grading, and Phase 3 – building construction. For this proposed action, URBEMIS was used for fugitive PM emissions from demolition and grading (earth cut/fill) activities. The earth cut/fill activity is included in URBEMIS Phase 2 –Site Grading, which allows the user to select one of four tiers of detail to calculate fugitive dust emissions. Movement of dam shell material was treated as grading. The volume of shell material for each feature and alternative were estimated in cubic yards per day; therefore, the Low Level tier was selected in URBEMIS for fugitive PM_{10} emission estimations.

On-Site Construction Equipment Engine Emissions
Both the SMAQMD and El Dorado County AQMD developed daily emission rates for construction equipment, which can be found in their CEQA Guides (SMAQMD 2004, El Dorado 2002). The emission factors compared favorably with the CARB OFFROAD model emission factors. The emission factors provided in the SMAQMD/El Dorado AQMD CEQA guidelines are emission rate data (lbs/day) by year for each year up to 2010. For this analysis, it was assumed that the emission factors for 2011 through 2014 were equal to those in 2010. The construction equipment emission rates from the CEQA guidelines are shown in Table 3.3-9.

Table 3.3-9 Construction Equipment Emission Rates (lb/day) for 2007-2014[1]					
Equipment Type	***ROG***	***CO***	***NO_x***	***PM_{10}***	***$PM_{2.5}$***
Bore/Drill Rigs					
2007	1.57	13.37	10.85	0.25	0.23
2008	1.88	15.97	12.97	0.30	0.28
2009	2.38	20.21	16.41	0.38	0.35
2010-2014	2.26	19.23	15.61	0.36	0.33
Concrete/Industrial Saws					
2007	1.08	7.97	7.84	0.29	0.27
2008	1.08	8.26	7.44	0.26	0.24
2009	1.08	8.56	7.04	0.23	0.21
2010-2014	1.08	8.86	6.65	0.20	0.18
Cranes					
2007	1.44	12.27	8.37	0.23	0.21
2008	1.44	12.27	8.37	0.23	0.21
2009	1.44	12.27	8.37	0.23	0.21
2010-2014	1.44	12.27	8.37	0.23	0.21
Crawler Tractors					
2007	1.45	10.75	10.58	0.39	0.36
2008	1.45	11.15	10.04	0.35	0.32
2009	1.45	11.55	9.50	0.31	0.29
2010-2014	1.45	11.95	8.96	0.27	0.25
Crushing Proc. Equipment					
2007	2.12	15.69	15.45	0.57	0.52
2008	2.12	16.28	14.66	0.51	0.47
2009	2.12	16.86	13.88	0.45	0.41
2010-2014	2.12	17.45	13.09	0.40	0.37
Excavators					
2007	1.84	15.64	10.67	0.29	0.27
2008	1.84	15.64	10.67	0.29	0.27
2009	1.84	15.64	10.67	0.29	0.27
2010-2014	1.84	15.64	10.67	0.29	0.27
Graders					
2007	1.76	14.98	10.22	0.28	0.26
2008	1.76	14.98	10.22	0.28	0.26
2009	1.76	14.98	10.22	0.28	0.26
2010-2014	1.76	14.98	10.22	0.28	0.26
Off-Highway Tractors/Compactors					
2007	1.84	13.63	13.42	0.49	0.45
2008	1.84	14.14	12.74	0.44	0.40
2009	1.84	14.65	12.05	0.39	0.36
2010-2014	1.84	15.16	11.37	0.34	0.31
Off-Highway Trucks/Water Trucks					
2007	3.60	30.62	20.89	0.58	0.53
2008	3.60	30.62	20.89	0.58	0.53
2009	3.60	30.62	20.89	0.58	0.53
2010-2014	3.60	30.62	20.89	0.58	0.53
Pavers					
2007	1.37	11.62	7.93	0.22	0.20
2008	1.37	11.62	7.93	0.22	0.20
2009	1.37	11.62	7.93	0.22	0.20
2010-2014	1.37	11.62	7.93	0.22	0.20
Paving Equipment					
2007	1.04	7.66	7.54	0.28	0.26
2008	1.04	7.95	7.16	0.25	0.23
2009	1.04	8.23	6.78	0.22	0.20
2010-2014	1.04	8.52	6.39	0.19	0.17

Table 3.3-9
Construction Equipment Emission Rates (lb/day) for 2007-2014[1]

Equipment Type	ROG	CO	NO_x	PM_{10}	$PM_{2.5}$
Rollers					
2007	0.86	7.34	5.01	0.14	0.13
2008	0.86	7.34	5.01	0.14	0.13
2009	0.86	7.34	5.01	0.14	0.13
2010-2014	0.86	7.34	5.01	0.14	0.13
Rough Terrain Forklifts					
2007	0.79	6.70	4.57	0.13	0.12
2008	0.79	6.70	4.57	0.13	0.12
2009	0.79	6.70	4.57	0.13	0.12
2010-2014	0.79	6.70	4.57	0.13	0.12
Rubber Tired Dozers					
2007	3.66	27.11	26.69	0.98	0.90
2008	3.66	28.12	25.33	0.88	0.81
2009	3.66	29.13	23.97	0.78	0.72
2010-2014	3.66	30.14	22.61	0.68	0.63
Rubber Tired Loaders					
2007	1.35	11.52	7.86	0.22	0.20
2008	1.35	11.52	7.86	0.22	0.20
2009	1.35	11.52	7.86	0.22	0.20
2010-2014	1.35	11.52	7.86	0.22	0.20
Scrapers					
2007	3.64	30.96	21.12	0.58	0.53
2008	3.64	30.96	21.12	0.58	0.53
2009	3.64	30.96	21.12	0.58	0.53
2010-2014	3.64	30.96	21.12	0.58	0.53
Signal Boards					
2007	1.72	12.70	12.50	0.46	0.42
2008	1.72	13.18	11.87	0.41	0.38
2009	1.72	13.65	11.23	0.37	0.34
2010-2014	1.72	14.12	10.60	0.32	0.29
Skid Steer Loaders					
2007	0.56	4.78	3.26	0.09	0.08
2008	0.56	4.78	3.26	0.09	0.08
2009	0.56	4.78	3.26	0.09	0.08
2010-2014	0.56	4.78	3.26	0.09	0.08
Surfacing Equipment					
2007	3.77	27.91	27.48	1.01	0.93
2008	3.77	28.95	26.08	0.90	0.83
2009	3.77	29.99	24.68	0.80	0.74
2010-2014	3.77	31.03	23.28	0.70	0.64
Tractors/Loaders/Backhoes					
2007	0.65	4.82	4.74	0.17	0.16
2008	0.65	5.00	4.50	0.16	0.15
2009	0.65	5.18	4.26	0.14	0.13
2010-2014	0.65	5.36	4.02	0.12	0.11
Trenchers					
2007	1.00	8.53	5.82	0.16	0.15
2008	1.00	8.53	5.82	0.16	0.15
2009	1.00	8.53	5.82	0.16	0.15
2010-2014	1.00	8.53	5.82	0.16	0.15

[1]Assumes an 8-hour work day (SMAQMD 2006b).

Sources: SMAQMD 2004; El Dorado 2002.

The emission factors presented in Table 3.3-9 are multiplied by the number of pieces of each equipment type that would be used at each of the Folsom DS/FDR feature sites for each year of the analysis. The year with most construction equipment on site is 2009 for Alternative 1 through 4, and is 2013 for Alternative 5. The peak number of equipment on site per day for the peak year of construction is summarized in Table 3.3-10.

Table 3.3-10
Peak Daily Construction Equipment Counts in Peak Year*

Equipment Type	*Alt 1*	*Alt 2*	*Alt 3*	*Alt 4*	*Alt 5*
Drill Rig	2	5	2	4	3
Dozers	5	6	6	6	6
Rippers/Graders	1	5	5	6	3
Scrapers	14	4	8	5	10
Excavators	2	8	0	6	1
Loaders	4	12	7	11	13
Small Crane	0	3	1	2	0
Compactors	0	4	1	4	1
Off-Highway Trucks	12	6	22	6	9
On-Highway Trucks	12	0	0	0	0
Water Trucks	1	6	4	6	5
Total	**53**	**59**	**56**	**56**	**51**

* The peak year of emissions for Alternatives 1 through 4 is 2009, and for Alternative 5 is 2013.

The construction scheduling estimate for the Folsom DS/FDR is based on a 16-hour work day (two shifts). However, the daily emission rates presented in Table 3.3-9 were developed based in an 8-hour work day (one shift) (SMAQMD 2006b). Therefore, the emissions estimated from the data in Tables 3.3-9 and 3.3-10 must be doubled to account for the second daily work shift. The results section includes this doubling of emissions for on-site construction equipment.

On-Site and Off-Site Haul Truck Engine Emissions and Road Dust

The haul truck engine emissions were calculated based on EMFAC2002 emission factors for heavy duty diesel trucks in Sacramento County and estimates of total vehicle miles traveled per day. The emission factors used in this analysis are presented in Table 3.3-11. The average speed for on-site hauling was assumed to be 15 mph, and the average speed for off-site hauling was assumed to be 30 mph.

Table 3.3-11 Heavy Duty Diesel Truck Emission Factors for Sacramento Valley (g/VMT)						
MPH	***VOC/ROG***	***CO***	***NO_x***	***PM_{10} Total[(1)]***	***SO_2***	***$PM_{2.5}$ Total[1]***
15	1.146	5.076	14.181	0.548	0.021	0.473
30	0.676	2.506	11.147	0.343	0.021	0.285

[(1)]PM_{10} and $PM_{2.5}$ totals include engine exhaust, tire wear, and brake wear.

g/VMT = gallons per vehicle miles traveled

Re-entrained road dust from haul truck travel was estimated for paved and unpaved roads. Paved road dust was estimated using emission factors developed by the Midwest Research Institute (MRI 1996), and unpaved road dust was estimated using emission factors from AP-42 (USEPA 2006). Table 3.3-12 presents the paved road emission factors, and Table 3.3-13 presents the unpaved road emission factors.

Table 3.3-12 Paved Road Re-entrained Dust PM_{10} Emission Factors (g/VMT)			
	Average Daily Trips (ADT)		
Road condition	***High***	***Low***	***Average***
Average conditions	0.37	1.3	0.81
Worst-case conditions	0.64	3.9	2.1

Source: Midwest Research Institute 1996.

Table 3.3-13 Unpaved Road Re-entrained Dust PM_{10} Emission Factors (g/VMT)			
	Silt (%)	***PM_{10}***	***$PM_{2.5}$***
Lowest	0.56	0.4	0.04
Worst	23	10.4	1.04
Mean	8.5	4.2	0.42
Folsom		**5.4**	**0.54**

Sources: USEPA 2006

The Folsom DS/FDR emission factor for unpaved road dust was averaged from the values calculated using the lowest and highest silt contents, which is slightly greater than the one calculated from the mean silt content.

The haul trucks were divided into three groups based on hauling materials and site locations. The long distance group was defined as hauling raw material from Marysville and Prairie City, for which the roundtrip distances were determined from Google™ Maps. The off-site group included trucks hauling materials from local sites to the dam area, which assumed that all roundtrips were within 15 miles. Both exhaust emissions and re-entrained dust from paved roads were calculated for the two groups of hauling trucks above. The third group was defined as trucks hauling materials internally on-site, mostly on unpaved roads. The round trip distances were determined between 0.5 and 6 miles based on the site map, depending on individual construction activity and site location. The round trip distances for each group were summarized in Table 3.3-14.

Table 3.3-14
Haul Truck Trip Distances and Paved vs. Unpaved Road Ratios

Haul Truck Group	***Roundtrip Distance (miles)***	***Exhaust Emissions***	***Paved/Unpaved Road Dust***
Marysville/Prairie	106/30	Calculated	All paved road
Off-site Material Haul	15	Calculated	All paved road
On-site Internal Haul	0.5 – 6	Calculated	95% unpaved vs. 5% paved roads

On-Site Material Processing Plant Dust

On-site materials processing was assumed to be crushing and sorting. Emissions were estimated using the AP-42 emission factors summarized in Table 3.3-15, with an estimated materials processing facility achieving a maximum production rate of 5,000 tons per day. The emissions were calculated as the total of each process emission assuming the total material handled was subjected to all steps listed in Table 3.3-15.

In developing the emission inventories for materials processing, it was assumed that prime power would be obtained from the electric utility grid, and that diesel engines would not be used for prime movers/generators. It was also assumed that wet suppression of plant dust would be required as a condition of obtaining an air quality permit; therefore, the Folsom DS/FDR design would include emission controls in the materials processing plants.

Concrete Batch Plant Dust

Concrete batching emissions were estimated using AP-42 emission factors and summarized in Table 3.3-16 (USEPA 2006). The maximum daily production rate was estimated to be 300 cubic yards. Since the emission factor is in pounds per ton of concrete produced, the production rate in cubic yards per day was converted to tons per day with a concrete density of 4,946 lbs/cubic yard, resulting in 742 tons per day concrete production. The composition ratio of the aggregate, sand, and cement materials in the concrete was estimated to be 6:3:1.

As with materials processing, it was assumed that prime power in the concrete batch plants would be obtained from the electric utility grid, and that diesel engines would not be used for prime movers/generators. It was also assumed that wet suppression of plant dust would be required as a condition of obtaining an air quality permit; therefore, the Folsom DS/FDR design would include emission controls in the concrete batch plants.

Table 3.3-15 ***Materials Processing Emission Factors (lbs per ton of material)***		
Source	***Total PM_{10}***	***Total $PM_{2.5}$***
Tertiary Crushing	0.0024	ND
Tertiary Crushing (controlled)	0.00054	0.00010
Fines Crushing	0.0150	ND
Fines Crushing (controlled)	0.0012	0.000070
Screening	0.0087	ND
Screening (controlled)	0.00074	0.000050
Fines Screening	0.072	ND
Fines Screening (controlled)	0.0022	ND
Conveyor Transfer Point	0.00110	ND
Conveyor Transfer Point (controlled)	4.6×10^{-5}	1.3×10^{-5}
Wet Drilling – Unfragmented Stone	8.0×10^{-5}	ND
Truck Unloading -Fragmented Stone	1.6×10^{-5}	ND
Truck Unloading – Conveyor, crushed	0.00010	ND

Source: USEPA 2006.

Table 3.3-16 ***Concrete Batch Plant PM_{10} Emission Factors (lbs ton of concrete)***		
Batch Plant Source	***Uncontrolled***	***Controlled***
Aggregate transfer	0.0033	ND
Sand transfer	0.00099	ND
Cement unloading to elevated storage silo (pneumatic)	0.46	0.00034
Cement supplement unloading to elevated storage silo	1.10	0.0049
Weigh hopper loading	0.0024	ND
Mixer loading (central mix)	0.156	0.0055
Truck loading (truck mix)	0.311	0.0263

Source: USEPA 2006.

Air Dispersion Modeling Methodology

This section describes the selection of the air dispersion model and describes the basic input parameters and assumptions used to conduct the dispersion modeling.

Model Selection

In 1991, the American Meteorological Society (AMS) and the USEPA initiated a joint effort to develop a vastly improved air quality model. A committee was formed (AERMIC [the AMS/USEPA Regulatory Model Improvement Committee]) to upgrade the current models which were developed nearly two decades ago. Much progress has occurred in the scientific knowledge of atmospheric turbulence and dispersion and so a need had been recognized to update the regulatory air quality models based on more up-to-date science.

The goal of such an update would be to improve the accuracy of these models. AERMIC chose to focus on the development of a new model, AERMOD (AERMIC's Dispersion Model), for estimating the near-field concentrations from a variety of stationary sources. That is, AERMOD is designed to handle the same source types formerly addressed with the USEPA recommended Industrial Source Complex Model (ISC3), including sources located in various terrain settings.

After sufficient technical review, AERMOD, along with its associated preprocessors (AERMET - the meteorological data preprocessor, AERMAP - the terrain data preprocessor), was submitted to the USEPA's Office of Air Quality Planning and Standards for consideration as a regulatory dispersion model. The model was approved on November 9, 2005 [Federal Register: November 9, 2005 (Vol. 70, Num. 216) Page 68217-68261] to replace ISC3 after a one-year transition period.

AERMOD (USEPA 2004a) was used to predict the impacts from sources during construction. The most recent available model version was used.

AERMOD is capable of handling multiple sources, including point, volume, and area source types. Line sources may also be modeled as a string of volume sources or as elongated area sources. Several source groups may be specified in a single run, with the source contributions combined for each group. The model contains algorithms for modeling the effects of aerodynamic downwash due to nearby buildings on point source emissions. The current version of AERMOD does not include algorithms for modeling depositional effects on particulate emissions.

Source emission rates can be treated as constant throughout the modeling period, or may be varied by month, season, hour-of-day, or other optional periods of variation. These variable emission rate factors may be specified for a single source or for a group of sources. The user may also specify a separate file of hourly emission rates for some or all of the sources included in a particular model run.

The AERMOD model is capable of predicting average hourly impacts using local meteorological data. Lakes Environmental's ISC-AERMOD View modeling interface tool was used to create the inputs and evaluate the output.

Model Options
The regulatory default options (which include the use of Final Plume Rise, Stack-tip Downwash, Buoyancy-induced Dispersion, the model's Calms Processing Routine, Default Wind Profile Exponents, and Default Vertical Potential Temperature Gradients) were used in the model.

Averaging times selected depend on the pollutant modeled, as each pollutant has a regulatory standard with its own averaging time. Only pollutant concentrations were calculated. No deposition was modeled.

AERMOD's rural dispersion processing routines were used. Although there is significant development near the Folsom Facility, the majority of this area is suburban residential, with large areas of undeveloped land. Also, the reservoir's effects must be accounted for, and AERMOD's urban processing routine would be inappropriate for this modeling scenario.

Since construction activities are intermittent (versus continuous), the emission factor feature of AERMOD was used to vary emissions. This allows the modeler to restrict emissions to only times and days when construction would occur. Since a detailed construction schedule was not available, only hour-of-day factors were used.

Since the proposed action is expected to be completed over an 8 year period, only the peak year of each alternative was modeled.

Modeled Pollutants
The particulate matter pollutants (PM_{10} and $PM_{2.5}$) do not have daily significance thresholds. Therefore these pollutants must be modeled and the predicted downwind concentrations compared against the California Ambient Air Quality Standards (CAAQS) and National Ambient Air Quality Standards (NAAQS) to determine if an adverse impact is caused by the Folsom DS/FDR actions.

It is anticipated that NO_x emissions from construction equipment may be substantial for all alternatives. Thus, since the NO_x emission inventories were above the construction significance threshold, modeling of NO_x was performed for comparison to the nitrogen dioxide (NO_2) CAAQS.

Emissions of SO_2 are expected to be extremely low, due to the use of ultra low sulfur diesel (15 ppm) fuel on the proposed action. Therefore, modeling of SO_2 was not conducted.

Emissions of CO from construction equipment and heavy duty diesel trucks are typically not a cause of CO nonattainment. With the continued reduction in CO emissions from on-road vehicles due to state regulation, CO concentrations in the region are now better than the CO CAAQS and NAAQS. Therefore, dispersion modeling of Folsom DS/FDR equipment CO was not conducted.

Source Representation

Emission sources were represented in the AERMOD model as best as possible. Again, AERMOD is capable of handling multiple sources, including point, volume, and area source types. Each actual emission source must be represented as one of the aforementioned types. All sources were modeled as area sources. The emissions of PM_{10} and $PM_{2.5}$ may be dominated by fugitive dust, and were thus modeled as ground based area sources. Emissions of the gaseous pollutants are likely to be dominated by engine exhaust, which was modeled as elevated area sources.

Excavation and Construction Sites

Excavation sites were primarily modeled as area sources. These areas were often represented by irregularly shaped polygons. Emissions were allocated based on the construction schedule, the number and types of equipment expected to be in use at that site, and the area of the site.

Concrete Processing Facilities

Concrete processing facilities (concrete batch plants) were modeled as elevated area sources, with a size of 10 to 20 acres, depending on the amount of activity expected to take place at each plant. These types of facilities often have tall equipment used to mix sand and aggregate and to load the mixture into trucks stationed underneath. Thus, there is a significant vertical dimension to the emissions.

Material/Rock Processing Facilities

Similarly to concrete processing, materials processing (sorting) and rock crushing were modeled as 10 acre area sources.

Roadways

Emissions from roadways located within excavation and construction sites were included as area source emissions with 25 foot widths. Although emissions of this type are often modeled as volume sources, the number of volume sources required to accurately represent the onsite roadways alone would number over 1200, and significantly increase runtimes to an impractical level. It will likely be indiscernible to the results to model the onsite roadways as area sources rather than volume sources.

Variable Emissions

The workday would consist of two 8-hour shifts. Emissions are assumed to occur from 7 AM to (but not including) 11 PM. Thus for dispersion calculations, emissions were factored by 1.00 during those hours, and 0.0 from 11 PM to (but not including) 7 AM. Although the construction activity would only occur during workdays (Monday through Friday), the model was initially set to process all days of the week for the entire year being modeled. If this conservative approach indicates that impacts may be above the CAAQS or NAAQS, a refinement to remove the weekend emissions may be introduced.

Receptors
The Folsom DS/FDR would encompass the southern and western banks of the Folsom Reservoir. The reservoir itself is roughly 4 miles east-west by 5 miles north-south. Receptor placement and grid selection must be dense enough to assure that the maximum predicted impacts are obtained, yet within the limits of the model's processing capability.

The most appropriate way to accomplish this was by performing two rounds of modeling. The first round used a single Cartesian receptor grid. A coarse 31 x 31 point receptor grid with 500 meter spacing covered an area of 225 square kilometers (approximately 55,600 acres). This grid encompassed areas to about 4 kilometers east of the easternmost work area (MIAD Left Borrow area) and about 4 kilometers west of the westernmost work area (Dike 5). This coarse grid also extended roughly 3.5 kilometers north of the northernmost work area (Dike 1) and 3.5 kilometers south of the southernmost work area (Dike 8). Receptor locations in the reservoir were removed. This grid adequately represent any pollutant dispersion outside the immediate vicinity of any work areas, as well as providing the analysts the general location of the highest concentrations in preparation for the second round of modeling.

The second round of modeling included a fine Cartesian grid of 121 (11x11) receptors spaced 50 meters apart, and centered on the location of the highest concentration value predicted in the first round of modeling. This allowed the analyst to better estimate the highest concentrations without using valuable computer resources and time to model receptors which are irrelevant to the compliance analysis.

Terrain elevations were included at each receptor. Digital elevation model (DEM) data produced by the United States Geological Service (U.S.G.S.) was obtained from Lakes Environmental's online database (www.webgis.com). 7.5-degree data was used for all receptor points. The actual receptor elevations will be chosen using the terrain processor included with the ISC-AERMOD View interface.

Meteorological Data
Proper quality-assured meteorological data is essential to running dispersion models. Data appropriate for input to the AERMOD dispersion model was obtained from the Lakes Environmental WebMet site (Lakes 2006), unless specific meteorological data

is provided by SMAQMD. The WebMet site data for Sacramento is from the Sacramento Executive Airport for surface data and from Oakland International Airport for upper air data. The dispersion analysis was conducted for one year of data.

A wind rose for Sacramento Executive Airport for 1985 is shown in Figure 3.3-2, and is considered to be generally indicative to existing wind characteristics local to the Folsom Facility. The length of each line in a wind rose diagram is proportional to the frequency of wind blowing out of that direction; and the percentage of calm periods is noted at the bottom. The calm periods representing a very stable atmosphere are most commonly observed during early morning hours before the sun heats the ground and the mixing height increases.

Output Options

Tabular output for the highest and second highest predicted concentrations was requested from the model for all pollutants except $PM_{2.5}$; in this case, the eighth highest value was requested to approximate the 98th percentile required by NAAQS for 24-hour averaging. In addition, plot files were requested so that visual depictions of the results can be created.

3.3.2.3 Environmental Consequences/Environmental Impacts

Emission Inventories

Emissions of criteria pollutants and TACs would occur during construction activities at the proposed site. Typical construction activities including demolition, site grading, and Folsom Facility feature construction, all of which would contribute to fugitive dust emissions or on- and off-site diesel exhaust emissions. Since no operational sources are part of the Folsom DS/FDR action, only construction air quality impacts have been analyzed.

Construction impacts were estimated following the methodology described above. Table 3.3-17 provides a summary of peak daily and annual emission rates for VOC, NO_x, CO, SO_2, PM_{10}, and $PM_{2.5}$. In cases where emission factors were only provided for PM_{10}, appropriate CARB PM size profiles were used to estimate $PM_{2.5}$ emissions. Detailed calculation tables that provide emissions by year and by general source categories are included in Appendix E.

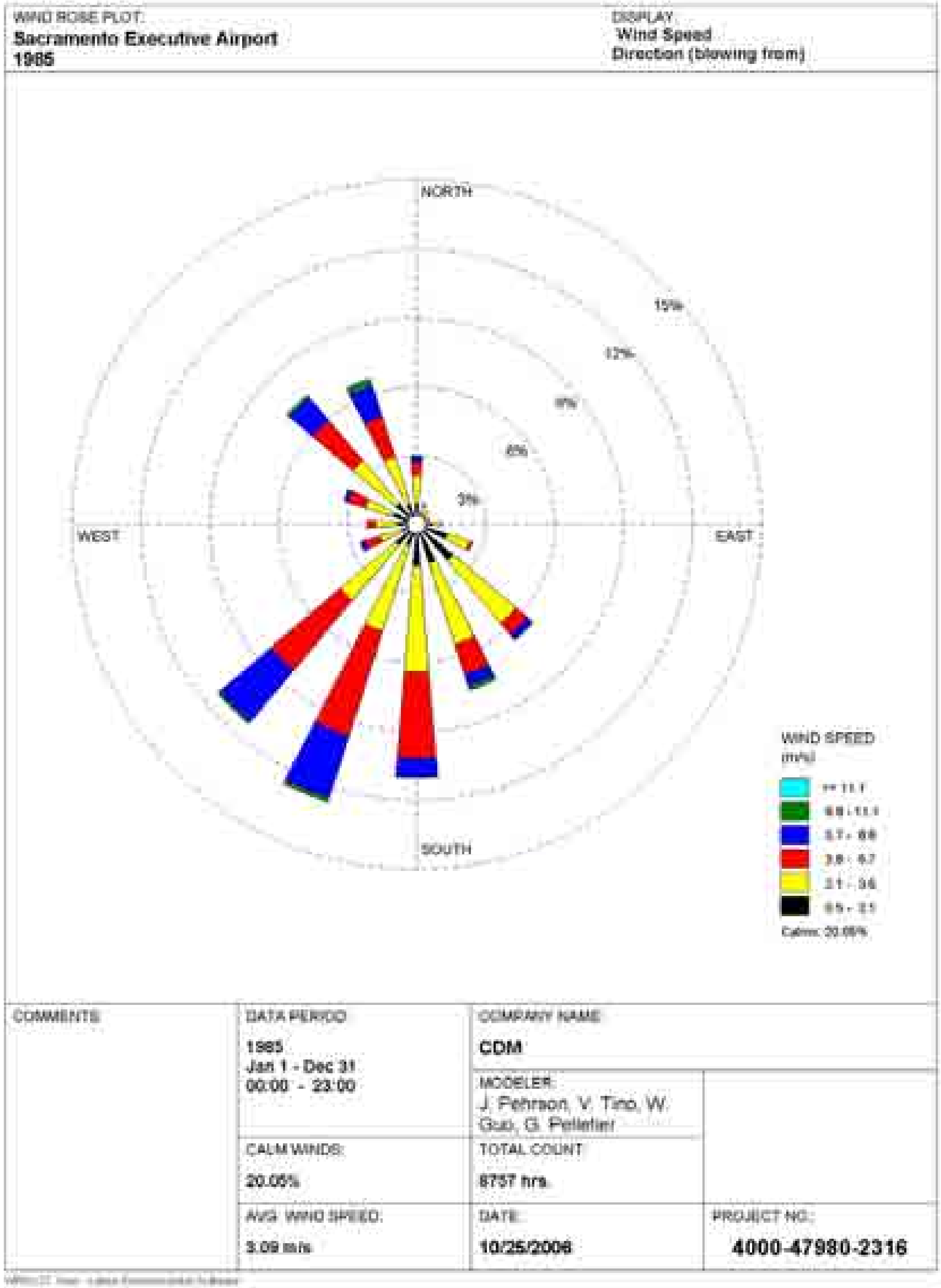

Figure 3.3-3
1985 Wind Rose for Sacramento Executive Airport

Table 3.3-17 ***Uncontrolled Construction Emission Inventories***						
Alternative	***VOC***	***NOx***	***CO***	***SO_2*** [(1)]	***PM_{10}***	***$PM_{2.5}$***
	Peak Daily Emissions in lbs/day					
1	207	1,734	1,809	~1.0	2,341	587
2 [(2)]	247	1,979	2,151	~1.0	3,874	910
3	306	1,969	2,561	~0.6	2,190	556
4 [(3)]	262	1,759	2,127	~0.6	2,688	659
5 [(3)]	289	2,057	2,291	~1.0	2,712	669
	Peak Annual Emissions in tons/year					
1	20.5	209.9	293.1	<1.0	239.0	63.5
2 [(2)]	24.6	251.8	351.7	<1.0	330.1	83.3
3	32.4	196.9	281.0	<1.0	215.4	56.8
4 [(3)]	18.9	116.9	156.9	<1.0	264.8	69.8
5 [(3)]	27.2	161.9	228.6	<1.0	267.4	71.5

[(1)] Ultra-low sulfur diesel fuel (15 ppm S) assumed to be used in all construction equipment.

[(2)] Alternative 2 VOC, NOx, and CO emissions assumed to be equal to Alternative 1 emissions plus Tunnel Construction emissions. Alternative 2 PM_{10} and $PM_{2.5}$ emissions estimated from ratio of peak daily material quantities moved for Alternative 2 relative to Alternative 1 (for daily emissions) and from ratio of equipment-hours per year for Alternative 2 relative to Alternative 1 (for annual emissions).

[(3)] PM_{10} and $PM_{2.5}$ emissions for Alternatives 4 and 5 estimated from ratio of peak daily material quantites moved for Alternatives 4 and 5 relative to Alternative 1 (for daily emissions), and from ratio of equipment-hours per year for Alternatives 4 and 5 relative to Alternative 1 (for annual emissions).

Based on the general layout of the Folsom DS/FDR construction activities, it is anticipated that 75 to 80 percent of the emissions would occur in Sacramento County, 20 to 25 percent in Placer County, and 1 to 5 percent in El Dorado County. A nominal amount of on-highway haul truck emissions may occur in Yuba County if material is transported from Marysville to the site.

As was discussed in Section 3.3.2, NO_x has a short-term (construction) significance threshold of 85 pounds per day under CEQA. Under the General Conformity Rule, NO_x and VOC each have a 50 tons per year (tpy) de minimis threshold, PM_{10} has a 100 tpy de minimis threshold, and CO has a 100 tpy de minimis threshold. The emission estimates provided in Table 3.3-17 indicate the uncontrolled NO_x emissions would be considered significant for the Folsom DS/FDR under CEQA, and uncontrolled NO_x, PM_{10}, and CO emissions exceed the General Conformity de minimis thresholds for all action alternatives. Unless standard conditions for the Folsom DS/FDR construction would require control of NO_x, PM_{10}, and/or CO emissions, a General Conformity evaluation must be conducted for these pollutants.

The controlled PM_{10} emissions are below the General Conformity de minimis thresholds. Therefore, the Folsom DS/FDR is assumed to conform to any PM_{10} SIP requirements for all action alternatives.

The major source of NO_x emissions are the on-site construction equipment and haul trucks with non-road equipment engines. Control of NO_x emissions from these mobile sources would not be subject to stationary source permitting requirements. Therefore, the control of NO_x from these sources will be considered a mitigation measure under CEQA.

See Section 3.3.4 for a discussion of potentially available mitigation options for mobile construction equipment.

Modeled Ambient Air Quality

Table 3.3-18 summarizes the results of the unmitigated modeling completed for Folsom DS/FDR, and compares the results to the NAAQS. The Sacramento-Del Paso Manor air quality monitoring station was used to estimate the background concentration at the site. The maximum concentration for each given pollutant from the years 2003 to 2005 was selected to estimate existing air quality near Folsom Reservoir.

The NAAQS background concentration for PM_{10} is 59 $\mu g/m^3$ for the 24-hour average. Adding the unmitigated Folsom DS/FDR PM_{10} contributions to this background indicates that PM_{10} concentrations would exceed the current NAAQS standard of 150 $\mu g/m^3$. Additional PM_{10} mitigation measures would need to be implemented during construction.

The NAAQS background concentration for $PM_{2.5}$ is 62 $\mu g/m^3$ for the 24-hour average, which exceeds the current NAAQS standard of 35 $\mu g/m^3$; therefore, the site would eventually be designated as nonattainment for $PM_{2.5}$. The modeled results indicate that the 24-hour NAAQS for $PM_{2.5}$ would be exceeded due primarily to the high background concentration. Additional $PM_{2.5}$ mitigation measures will need to be implemented during construction.

Table 3.3-19 compares the modeled pollutant concentrations with the CAAQS. The background PM_{10} concentrations, as determined for CAAQS comparisons, exceeds the current 24-hour and annual PM_{10} CAAQS. Therefore, adding the Folsom DS/FDR actions would further erode the PM_{10} air quality near the site. The background annual $PM_{2.5}$ concentration, as determined for comparison to the CAAQS, is equal to the $PM_{2.5}$ CAAQS. Thus, any contribution would cause the local concentrations to exceed the $PM_{2.5}$ CAAQS during construction.

Table 3.3-18
Comparison of Modeled Concentrations (Unmitigated Results) to NAAQS

Pollutant	**Modeled Concentration**					**Modeled Concentration with Background**[8]				
	Alt 1	**Alt 2**[1]	**Alt 3**[2]	**Alt 4**[1]	**Alt 5**[1]	**Alt 1**	**Alt 2**	**Alt 3**	**Alt 4**	**Alt 5**
NO_2										
Annual[3]	8	10	8	4	6	29	31	28	25	27
PM_{10}										
24-Hr[4]	110	***182***	110	126	127	***169***	***241***	***169***	***185***	***186***
Annual[5]	7	10	7	8	8	29	32	29	30	30
$PM_{2.5}$										
24-Hr[6]	13	20	13	15	15	***78***	***85***	***78***	***80***	***80***
Annual[7]	2	3	2	2	2	14	15	14	14	14

(1) Alternative 2, 4 and 5 concentrations estimated from Alternative 1 concentrations multiplied by the ratio of Alternative 2, 4 or 5 emissions to Alternative 1 emissions.
(2) Alternative 3 concentrations assumed to be the same as Alternative 1 concentrations.
(3) Reported concentration of NO_2 shown is 75 percent of the modeled NOx concentration.
(4) The modeled high-8th-high value is reported as the 24-Hour average for PM_{10}.
(5) The annual average PM_{10} NAAQS has been rescinded, effective December 18, 2006 (71 FR 61144).
(6) The modeled high-8th-high value averaged over 3 years is reported as the 24-Hour average for $PM_{2.5}$; this method approximates the 98th percentile. See Appendix E for additional discussion of this methodology.
(7) The maximum annual average over 3 years of meteorological data (1985, 1986, and 1987) is reported as the appropriate annual average for the $PM_{2.5}$ NAAQS.
(8) Sacramento-Del Paso Manor monitoring station used for background concentrations (years 2003, 2004, and 2005):

- NAAQS background concentration for NOx: 20.8 μg/m3 (Annual).
- NAAQS background concentrations for PM10: 59 μg/m3 (24-hr) and 22 μg/m3 (Annual).
- NAAQS background concentrations for PM2.5: 62 μg/m3 (24-hr) and 12.2 μg/m3 (Annual).

Values in ***Bold Italics*** indicate concentrations that exceed the NAAQS.

Table 3.3-19
Comparison of Modeled Concentrations (Unmitigated Results) to CAAQS

Pollutant	**Modeled Concentration**					**Modeled Concentration with Background**[6]				
	Alt 1	**Alt 2**[1]	**Alt 3**[2]	**Alt 4**[1]	**Alt 5**[1]	**Alt 1**	**Alt 2**	**Alt 3**	**Alt 4**	**Alt 5**
NO_2										
1-Hr[3]	188	215	188	191	223	378	404	378	381	413
PM_{10}										
24-Hr[4]	110	***182***	110	126	127	***187***	***259***	***187***	***203***	***204***
Annual	7	10	7	8	8	***33***	***36***	***33***	***34***	***34***
$PM_{2.5}$										
Annual[5]	2	3	2	2	2	***14***	***15***	***14***	***14***	***14***

(1) Alternative 2, 4 and 5 concentrations estimated from Alternative 1 concentrations multiplied by the ratio of Alternative 2, 4 or 5 emissions to Alternative 1 emissions.

(2) Alternative 3 concentrations assumed to be the same as Alternative 1 concentrations.

(3) Reported concentration of NO_2 shown is determined from the modeled NOx concentration multiplied by the NO_2-to-NOx ratio obtained from the NO_2-to-NOx versus NOx graph included in Appendix E.

(4) The modeled high-8th-high value is reported as the 24-Hour average for PM_{10}.

(5) The maximum annual average over 3 years of meteorological data (1985, 1986, and 1987) is reported as the appropriate annual average for the $PM_{2.5}$ NAAQS.

(6) Sacramento-Del Paso Manor monitoring station used for background concentrations (years 2003, 2004, and 2005):

- CAAQS background concentration for NOx: 189.9 μg/m^3 (1-Hr).
- CAAQS background concentrations for PM_{10}: 77 μg/m^3 (24-hr) and 26 μg/m^3 (Annual).
- CAAQS background concentrations for $PM_{2.5}$: 12 μg/m^3 (Annual).

Values in ***Bold Italics*** indicate concentrations that exceed the CAAQS.

3.3.3 Significance and Comparison of the Alternatives

As was discussed in Section 3.3.2, NOx has a short-term (construction) significance threshold of 85 pounds per day under CEQA. Under the General Conformity Rule, NOx and VOC each have a 50 tons per year (tpy) de minimis threshold, PM_{10} has a 100 tpy de minimis threshold, and CO has a 100 tpy de minimis threshold. The emission estimates provided in Table 3.3-17 indicate the uncontrolled NOx emissions would be considered significant for this project under CEQA, and uncontrolled NOx, PM_{10}, and CO emissions exceed the General Conformity de minimis thresholds for all action alternatives. Unless standard conditions for Folsom DS/FDR construction will require control of NOx, PM_{10}, and/or CO emissions, a General Conformity evaluation must be conducted for these pollutants.

A comparison of alternatives will need to consider the amount of material moved and the number of pieces of equipment used in the peak day and peak year of construction activity. In the development of alternatives, the details on equipment counts and material moved for Alternatives 1 and 3 were further along at the time of the air quality impact analysis than the details for Alternatives 2, 4 and 5. Therefore, the PM emission inventories for Alternatives 2, 4, and 5 are based on ratios of daily and annual material movement quantities between those alternatives and Alternative 1. The gaseous pollutant emissions for Alternatives 4, and 5 are based on preliminary equipment count information that may not be as detailed as the data obtained for Alternatives 1 and 3. The gaseous pollutant emissions for Alternative 2 were estimated assuming the tunnel construction occurs simultaneously with the same features being worked as with Alternative 1. Thus the peak VOC, CO, and NOx emissions for Alternative 2 are the Alternative 1 emissions plus the tunnel emissions.

The major source of PM (PM_{10} and $PM_{2.5}$) emissions is fugitive dust from on-site construction activities. Comparing PM emissions between alternatives indicates that Alternative 2 has the highest emissions followed by Alternatives 5, 4, 1, and 3. Alternative 2 requires the most on-site material to be moved over a given day and given year, and has the highest on-site material movement requirement of all alternatives, almost 12 million cubic yards. On-site material moved for Alternatives 1, 3, 4, and 5 over the project life total approximately 5.2 million, 5.6 million, 5.8 million, and 7.8 million cubic yards, respectively. Thus materials moved for Alternatives 1, 3 and 4 are similar, thus the PM emissions are expected to be roughly the same. In addition to material moved, the specific construction schedule identifying which features are worked simultaneously, how many work days per feature, and how many years per feature effect the peak daily and annual emissions.

The major sources of VOC, CO, and NOx emissions are the on-site construction equipment and haul trucks with non-road equipment engines. Control of NOx emissions from these mobile sources would not be subject to stationary source permitting requirements. Therefore, the control of NOx from these sources will be considered a mitigation measure under CEQA. Comparing the daily NOx emissions for each alternative indicates Alternatives 5, 2, and 3 have the highest emission levels, with lower emissions for Alternatives 4 and 1. These inventories imply that more equipment is needed on the peak day for Alternatives 2, 3 and 5 than for Alternatives 1 and 4.

Please see Section 3.3.4 for a discussion of potentially available mitigation options for mobile construction equipment.

3.3.4 Mitigation Measures

The emissions of unmitigated NO_x, primarily from off-road construction equipment, would be above the CEQA significance threshold for construction. In addition, unmitigated PM_{10} and $PM_{2.5}$ concentrations would exceed the NAAQS and CAAQS. Finally, unmitigated NO_x, PM_{10}, and CO emissions exceed the General Conformity de minimis thresholds for each year of the Folsom DS/FDR construction. Therefore additional mitigation would need to be applied to the emission sources.

3.3.4.1 Stationary Source Mitigation Options

The stationary sources associated with the Folsom DS/FDR would include the concrete batch plant(s) and material crushing/processing facilities. Because these plants would be subject to air quality permitting by one or more of the local air districts, it is assumed that the following controls will be installed:

- *AQ-1* - Facility power will come from the electric utility grid, not diesel-driven generators and pumps. Using grid power eliminates both the gaseous pollutants associated with diesel engines, as well as diesel particulate matter which is a listed toxic air contaminant in California.

- *AQ-2* - Wet suppression will be used to reduce plant dust emissions. For this analysis, the controlled emissions are based on AP-42 controlled emission factors for batch plants and crushing facilities.

These controls are included as part of the Folsom DS/FDR design for the stationary plants. The emissions for these units will be refined as the design is firmed up for air quality permitting and eventual operation.

3.3.4.2 Mobile Source Mitigation Options

The standard CEQA mitigation measures for construction equipment emissions are (SMAQMD 2004):

- *AQ-3* - The Project Agencies will provide a plan for approval by SMAQMD, demonstrating that the heavy-duty (> 50 horsepower) off-road vehicles to be used in the construction project, including owned, leased and subcontractor vehicles, will achieve a project wide fleet-average 20 percent NO_x reduction and 45 percent particulate reduction compared to the most recent CARB fleet average at time of construction; and

- *AQ-4* - The Project Agencies will submit to the SMAQMD a comprehensive inventory of all off-road construction equipment, equal to or greater than 50 horsepower, that will be used an aggregate of 40 or more hours during any portion of the construction project. The inventory shall include the horsepower rating, engine production year, and projected hours of use or fuel throughput for each piece of equipment. The inventory shall be updated and submitted monthly throughout the duration of the project, except that an inventory shall not be required for any 30-day period in which no construction activity occurs. At least 48 hours prior to the use of subject heavy-duty off-road equipment, the project representative shall provide SMAQMD with the anticipated construction timeline including start date, and name and phone number of the project manager and on-site foreman.

NO_x Mitigation Options
Several mitigation options that may be applicable to mobile construction equipment engines to reduce NO_x emissions are described below. The specific measures to be employed will be based on discussions with the SMAQMD.

- *AQ-5* - Use of emulsified or aqueous diesel fuel. Use of emulsified or aqueous diesel fuel could theoretically be applied to all diesel equipment operating at the site by making this the only diesel fuel purchased for the Folsom DS/FDR action. It is anticipated that equipment fueling would occur onsite with a fuel depot and/or mobile fueling trucks. It is assumed that aqueous diesel fuel would provide a 14 percent reduction NO_x emissions as well as a 63 percent reduction of engine exhaust PM_{10} emissions, consistent with the control efficiencies incorporated in the URBEMIS2002 model.

- *AQ-6* - Use of equipment with engines that incorporate exhaust gas recirculation (EGR) systems. EGR systems would need to be part of the engine design for a substantial portion of the existing construction equipment fleet in the region to be effective. While EGR systems can provide reductions of NO_x, PM_{10}, CO, and VOC emissions, it is not likely that enough available construction equipment have EGR engines to provide any real reductions for the Folsom DS/FDR action. However, the availability of construction equipment with EGR systems will need to be reviewed in detail prior to the final decision to incorporate or drop this option from the MMRP for the proposed action.

- *AQ-7* - Installation of a lean NO_x catalyst in the engine exhaust system. Lean NO_x catalyst filters may be available for construction equipment exhaust. However, these units would need to be certified by CARB before being installed on specific construction equipment engines. In addition, other add-in exhaust filters are not compatible with aqueous diesel fuel. Therefore, aqueous fuel use and lean NO_x catalysts may be mutually exclusive mitigation options. Again, a detailed review of applicable catalysts and compatibility with different fuels will need to be conducted before a final decision can be made to incorporate in or drop this option from the MMRP.

Currently, it is assumed that off-highway 30-yard quarry trucks would be used to move material between the borrow areas and the storage/use sites. Approximately 3,400,000 cu yd of excavated would be moved using these trucks, and emissions from these trucks alone represent approximately 40 percent of the Alternative 1 total ROG, NO_x and CO emissions. Using smaller on-highway haul trucks for this activity would reduce emissions for Alternative 1, but would also increase the schedule for these activities. For this analysis, it is assumed that the on-highway trucks will be used to mitigate the gaseous pollutant emissions from on-site material hauling equipment

Finally, NO_x emissions that exceed 85 lbs/day after installation of control devices and/or implementation of other administrative controls will be subject to a mitigation implementation fee used to control other emission sources in the proposed action region. This fee, currently $14,300 per ton of NO_x in excess of the 85 lbs/day significance threshold represents the final mitigation measure used to reduce the NO_x impact to a level of insignificance.

PM Mitigation Options
Fugitive dust control will be applied to reduce PM_{10} and $PM_{2.5}$ emissions. Typical dust mitigation measures include:

- Wet suppression and soil stabilization
- Wind fencing around active area
- Paving on-site roadways
- Truck wheel washing facilities at site exits onto public roadways
- Maintaining minimum truck bed freeboard or covering haul truck beds

The Folsom DS/FDR will employ some combination of these measures as appropriate for the area and equipment operating on a given feature.

3.3.4.3 Mitigated Emission Inventories

The estimated mitigated emission inventories are presented in Table 3.3-20. These inventories assume that NO_x emissions from off-road equipment are reduced by 20 percent, and that fugitive PM emissions are reduced by 50 percent.

Table 3.3-20
Mitigated Construction Emission Inventories

Alternative	VOC	NOx[3]	CO	PM_{10}[4]	$PM_{2.5}$[4]
	Peak Daily Emissions in lbs/day				
1	207	1,508	1,809	1,372	383
2[1]	247	1,704	2,151	2,270	593
3	306	1,629	2,562	1,284	363
4[2]	262	1,464	2,124	1,575	430
5[2]	288	1,873	2,280	1,589	437
	Peak Annual Emissions in tons/year				
1	20.4	170.8	293.1	140.4	41.7
2[1]	24.5	204.9	351.7	193.9	54.7
3	32.8	158.9	281.0	126.5	37.3
4[2]	18.9	95.8	156.8	155.6	45.8
5[2]	27.1	144.3	228.0	157.1	47.0

(1) Alternative 2 VOC, NOx, and CO emissions assumed to be equal to Alternative 1 emissions plus Tunnel Construction emissions. Alternative 2 PM_{10} and $PM_{2.5}$ emissions estimated from ratio of peak daily material quantities moved for Alternative 2 relative to Alternative 1 (for daily emissions) and from ratio of equipment-hours per year for Alternative 2 relative to Alternative 1 (for annual emissions).

(2) PM_{10} and $PM_{2.5}$ emissions for Alternatives 4 and 5 estimated from ratio of peak daily material quantites moved for Alternatives 4 and 5 relative to Alternative 1 (for daily emissions), and from ratio of equipment-hours per year for Alternatives 4 and 5 relative to Alternative 1 (for annual emissions).

(3) Construction equipment engine NOx emissions assumed to be reduced by 20 percent compared to unmitigated NOx emissions.

(4) Fugitive dust assumed to be reduced by 50 percent compared to unmitigated PM emissions.

NO_x emissions with all feasible mitigation measures and payment of the mitigation implementation fee would be less than significant under CEQA. However the, mitigated NO_x, PM_{10}, and CO emissions associated with the federal action would be greater than the General Conformity de minimis threshold. Therefore, a full NO_x, PM_{10}, and CO conformity evaluation will need to be developed for the preferred alternative (proposed action) before a ROD can be issued for the Folsom DS/FDR.

3.3.4.4 Mitigated Air Dispersion Results

The modeled ambient air quality associated with the mitigated emission inventories are compared to the NAAQS in Table 3.3-21, and are compared to the CAAQS in

Table 3.3-22. These results indicate that the 24-hour $PM_{2.5}$ NAAQS may be exceeded, primarily because the existing background concentrations already exceed the current standard. The mitigated PM_{10} concentrations would be better than the NAAQS for all alternatives, except Alternative 5. However, the PM_{10} and $PM_{2.5}$ CAAQS may be exceeded during construction for all alternatives. Although the exceedances are primarily due to background PM concentrations exceeding the respective CAAQS, this draft analysis concludes that PM_{10} and $PM_{2.5}$ would remain significant under CEQA after mitigation.

Due to the conservative nature of the inventory estimations used in the analysis, it is anticipated that refinement of the estimates will be made when the construction schedule is firmed up. In addition, more current emission factors may be applied in the refinement.

3.3.5 Cumulative Effects

Table 5-1 lists projects considered in the cumulative analysis. Many of the projects, including the New Folsom Bridge, include construction within the study region. Construction of these projects would increase emissions of criteria pollutants, including VOC, NO_x, CO, SO_2, and PM emissions, from onsite construction and transport of materials. If these construction projects are implemented concurrently, the combined cumulative effects would be above CEQA thresholds for air quality emissions and the General Conformity de minimus thresholds. Each project would need to mitigate individual air quality effects, which could decrease overall cumulative effects. However, without consideration of scheduling and sequence of activities, concurrent construction projects within and adjacent to Folsom Reservoir would have significant cumulative air quality impacts.

The effects of the Folsom DS/FDR to air quality would be cumulatively considerable. Additionally, mitigated NO_x, PM_{10} and CO emissions associated with the Folsom DS/FDR would be greater than the General Conformity *de minimis* threshold. Therefore, these incremental effects would be significant under the cumulative condition.

Table 3.3-21
Comparison of Modeled Concentrations (Mitigated Results) to NAAQS

Pollutant	Modeled Concentration					Modeled Concentration with Background[8]				
	Alt 1	**Alt 2**[1]	**Alt 3**	**Alt 4**[2]	**Alt 5**[2]	**Alt 1**	**Alt 2**	**Alt 3**	**Alt 4**	**Alt 5**
NO_2										
Annual[3]	6	6	5	6	7	27	27	26	27	28
PM_{10}										
24-Hr[4]	64	64	45	76	112	123	123	104	135	***171***
Annual[5]	3	3	2	4	5	25	25	24	26	27
$PM_{2.5}$										
24-Hr[6]	9	9	8	9	14	***71***	***71***	***70***	***71***	***78***
Annual[7]	1	1	1	1	2	13	13	13	13	14

(1) Alternative 2 concentrations assumed to be equal to Alternative 1 concentrations.
(2) Alternative 4 and 5 concentrations estimated from Alternative 1 concentrations multiplied by ratio of Alternative 4 or 5 emissions to Alternative 1 emissions.
(3) Reported concentration of NO_2 shown is 75 percent of the modeled NOx concentration.
(4) The modeled high-8th-high value is reported as the 24-Hour average for PM_{10}.
(5) The annual average PM_{10} NAAQS has been rescinded, effective December 18, 2006 (71 FR 61144).
(6) The modeled high-8th-high value averaged over 3 years is reported as the 24-Hour average for $PM_{2.5}$; this method approximates the 98th percentile. See Appendix E for additional discussion of this methodology.
(7) The maximum annual average over 3 years of meteorological data (1985, 1986, and 1987) is reported as the appropriate annual average for the $PM_{2.5}$ NAAQS.
(8) Sacramento-Del Paso Manor monitoring station used for background concentrations (years 2003, 2004, and 2005):

- NAAQS background concentration for NOx: 20.8 µg/m3 (Annual).
- NAAQS background concentrations for PM10: 59 µg/m3 (24-hr) and 22 µg/m3 (Annual).
- NAAQS background concentrations for PM2.5: 62 µg/m3 (24-hr) and 12.2 µg/m3 (Annual).

Values in ***Bold Italics*** indicate concentrations that exceed the NAAQS.

Table 3.3-22
Comparison of Modeled Concentrations (Mitigated Results) to CAAQS

Pollutant	Modeled Concentration					Modeled Concentration with Background[6]				
	Alt 1	**Alt 2[1]**	**Alt 3**	**Alt 4[2]**	**Alt 5[2]**	**Alt 1**	**Alt 2**	**Alt 3**	**Alt 4**	**Alt 5**
NO_2										
1-Hr[3]	166	166	186	166	206	356	356	376	356	396
PM_{10}										
24-Hr[4]	64	64	45	76	112	***141***	***141***	***122***	***153***	***189***
Annual	3	3	2	4	5	***29***	***29***	***28***	***30***	***31***
$PM_{2.5}$										
Annual[5]	1	1	1	1	2	***13***	***13***	***13***	***13***	***14***

(1) Alternative 2 concentrations assumed to be equal to Alternative 1 concentrations.

(2) Alternative 4 and 5 concentrations estimated from Alternative 1 concentrations multiplied by ratio of Alternative 4 or 5 emissions to Alternative 1 emissions.

(3) Reported concentration of NO_2 shown is determined from the modeled NOx concentration multiplied by the NO_2-to-NOx ratio obtained from the NO_2-to-NOx versus NOx graph included in Appendix E.

(4) The modeled high-8th-high value is reported as the 24-Hour average for PM_{10}.

(5) The maximum annual average over 3 years of meteorological data (1985, 1986, and 1987) is reported as the appropriate annual average for the $PM_{2.5}$ NAAQS.

(6) Sacramento-Del Paso Manor monitoring station used for background concentrations (years 2003, 2004, and 2005):

- CAAQS background concentration for NOx: 189.9 μg/m^3 (1-Hr).
- CAAQS background concentrations for PM_{10}: 77 μg/m^3 (24-hr) and 26 μg/m^3 (Annual).
- CAAQS background concentrations for $PM_{2.5}$: 12 μg/m^3 (Annual).

Values in ***Bold Italics*** indicate concentrations that exceed the CAAQS.

3.4 Aquatic Resources

This section presents potential impacts to aquatic resources from construction of the Folsom DS/FDR alternatives.

3.4.1 Affected Environment/Existing Conditions

3.4.1.1 Area of Analysis

The area of analysis for fisheries and other aquatic (vernal pool[1]) impacts includes the entirety of Folsom Reservoir as well as reaches of the American River and Lake Natoma between Folsom Dam and Nimbus Dam. Fishes residing in Folsom Reservoir use habitat throughout the reservoir and are not restricted to the area of the dam. Impacts that may occur to fish near the dam could affect populations in other parts of the reservoir.

3.4.1.2 Regulatory Setting

Federal

Endangered Species Act of 1973 (16 USC §1531 et seq.; 50 CFR Parts 17 and 222). This act includes provisions for protection and management of species that are federally listed as threatened (FT) or endangered (FE) and designated critical habitat for these species. "Endangered species" are defined as "any species which is in danger of extinction throughout all or a significant portion of its range"; "threatened species" are defined as "any species that is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range" (16 U.S.C.A. §1532). Critical habitat is defined as the specific areas within the geographical area occupied by the species, at the time it is listed in accordance with the provisions of Section 4 of the Act, on which are found those physical or biological features (I) essential to the conservation of the species and (II) which may require special management considerations or protection; and specific areas outside the geographical area occupied by the species at the time it is listed in accordance with the provisions of Section 4 of the Act, upon a determination by the Secretary that such areas are essential for the conservation of the species (16 U.S.C.A. §1532). The National Marine Fisheries Service's (NMFS) jurisdiction under the Federal Endangered Species Act is the protection of marine mammals and fishes and anadromous fishes (i.e., fish born in fresh water that migrate to the ocean to grow into adults and then return to fresh water to spawn). The U.S. Fish and Wildlife Service (USFWS) is the administering agency for this authority for terrestrial species (species of animals and plants that live on or grow from the land).

Magnuson-Stevens Fishery Conservation and Management Act. The Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act) establishes a

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[1] Vernal pools are seasonally ponded landscape depressions in which water accumulates because of limitations to subsurface drainage and that support a distinct association of plants and animals.

management system for national marine and estuarine fishery resources. This legislation requires that all Federal agencies consult with NMFS regarding all actions or proposed actions permitted, funded, or undertaken that may adversely affect "essential fish habitat." Essential fish habitat is defined as "waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity." The legislation states that migratory routes to and from anadromous fish spawning grounds are considered essential fish habitat. The phrase "adversely affect" refers to the creation of any impact that reduces the quality or quantity of essential fish habitat. Federal activities that occur outside of an essential fish habitat but that may, nonetheless, have an impact on essential fish habitat waters and substrate must also be considered in the consultation process. Under the Magnuson-Stevens Act, effects on habitat managed under the Pacific Salmon Fishery Management Plan must also be considered.

Fish and Wildlife Coordination Act (FWCA).
The FWCA (16 USC 661 et seq.) requires Federal agencies to consult with USFWS, or, in some instances, with NMFS and with State fish and wildlife resource agencies before undertaking or approving water projects that control or modify surface water. The purpose of this consultation is to ensure that wildlife concerns receive equal consideration during water resource development projects and are coordinated with the features of these projects. The consultation is intended to promote the conservation of fish and wildlife resources by preventing their loss or damage and to provide for the development and improvement of fish and wildlife resources in connection with water projects. Federal agencies undertaking water projects are required to fully consider recommendations made by USFWS, NMFS, and State fish and wildlife resource agencies in project reports and to include measures to reduce impacts on fish and wildlife in project plans.

State

California Endangered Species Act of 1984 (California Fish and Game Code (CDFG) §2050-2097). This act includes provisions for the protection and management of species listed by the state of California as endangered (SE) or threatened (ST), or designated as candidates for such listing (SC). The act includes a requirement for consultation "to ensure that any action authorized by a state lead agency is not likely to jeopardize the continued existence of any endangered or threatened species or results in the destruction or adverse modification essential to the continued existence of the species" (§2090). Animals of California declared to be endangered, threatened, or rare are listed at 14 CCR §670.5. The administering agency for the above authority is the CDFG.

3.4.1.3 Environmental Setting

Folsom Reservoir inundates approximately 12,000 acres of the North Fork, South Fork, and main stem of the American River. Although the maximum depth of the reservoir is 266 feet just behind Folsom Dam, most of the reservoir is shallower averaging 66 feet in depth. The reservoir has about 85 miles of shoreline. The waters of Folsom Reservoir stratify in the warmer months from April through November, with a layer of warmer water known as the epilimnion sitting on top of a bottom layer of cold water known as the hypolimnion.

Nimbus Dam is located about 6 miles downstream of Folsom Dam and inundated the American River for most of this reach creating Lake Natoma. Anadromous fish, such as Chinook salmon and steelhead can access about 23 miles of the lower American River downstream of Nimbus Dam but do not ascend the river beyond Nimbus Dam. The Nimbus Hatchery was constructed as a mitigation hatchery for the original Folsom Dam project.

Habitat within Folsom Reservoir and Lake Natoma allow for a diverse assemblage of native and introduced fish species to coexist. Folsom Reservoir is managed as a ‘two-story’ fishery, with cold-water fishes such as trout inhabiting the hypolimnion and warm-water fishes such as bass and sunfish inhabiting the epilimnion and shoreline areas. Two cold water fisheries for rainbow trout and Chinook salmon are actively maintained through a stocking program.

Seasonally wet areas outside the reservoir receive water from seeps, drainages and from direct precipitation. Dominant species include pointed rush, Baltic rush, and often scattered willow and cottonwood. During the dry season, these areas support annual upland vegetation such as non-native brome grasses and other forbs. These seasonally wet areas may provide habitat for aquatic invertebrate species. Special-status aquatic invertebrate species with potential to occur are vernal pool fairy shrimp (*Branchinecta lynchi*) and California vernal pool tadpole shrimp (*Lepidurus packardi*).

Fish Species Present in the Folsom Reservoir Area

Native and introduced fishes are present in the Folsom Reservoir area. Native fishes occur primarily as a result of their continued existence in tributaries of Folsom Reservoir and Lake Natoma. Two native species are planted in Folsom Reservoir for fishing, rainbow trout and Chinook salmon. The populations of most other species are currently self-supporting. Introduced fishes are more commonly found in the reservoirs than are native fishes. Most of these fishes were introduced into the State as game fish or as forage fish to support game fish populations. Some of the introduced fishes may have been unintentionally introduced into Folsom Reservoir over the past 50 years.

Game Fishes

Rainbow trout (Oncorhynchus mykiss)

Rainbow trout habitat use and life history behavior varies depending on where they are found. Most stream-dwelling wild rainbow trout reach sexual maturity in their second or third year and usually spawn between February and June, depending on water temperature and strain. Spawning occurs in streams over gravel, usually in riffles (a section of stream that has shallow, fast-flowing water followed by deep, slow-flowing water).or pool tailouts. The eggs hatch in 15 weeks at 3.5˚C and 11 weeks at 5˚C. Fry (small juvenile fish).emerge from the gravel beginning two to three weeks later, depending upon temperature. Juvenile and adult rainbow trout may migrate into a lake or other downstream areas or remain in the stream defending a small home range. Stream dwelling fish feed mostly on drifting invertebrates, but also eat benthic (pertaining to the bottom of a body of water).invertebrates, and terrestrial insects that fall into the water. Rainbow trout in lakes may feed on zooplankton, benthic invertebrates, or small fish. It is generally accepted that temperatures less than 20˚C are suitable for growth. Mortality can occur at temperatures exceeding 27˚C, although some fish may tolerate higher temps for brief periods. CDFG stocks juvenile and adult rainbow trout in Folsom Reservoir on a regular basis. Although natural reproduction does occur in the tributaries, stocked trout make up the vast majority of the rainbow trout population in the reservoir (Wallace, Roberts, and Todd et al. 2003).

Chinook salmon (Oncorhynchus tshawytcha)
Prior to the construction of Folsom and Nimbus dams, Chinook salmon migrated through and spawned in the American River where the two reservoirs are now located. Folsom Reservoir is now stocked for angling purposes with fingerling and yearling Chinook salmon from the Nimbus fish hatchery. Juvenile salmon feed largely on zooplankton while in the reservoir. The salmon are first caught at 12 to 14 inches and continue to grow for up to 3 years (Wallace, Roberts, and Todd et al. 2003). Under natural river conditions, these juveniles would smoltify (physiologically change in preparation to entering salt water) and migrate to the ocean. As these stocked fish cannot migrate to the ocean as smolts, it is estimated they experience high stress mortality (Wallace, Roberts, and Todd et al. 2003), although a few individuals may survive to become adults. Chinook salmon require cold water temperatures to spawn and rear. Rearing juveniles prefer water temperatures between 5 and 19˚C. Temperatures greater than 24˚C can lead to mortality in all age classes. Natural spawning occurs in rivers over large gravel. However, although adult salmon have been observed migrating upstream of the reservoir, natural reproduction contributes very little to the population in the reservoir (Wallace, Roberts, and Todd et al. 2003). The lower American River has been designated as Critical Habitat for spring-run Chinook salmon, and steelhead.

Brown trout (Salmo trutta)
Brown trout are native to Europe and western Asia. Peak spawning activity generally occurs in October and November and tapers off in December. Eggs are deposited among gravel in the riffles or pool tailouts of streams. Habitat preferences have a high degree of overlap with rainbow trout. In streams, fry and juvenile brown trout tend to prey on drift organisms and are similar in diet to rainbow trout except they are more piscivorous (eat other fish) as they get larger. In lakes they feed on

zooplankton or macroinvertebrates. Trout greater than 25 cm pursue large prey such as other fish, crayfish, and dragon fly or damsel fly larvae. Preferred water temperatures for brown trout are 12 to 20˚C. Brown trout were introduced to Folsom Reservoir as a game fish but are not currently stocked (Wallace, Roberts, and Todd et al 2003).

Bluegill (Lepomis macrochirus)
Bluegill are native to the eastern United States. They are notable for their ability to thrive in a wide range of environmental conditions. Although they can tolerate water temperatures approaching freezing, they grow best in water from 27 to 32˚C. They are usually found in shallow, slow moving water among beds of aquatic vegetation. Bluegill are highly opportunistic feeders subsisting on all kinds of aquatic invertebrates and small fish. Spawning occurs in spring and summer when water temperatures reach 18 to 21˚C over nests in shallow water.

Redear sunfish (Lepomis microlophus)
Redear are native to the southeastern United States. They prefer relatively deep, sluggish, warm water with abundant vegetation. They grow best in water from 24 to 32˚C. Diet consists mostly of benthic invertebrates, especially snails. Spawning occurs over nests during the summer. Redear mature later than bluegill and often grow quite large.

Green sunfish (Lepomis cyanellus)
Green sunfish inhabit small, warm, streams, ponds and lake edges and are incredibly adaptable to extreme environments. They prefer temperatures between 26 to 30˚C and can withstand temperatures at least as warm as 38˚C. They are generally rare in habitats that contain more than three or four other species of fish. Thus, in lakes and reservoirs they are usually only locally abundant in shallow, weedy areas that exclude larger or less tolerant species. They are opportunistic predators on invertebrates and small fish. Spawning activity occurs in spring and summer over fine gravel.

White crappie (Promoxis annularis)
White crappie, another introduced game fish, thrive in lakes, reservoirs, and other slow moving waters. They prefer warmer waters where summer temperatures reach 27 to 29˚C. Diet consists of many varieties of aquatic invertebrates and small fish. White crappie build nests in shallow water and spawning occurs from March through July. Adult males defend their nests for a short time. Larval young leave the nest to drift in open water and feed on zooplankton.

Black crappie (Promoxis nigromaculatus)
Black crappie are very similar to white crappie in their habitat, spawning and feeding requirements in reservoirs.

Largemouth bass (Micropterus salmoides)

Largemouth bass were introduced into California in 1891 and have since been spread to many waters of the state. They are abundant in farm ponds, lakes, reservoirs and river backwaters where other nonnative fish are abundant as well. Largemouth bass are normally found in warm, shallow (less than 20 feet or 6 m) waters of moderate quality and beds of aquatic plants. They are known to survive in isolated pools during droughts or in polluted waters, due to their ability to withstand adverse water quality conditions. Spawning occurs in spring when water temperatures reach 15˚C. By the time they reach two inches, they feed largely on aquatic insects and fish fry, including those of their own species. Once largemouth bass exceed four inches, they usually subsist primarily on fish. Occasionally, adults prefer crayfish or amphibians. Optimal temperatures for growth are 25 to 30˚C although growth will occur at temperatures ranging from 10 to 35˚C. Largemouth bass are a popular game fish in Folsom Reservoir although they are not actively stocked.

Spotted bass (Micropterus punctulatus)

Spotted bass are native to the Mississippi River drainage. In California reservoirs, they tend to inhabit slow moving waters in the vicinity of tributaries and hide along steep rocky banks. They prey upon a variety of invertebrates and fish. Spawning occurs in spring and early summer at temperatures around 15 to 18˚C over nests built in the bottom substrate.

Brown bullhead (Ameiurus nebulosus)

Brown bullheads are native to a large area of the eastern United States and Canada. They are widely distributed and highly adaptable living in habitats ranging from warm turbid sloughs to clear mountain lakes. In California, they are most abundant in larger bodies of water such as large rivers and foothill reservoirs where they are generally associated with the deeper littoral zone[2] (2 to 5 m), with mats of aquatic vegetation and muddy bottoms. This species tolerates a wide range of temperatures and is able to survive in low dissolved oxygen conditions. Brown bullhead feed largely on insect larvae and fish. Spawning occurs from May through July near aquatic vegetation or large woody debris.

White catfish (Ictalurus catus)

White catfish are native to the east coast of the United States from the Hudson River south to Florida. They inhabit the bottom of warm, sluggish waters such as reservoirs where temperatures exceed 20˚C during the summer. Diet consists of a variety of aquatic invertebrates and fish. Spawning occurs in June and July over nests on the bottom or in crevices.

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[2] A littoral zone is the area on or near the shore of a body of water.

Channel catfish (Ictalurus punctatus)
Channel catfish are native to the Mississippi-Missouri River system in the United States and into northeastern Mexico. They prefer to inhabit the bottom of swiftly moving rivers although they can live well in more sluggish habitats. Diet consists of a variety of aquatic invertebrates and fish. Spawning occurs in summer when water temperatures reach 21 to 29˚C. Nests are built in small caves or crevices.

Native Non-Game Fishes
Hardhead (Mylopharodon conocephalus) – CSC
Hardhead are large minnows reaching up to 60 cm in length that are native to the low to mid-elevation foothill streams of central valley and Russian River watersheds. They prefer stream habitats with clear, deep pools and runs but can also subsist in parts of reservoirs. Preferred temperatures are around 24 to 28˚C, which is why hardhead are often found near the surface in reservoir habitats. Diet consists of both plant material and invertebrates. Spawning occurs in April and May over stream gravels. Juveniles rear along edge habitats in covered areas. Hardhead do not tolerate the presence of bass or sunfish. For that reason they are unlikely to inhabit most parts of Folsom and Natoma lakes. Hardhead are more likely to be found in the tributary arms of Folsom Reservoir, rivers upstream of Folsom Reservoir or in the flowing reaches below Folsom Dam where there are fewer warm water fishes.

Sacramento pikeminnow (Ptychocheilus grandis)
Sacramento pikeminnow are large minnows growing up to a meter in length that are native to low to mid-elevation central valley drainages. They prefer stream and river habitats with deep pools and cover. They generally prefer waters where temperatures reach 18 to 28˚C in the summer. Juveniles feed on aquatic insects while adults are predatory on other fishes. Spawning occurs over gravel riffles or other shallow flowing areas in the spring and early summer. Juveniles rear along edge habitats, moving into deeper water with age. Adults can be sedentary or highly migratory but are usually not found in large reservoirs except near where large tributary streams enter.

California roach (Lavinia symmetricus)
California roach are small minnows native to the central valley, Sierra foothills, and some coastal watersheds of California. They can be abundant in small, warm stream habitats where they browse on small benthic invertebrates and algae. They tolerate a greater temperature range (up to 35°C) than other native fishes. Spawning occurs in spring and early summer when water temperatures exceed 16˚C, when spawning aggregations are formed. Roach are broadcast spawners, scattering eggs and sperm over small gravel substrate. Within the Folsom Reservoir area, roach are more likely to be found in and around small tributary streams than in the reservoirs.

Sacramento sucker (Catostomus occidentalis)
The Sacramento Sucker is a common, widely distributed species in central and northern California. They are most abundant in larger streams and rivers at moderate elevations. Sacramento suckers first spawn at an age of about four to six. Spawning generally takes place in February through June, depending on water temperatures, and may continue into July or August in some systems. In streams, suckers spawn over gravel riffles, whereas in lakes they spawn along shorelines. Larval suckers are found concentrated over detritus bottoms or in emergent vegetation in warm, protected stream margins. Juvenile suckers are found close to the bottom in shallow, low velocity water along stream margins. Suckers forage on algae, diatoms, and some invertebrates. Preferred temperatures are around 20 to 25˚C.

Riffle sculpin (Cottus gulosus)
Riffle sculpin are native to the Sacramento-San Joaquin river basins and are common in fast moving streams with rocky substrate and cover such as boulders or logs. They prefer water less than 25 to 26˚C. Diet generally consists of benthic invertebrates. Spawning occurs from February through April. Riffle sculpins have been identified in the stilling basin below Folsom Dam (Corps 2006b). In the Folsom Reservoir areas they are probably restricted to the flowing reaches below Folsom Dam and the uppermost reaches of Lake Natoma.

Introduced Non-Game Fishes
Threadfin shad (Dorosoma pretenense)
Threadfin shad are in the same family as herring and are native to rivers of Gulf of Mexico south to Belize. They were introduced to California as a forage fish (a fish planted as food for other more desirable fish species). Threadfin shad inhabit open waters of reservoirs and slow moving rivers and prefer warm temperatures in excess of 22 to 24˚C in the summer. Diet consists almost entirely of plant and animal plankton they filter from the water. Spawning occurs from April through August over any kind of submerged structure. Threadfin shad grow very fast but live only 1 to 2 years.

Wakasagi smelt (Hypomesus nipponensis)
Wakasagi smelt are native to Japan and were introduced to California as forage fish for trout. These small smelt school in the open waters of lakes, reservoirs, and estuaries feeding on plankton. Spawning takes place in April and May and the short life cycle generally only lasts one year. Wakasagi smelt are common in Folsom Reservoir and Lake Natoma. They were the most numerous fish found in the Folsom Dam stilling basin when it was drained several years ago.

Seasonal Aquatic Habitats and Invertebrate Species in the Folsom Reservoir Area
The species discussed in the preceding section occur in permanent waters such as Folsom Reservoir and Natoma Lake or the stilling basin. The following section

discusses aquatic invertebrates that can occur in temporary water bodies including seasonal ponds and vernal pools.

Vernal pool fairy shrimp (Branchinecta lynchi) – FT.
Vernal pool fairy shrimp are restricted to seasonal vernal pools (Eng, et al. 1990; Federal Register 1994). The vernal pool fairy shrimp prefers cool-water pools that have low to moderate dissolved solids (Eriksen and Belk 1999). This fairy shrimp is found primarily in the Central Valley and the foothills of the Sierra Nevada in northern California from 10 to 290 meters in elevation (Eng et al. 1990, Eriksen and Belk 1999, Federal Register 1994). Critical habitat has been designated for this species, but includes no land in the Folsom Reservoir area (Federal Register 2003).

Fairy shrimp are adapted for survival in water bodies that are transient and their cysts (protected eggs) can withstand long dry periods. They require cool waters early in the rainy season for hatching and are highly susceptible to contaminants. Dispersal of cysts is thought to occur by animal vectors, including grazing animals or waterfowl.

Evidence of seasonal ponding was observed in August surveys in the vicinity of Dike 2 and south of MIAD, at locations that may be included in the Folsom DS/FDR as contractor use areas. Vernal pool fairy shrimp have been observed less than one mile away from the Folsom Reservoir area (David Murth pers. obs., as cited in LSA 2003). Although the seasonal pools within the study area contain less water than is typical for this species' habitat, the close proximity of the Folsom DS/FDR area to a known occurrence provides at least a low potential for this species to occur.

California Vernal Pool Tadpole Shrimp (Lepidurus packardi) - FE.
The California vernal pool tadpole shrimp is a small crustacean found in ephemeral freshwater pools. This species inhabits vernal pools ranging in size from 5 square meters to 36 hectares. The water in the pools can be clear to turbid and often has low conductivity, total dissolved solids, and alkalinity (Federal Register 1994, Eng et al. 1990). Temperatures in pools where this tadpole shrimp have been found to vary from 3 to 23°C (Gallagher 1996). Vernal pool formations occur in grass-bottomed swales of grasslands, in old alluvial soils underlain by hardpan or in mud bottomed pools (Federal Register 1994). Pools with cobble over hardpan bottoms also serve as habitat (Gallagher 1996). Gallagher (1996) found that the depth, volume, and duration of inundation of a pool were important for the presence of this tadpole shrimp in vernal pools when compared to the needs of other branchiopods (a group of primitive and primarily fresh water crustaceans, mostly resembling shrimp). He found that this species did not reappear in ponds that dried and rehydrated during the study period, while other branchiopod species did. California vernal pool tadpole shrimp needs deeper and longer-lasting pools if they are to persist over a rainy season in which both wet and dry periods occur.

Potential habitat for the vernal pool tadpole shrimp occurs within the Folsom Reservoir area. Because this species requires pools of specific size and inundation duration, potential habitat within the Folsom Reservoir area is limited. However, this species is known to occur in small pools in the Mather Air Force Base vicinity in eastern Sacramento County, and therefore even small pools may supply adequate habitat if inundation is of sufficient duration.

3.4.2 Environmental Consequences/Environmental Impacts

3.4.2.1 Assessment Methods

Potential impacts of the Folsom DS/FDR alternatives were evaluated on a qualitative basis because 1) details regarding specific borrow site actions, internal roadway construction and placement, and types and energy dissipation of explosives were still be defined at the time of this assessment; 2) there is limited or no data available to quantify population levels of the different species within Folsom Reservoir generally, or at or near potential borrow sites (Figure 2-1), and 3) impact mechanisms are only generally described.

3.4.2.2 Significance Criteria

Impacts would be potentially significant if they would:

- Have a substantial adverse effect, either directly or through habitat modifications, on any species identified as a candidate, sensitive, or special status species in local or regional plans, policies, or regulations, or by the CDFG, NMFS, or USFWS;

- Interfere substantially with the movement of any native resident or migratory fish species;

- Conflict with the provisions of an adopted Habitat Conservation Plan, Natural Community Conservation Plan, or other approved local, regional, or state habitat conservation plan;

- Substantially change the diversity or numbers of any aquatic community or species or interfere with the survival, growth, or reproduction, of affected populations;

- Introduce new aquatic species into an area; or,

- Cause substantial deterioration or adverse alteration of existing fish habitat. “Substantial” in this context means a long-term (3 years or more) impact that can be verified by repeated measurement, or would impact habitat designated as, “Critical Habitat” by NOAA Fisheries for listed anadromous species.

Of these six significance criteria, only the first, fourth, and sixth apply. Folsom and Nimbus Dams effectively stop all fish migration and significance criterion 2 would not apply. The Folsom DS/FDR actions would not conflict with any known conservation plans, or other approved local, regional, or state habitat conservation plan. The Folsom DS/FDR actions would not be introducing new fish species and therefore, criterion 5 would not apply**.**

3.4.2.3 Environmental Consequences/Environmental Impacts

Environmental Consequence/Environmental Impacts of the No Action/No Project Alternative

There would be no impacts to aquatic resources under this alternative. Existing conditions would be maintained.

The No Action/No Project Alternative would have no effect on aquatic resources.

Environmental Consequences/Environmental Impacts of Alternative 1

Alternative 1 would have the lowest magnitude of impacts for all activities in comparison to the other alternatives (except for the 'No Action/No Project' alternative) due to the relatively smaller amount of borrow material that would be excavated from the reservoir.

Construction of Alternative 1 would not have any downstream impacts that would harm fish, or their habitat.

Alternative 1 is primarily a standalone Safety of Dams alternative, and was designed to pass the Probable Maximum Flood and address the seismic and static risks. The Main Concrete Dam would retain all of its current capabilities. If this alternative was implemented, it is anticipated that the features would only be operated once every 300 years or greater. The fuseplug and Auxiliary Spillway would only operate at a point when over 500,000 cfs was already being released downstream through the existing spillway. The fuseplug spillway in conjunction with the existing spillway could release a total discharge between 850,000 and 900,000 cfs.

All operations-related impacts would have already occurred downstream before the fuseplug would operate. All habitat within the Lower American River Parkway and the river channel itself would already be adversely impacted. Therefore, this alternative would not have significant downstream impacts to fish, or their habitat.

This alternative would not have adverse impacts to the coldwater pool, or downstream temperatures (water quality). The fuseplug would be reconstructed as soon as the event has passed. Stockpiles of the material required to rebuild the fuseplug would be available for this purpose. Timely replacement of the fuseplug would ensure that there are no adverse impacts to the coldwater pool, or downstream conditions. Construction of this alternative would not impact Critical Habitat downstream for listed species.

Downstream impacts from reservoir operations and flood releases would be less than significant for Alternative 1.

Blasting impacts for borrow excavation could harm fish.

Blasting for borrow excavation would occur along the reservoir shoreline and would affect fishes in the reservoir in close proximity (kill, injure, displace, or change the behavior of these fish). The littoral fish community around the proposed borrow areas is mostly composed of exotic warm water fishes such as largemouth bass and sunfish. The only special status species known to be present in the area of analysis is hardhead. This species is most likely to be found in the tributary arms or their upstream rivers and unlikely to be found in the main body of the reservoir. Blasting would unlikely harm any special status fish species.

Direct impacts of blasting on fishes for borrow would be temporary and less than significant; no special-status species would likely be affected.

Blasting impacts for the approach channel could harm fish.

Controlled blasting would also be necessary for the construction of the approach channel to the Auxiliary Spillway. The approach channel for Alternative 1 would be 300 to 500-ft. long, and 500-ft. wide. The last 150-ft would be concrete-lined. Material would be excavated from the lakebed mechanically until refusal. The soil would be removed mechanically with a clamshell, suction dredge, dragline, or another suitable method. Once the material cannot be removed with a clamshell, or other means, the excavation would require controlled blasting. The majority of the blasting would take place under water. The material that is excavated by blasting would be placed on a barge or floating platform, with containment in place to reduce or eliminate sedimentation. All material excavated from the reservoir would be transported to a containment area onshore, where the material can dry.

Appropriate methods would be employed to deter fish from utilizing the footprint for the approach channel prior to blasting. Once blasting has been initiated it is reasonable to assume the any fish not harmed in the first blast would vacate the general area. Since blasting would follow the removal of sediment in the footprint area, and the area would be highly disturbed, most of the fish would have left the area before any blasting takes place. Impacts to fish habitat from the construction of the approach channel would be significant, but the impacts would be temporary and would only last for the duration of construction.

Blasting impacts to fish within the footprint for the approach channel would be reduced by employing appropriate fish avoidance devices, such as a fishpulser, low frequency sound, high frequency sound, scare charges, or using a bubble curtain.

Direct impacts of blasting on fishes and habitat for the spillway approach would be temporary and less than significant; no special-status species would likely be affected.

Construction of the approach channel could have impacts to water quality.

Previous explorations by Reclamation have shown that there is a thin layer of sediment on top of weathered bedrock within the chute alignment. Reclamation and the Corps do not anticipate problems with water quality and sedimentation due to the minimal amount of sediment that would need to be removed. Construction methods would be required to comply with all water quality regulations and would be fully permitted before construction can begin. Best management practices and the employment of silt curtains, or other containment methods would reduce the impacts to less than significant. Section 3.1 provides additional water quality analysis and mitigation.

The sediments within the chute alignment are known to contain elemental mercury, as well as other metals. Of the 18 samples that were collected by Reclamation in 2006, only two reached the threshold of 0.2 mg/kg for mercury. Of all the samples analyzed for metals, no results met or exceeded any of the sediment standards, and as a result would be suitable for unconfined aquatic disposal.

Sediment containing mercury would be temporarily suspended during construction of the Auxiliary Spillway approach channel, but the amount of material that would be suspending would be minimal. Regardless, Reclamation and the Corps would be required to minimize the amount of material that is suspended in order to meet water quality standards. The majority of the material that could be suspended would drop out of suspension almost immediately. Unless releases are being made from the outlets, the majority of the rest of the material should fall out of suspension within Folsom Reservoir. Any material that stays suspended would be minor and would not represent a hazard or substantially impair water quality.

There are also several locations within the reservoir that could be enhanced for construction purposes with the placement of material excavated from the Auxiliary Spillway. Fill areas would be used for staging, stockpiling and potentially for processing materials. Fill material would be used at the Observation Point area, Beal’s Point, Folsom Point, and Dike 7.

In order to avoid or eliminate water quality impacts during the placement of material within the reservoir, best management practices would be employed. If at all possible, material would be placed in the dry. Silt curtains or other physical methods would also be employed to reduce to eliminate water quality issues during construction.

Reclamation and the Corps would use Best Management Practices for sediment and mercury in order to reduce the impacts to water quality to less than significant.

Direct impacts of blasting and excavation on water quality for the spillway approach would be temporary and less than significant; no special-status species would likely be affected.

The alternative could result in staging, construction (borrow development), and materials transport impacts.

Staging operations associated with borrow site excavation would cause an increase in local turbidity as sediment is re-suspended in the water column from blasting activity, excavation, and transport operations. The turbidity increases associated with these activities would cause behavioral and sub-lethal effects on all fish in the localized area. Turbidity increases due to transport or construction staging are likely to be localized in space and time and particles would settle out of the water column a few hours after the cessation of the disturbance. The littoral fish community around the proposed borrow areas is mostly composed of exotic warm water fishes such as largemouth bass and sunfish. The only special status species known to be present in the area of analysis is hardhead. This species is most likely to be found in the tributary arms or their upstream rivers and unlikely to be found in the main body of the reservoir. Construction would not likely harm any special status fish species.

Turbidity increases from construction staging, borrow excavation, and transport would be less than significant, temporary impacts.

The alternative could result in equipment and transport impacts to fish.

Borrow site develop to the shoreline coupled with haul roads constructed along the shore line could result in vibration effects to fish inhabiting the shoreline. The expected response of fish would be to swim away from the area of impact. No long-term health impacts would be expected.

Vibration increases along the shoreline from construction equipment and transport would be less than significant, temporary impacts.

Borrow site lighting could attract fish and increase potential for harm from construction activities.

Intense lighting along the shoreline would be needed to facilitate construction and excavation operations after sunset. Zooplankton, aquatic insects, and fish of all life stages can be attracted to intense lighting near the reservoir. Fish attracted to near-shore light sources would be more vulnerable to harm from blasting or activities such as excavation and transport. There is a low probability that special status fish species occur in the areas that would be lighted.

Indirect effects of borrow site lighting would be less than significant.

Construction activities could lead to habitat modification impacts.

Borrow areas would be excavated into the inundation zone to provide rock for construction activities. The borrow areas would be shaped and contoured so that they are gently sloped and would drain completely as the reservoir is operated. When fully contoured, the borrow sites would resemble broad depressions in the new lake bottom (Figure 3.4-1). Maximum depth of the borrow sites would be around 30 feet. Excavation of the borrow sites would increase the average depth of the littoral habitat in the inundation zone and would locally increase the bottom slope perhaps changing some of the littoral zone to deeper, cold water habitat. Currently the inundation zone consists of a mixture of weathered rock, decomposed granite and other sediment. Only one area near Folsom Point supports vegetation such as willows or cottonwoods. Excavation of the borrow areas would change the substrate of these areas to newly exposed rock. Newly exposed rock substrate is likely to provide less cover for fish and would likely support a reduced assemblage of benthic fauna. Over time, the bare rock substrate of the excavated borrow sites would weather and become more like the pre-disturbed substrate, and vegetation may become reestablished. Eventually the excavated and contoured inundation zone would closely resemble its current state. Benthic substrate changes could cause localized changes in fish and invertebrate species composition. It is unlikely that an overall change in the reservoir fisheries would be detectable.

The changes in benthic substrate and cover resulting from borrow pit excavation would be less than significant, long-term impacts.

Excavation of borrow sites would impact reservoir bathymetry[3].

Excavation of the borrow sites would reduce local bed elevation by as much as 30 ft. This change in topography would change the relative abundance of habitat types

[3] Bathymetry is the measurement of the depth of the water body floor from the water surface; the equivalent of topography, or an underwater elevation model.

available at various reservoir levels. At the high water levels occurring during the spring and early summer, much of the inundation zone is submerged shallow water habitat within the warmer epilimnion. A 30-ft reduction in the bed elevation could result in these areas becoming part of the deeper, cooler water habitat below the epilimnion when the reservoir level is high. Deeper benthic habitat is associated with reduced numbers of warm-water fish and benthic invertebrates in some reservoirs (Keast & Harker 1977), although it can also mean improved habitat suitability for cold water fish such as trout. Any change in benthic habitat as a result of borrow excavation would only be relevant for part of the year since the water level within the reservoir varies so widely. Habitat changes could cause changes in fish species composition within localized areas. It is unlikely that an overall change in the reservoir fisheries would be detectable.

The change in bathymetry of the inundation zone resulting from borrow pit excavation would be a less than significant, long-term impact.

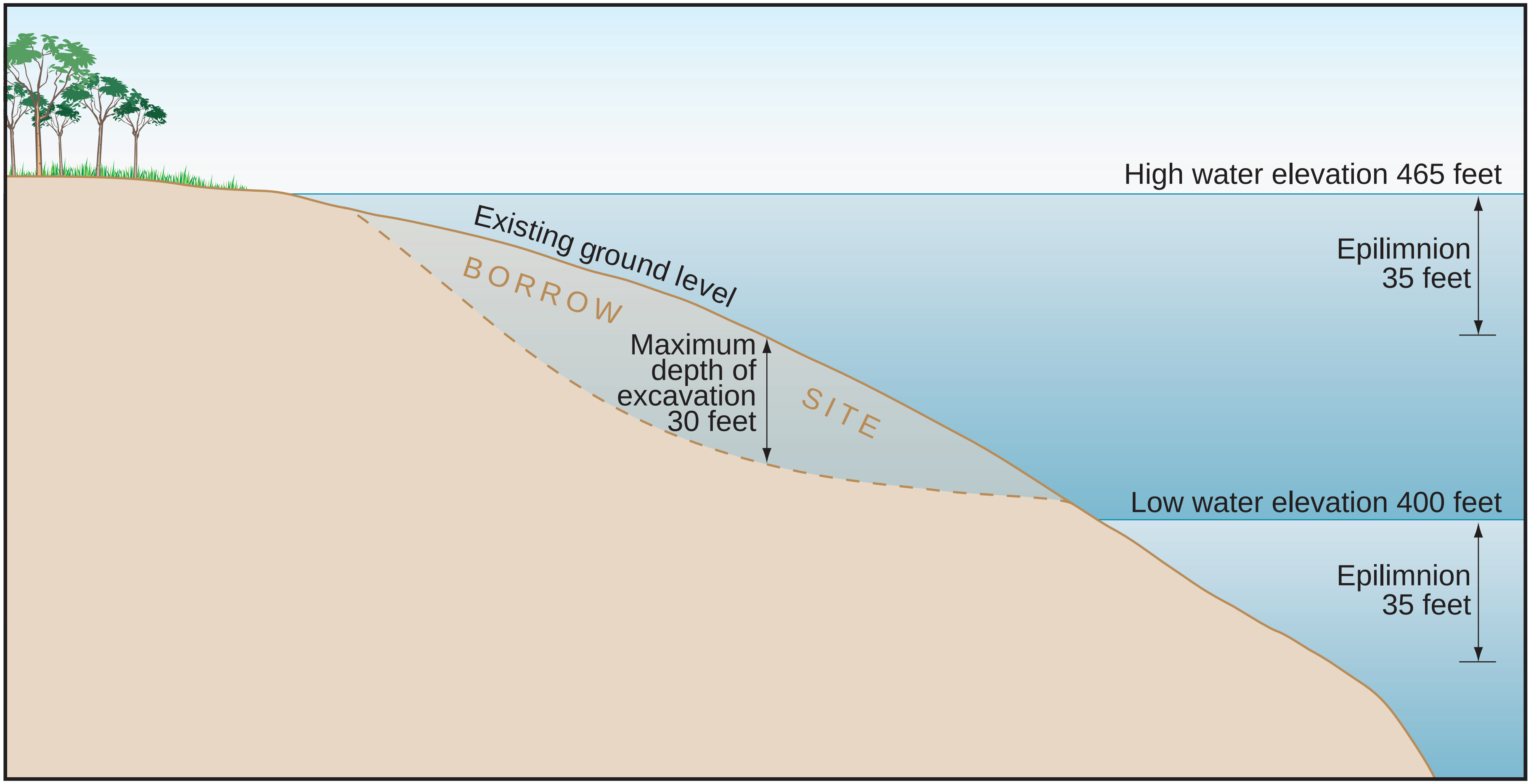

Figure 3.4-1

Cross Section of an Idealized Borrow Site Located in the Innundation Zone of Folsom Reservoir Showing High and Low Water Levels and the Location of the Summer Thermocline

CDM

Construction activities may result in alteration of habitat for protected vernal pool invertebrates or direct impacts to these species.

Seasonal ponds that could provide limited habitat for the vernal pool fairy shrimp or California vernal pool tadpole shrimp were observed at proposed construction use areas near Dike 2 and east of MIAD. Activities associated with this type of use include road access, movement of vehicles and other construction equipment, presence of workers in the area, and possibly short-term storage of construction supplies and materials. These activities and the associated uses of the area may directly impact the seasonally ponded area by physical disturbance, erosion and deposition of materials on the surface, and discharge of toxic substances from machinery. Impacts to these ponds could result in significant adverse effects if the ponds were occupied by either of these species.

This impact would be potentially significant. Mitigation Measures AQINV-1a through AQINV1c would reduce this impact to a less than significant level.

Jet Grouting at MIAD could adversely alter the water level or chemistry within downstream wetlands.

The injection of grout into the subsurface at MIAD could adversely affect downstream wetlands through either a water chemistry change (grout has low pH and soluble compounds) or water level change. This could adversely affect wetlands ecological health or reduce water levels. Jet grout could re-emerge near or within the wetlands, also adversely affecting water quality.

This impact would be potentially significant but mitigable. Mitigation Measures HWQ-4 through HWQ-8 described in Section 3.1.4 Hydrology, Water Quality and Groundwater, would reduce this impact to a less than significant level.

Environmental Consequences/Environmental Impacts of Alternative 2

Alternative 2 would involve greater borrow activities and the impacts would be slightly greater in area and in duration relative to Alternative 1. Impacts from excavation and construction of the Auxiliary Spillway approach channel are the same as Alternative 1. The impacts of Alternative 1 to fisheries would still be considered less than significant. Effects to vernal pool species would be similar. Alternative 2 would have the potential for increasing the reservoir pool elevation above normal operations during emergency floodwater retention events. This effect is introduced below. Dewatering of MIAD to facilitate excavation and replacement of the downstream foundation could reduce water levels in downstream wetlands. Alternative 2 would have similar potential effects to vernal pool species as Alternative 1.

Construction of Alternative 2 would not have any downstream impacts that would harm fish, or their habitat.

Alternative 2 is a Flood Damage Reduction alternative, and was designed to pass the Probable Maximum Flood. Under this alternative, it is anticipated that the features would be operated infrequently to pass the design flood. The principle features of Alternative 2 would be a fuseplug Auxiliary Spillway with an underlying tunnel, and a raise of up to 4 feet.

The fuseplug spillway features of this alternative would only operate at a point when over 500,000 cfs was already being released downstream as described in Alternative 1. The tunnel would provide a substantially lower level of discharge capacity, allowing for the initiation of earlier releases, and maintaining flows at 160,000 cfs or below for duration's equivalent to the 1 in 200 year event.

All operations-related impacts would have already occurred downstream before the fuseplug would operate. All habitat within the Lower American River Parkway and the river channel itself would already be adversely impacted. Therefore, this alternative would not have significant downstream impacts to fish, or their habitat.

Alternative 2 would not have adverse impacts to the coldwater pool, or downstream temperatures (water quality). The fuseplug would be reconstructed as soon as feasible once the event has passed. Stockpiles of the material required to rebuild the fuseplug would be available for this purpose. Timely replacement of the fuseplug would ensure no adverse impacts to the coldwater pool, or downstream conditions.

Construction and utilization of the features in Alternative 2 would not substantially alter current Folsom Reservoir operations and, in general, would decrease downstream hydraulic impacts during a severe storm event. Construction of this alternative would not impact Critical Habitat downstream for listed species.

Downstream impacts from reservoir operations and flood releases for Alternative 2 would be less than significant.

Direct or indirect impacts to protected vernal pool invertebrates or their habitat may occur due to temporary or permanent alteration of habitat by a large hydrologic event.

Under the Folsom DS/FDR, Reclamation would utilize the temporary increase in reservoir capacity afforded by the dam raise during extreme flood events to safely release water through the concrete dam into the American River. Seasonal pools located at or below the maximum capacity after the dam raise may be subject to inundation during extreme flood events. Inundation of these pools could alter habitat conditions and introduce invasive predators such as fish into naturally fish-less systems. Inundation may also cause geomorphic alterations to such pools through sedimentation or erosion. Such occurrences could result in direct impacts to individuals and adverse effects to the habitat of this species.

This impact would be potentially significant but mitigable. Mitigation Measure AQINV-2 would reduce this impact to a less than significant level.

Excavation and replacement of the MIAD foundation could adversely alter the water level or chemistry within downstream wetlands.

Dewatering of the toe of MIAD to facilitate replacement of its foundation could adversely affect downstream wetlands through either a water chemistry change or water level change. This could adversely affect wetlands ecological health or reduce water levels.

This impact would be potentially significant but mitigable. Mitigation Measure HWQ-10 described in Section 3.1.4 Hydrology, Water Quality and Groundwater, would reduce this impact to a less than significant level.

Environmental Consequence/Environmental Impacts of Alternative 3

This alternative would involve the same impacts as Alternative 1, including underwater blasting and dredging for construction of the JFP Auxiliary Spillway. Because Alternative 3 would increase the amount of spillway site excavation compared to Alternative 1, the impacts would be slightly greater in area and in duration of construction relative to Alternative 1. Alternative 3 would have an additional impact related to the extension of the stilling basin downstream of Folsom Dam. Impacts to vernal pool species would be the same and would require mitigation. Impacts at MIAD would be the same as Alternative 1. The impacts to aquatic resources would still be considered less than significant with mitigation as appropriate.

Construction of Alternative 3 would not have any downstream impacts that would harm fish, or their habitat.

Under Alternative 3, Folsom Dam would have four methods of discharging flows from the reservoir: three power penstocks, eight flood control outlets (four upper tier and four lower tier, all 5 ft x 9 ft), tainter/radial spillway gates set near the main spillway crest (five service and three emergency), and six submerged tainter gates in the proposed Auxiliary Spillway. In general, utilization of the features described in Alternative 3 would involve greater releases earlier in a major hydrologic event that closely match downstream channel capacity.

The JFP Auxiliary Spillway would allow the objective release of 115,000 cfs to be achieved sooner in a flood event, and would lessen peak flows fore large, infrequent hydrologic events. A maximum flood release of 160,000 cfs, which is the emergency downstream channel capacity, would be made through the Auxiliary Spillway when necessary based on observed and anticipated reservoir inflows. Emergency releases of 160,000 cfs or above would not be made any sooner with the JFP Auxiliary Spillway features completed than under existing condition.

Variations in releases utilizing the Folsom DS/FDR features would not be any larger than those allowed under existing conditions. Under this alternative, the same amount of water would ultimately be released with and without implementation of this alternative (due to operational constraints), but operators would have the ability to release more water sooner in a hydrologic event. Features of this alternative would be operated under existing operating criteria, therefore, the implementation of Alternative 3 would not have adverse impacts to fish or their habitat. Construction of this alternative would not impact Critical Habitat downstream for listed species.

Downstream impacts from reservoir operations and flood releases for Alternative 3 would be less than significant.

Underwater construction activities for the JFP Spillway may result in localized impacts to reservoir fishes.

Fishes in the JFP spillway construction area would be exposed to the effects of underwater blasting and dredging. Underwater blasting would kill, injure, or alter the behavior of fishes in the construction area. Fish not killed outright from the concussion may be injured and eventually die or become prey for other fish and birds. Dredging would create additional disturbance, increase local turbidity and underwater noise as the blasted rubble is removed. The additional effects of dredging on the fish population would be minimal if dredging occurs within hours to days after blasting. Construction of the JFP spillway would displace some of the habitat that is presently used by fish in the reservoir.

The impacts to water quality would be slightly greater for this alternative than Alternatives 1 and 2, due to the length of the approach. The base of the approach channel would vary in width from about 330 feet (at the upstream end) to 168 feet wide (just upstream of gate structure), and would be about 900-ft long.

The disturbance from blasting and dredging would be a less than significant, short-term impact. The loss of habitat from the reservoir would be a less than significant long-term impact.

Dewatering the Stilling Basin would displace and potentially harm fish.

The Stilling Basin must be dewatered while extension work is being performed. Because there is no fish stocking program for the Stilling Basin, the fish (primary non-native and exotics) inhabiting the facility most likely were transported through the Folsom Dam river outlets. Dewatering of the stilling basin could result in the harm or death of some native fish, such as riffle sculpin, that are known to occur there (Corps 2006b). However, special status species are unlikely to be present as there is no mechanism for them to be present. Because it would not be possible to remove all fish prior to dewatering, some fish loss would be expected. A fish recovery plan would be implemented to minimize this impact (see Mitigation Measure Fish-1).

The impact of dewatering of stilling basin for extension work would be less than significant for special status fish species.

Environmental Consequences/Environmental Impacts of Alternative 4

This alternative would involve the same construction impacts as Alternative 2 and Stilling Basin impacts as Alternative 3. However, because Alternative 4 would increase the amount of borrow excavation compared to Alternative 2, the impacts would be slightly greater in area and in duration of construction relative to Alternative 3. Impacts to fish populations would still be considered less than significant with appropriate mitigation. Impacts to vernal pool species would be the same and would require mitigation.

Construction of Alternative4 would have no downstream impacts that would harm fish, or their habitat.

Alternative 4 would provide Folsom Dam with the same four methods of discharging water as Alternative 3. In general, utilization of the features described in Alternative 4 would involve greater releases earlier in a major hydrologic event that closely match downstream channel capacity. The new Auxiliary Spillway would allow the objective release of 115,000 cfs to be achieved sooner in a flood event, and would lessen peak flows fore large, infrequent hydrologic events. A maximum flood release of 160,000 cfs, which is the emergency downstream channel capacity, would be made through the new Auxiliary Spillway when necessary based on observed and anticipated reservoir inflows.

Emergency releases of 160,000 cfs or above would not be made any sooner with the Folsom DS/FDR features than under existing conditions. Variations in releases utilizing Folsom DS/FDR features would not be any larger than those allowed under the existing conditions. Under this scenario, the same amount of water would ultimately be released with and without the Folsom DS/FDR features (due to operational constraints), but operators would have the ability to release more water sooner in a hydrologic event. The features would be operated under existing operating criteria, therefore, there would be no adverse impacts to fish or their habitat due to the implementation of Alternative 4. Construction of this alternative would not impact Critical Habitat downstream for listed species.

Downstream impacts from reservoir operations and flood releases for Alternative 4 would be less than significant.

Environmental Consequences/Environmental Impacts of Alternative 5

This alternative would have substantially greater impacts than Alternative 4 due to the need to fully develop all in-reservoir borrow sites. Because a new Auxiliary Spillway would not be constructed, there would be no borrow material coming from that site. The impacts would be greater in the area within and along the shoreline and in duration of construction relative to Alternative 4, but would still be considered less than significant with appropriate mitigation. Vernal pool and MIAD impacts would be the same as for Alternative 4.

Construction of Alternative 5 would not have any downstream impacts that would harm fish, or their habitat.

The 17-ft raise would be designed to contain a large storm event and pass it without overtopping the downstream levees. Variations in releases utilizing Folsom DS/FDR features would not be any larger than those allowed under existing conditions. In addition, the top of the flood control pool would be raised to increase the flood storage space. Alternative 5 would allow the reservoir to hold more flood water and would allow a substantially larger timeframe for the evacuation of downstream communities.

Downstream impacts would remain the same as the No Action/No Project Alternative. The implementation of Alternative 5 would not have adverse downstream impacts to fish or their habitat. Releases would be made according to the Interim Flood Control Diagram. Construction of this alternative would not impact Critical Habitat downstream for listed species.

Downstream impacts from reservoir operations and flood releases for Alternative 5 would be less than significant.

3.4.3 Comparative Analysis of Alternatives

The No Action/No Project Alternative would have no impact on fisheries resources. The action alternatives described above would all have several identifiable impacts, but all would be considered “less than significant”, except for vernal pool habitat and potential impacts to MIAD wetlands. Therefore, the differences between the overall impacts of the Folsom DS/FDR alternatives have to do with the relative magnitude of the “less than significant” adverse impacts. These adverse impacts are provided in Table 3.4-1 with the provision that impacts associated with borrow site excavation would tend to increase between Alternative 1 and 5 as borrow volumes increase. Prior to applying mitigation measures, there would be significant impacts to vernal pool habitats and species. However, with mitigation, these impacts would be reduced to less than significant under all alternatives.

Table 3.4-1 ***Comparison of Folsom Dam Raise Impacts for Fisheries and Vernal Pool Species (relative level of impacts increase from Alt 1 to Alt 5)***						
Affected Resource and Area of Potential Impact	***Alternative***					
	No Action Compared to Existing Conditions	***1***	***2***	***3***	***4***	***5***
Impact						
1. Blasting	N	LS, A	LS, A	LS, A	LS, A	LS, A
2. Turbidity	N	LS, A	LS, A	LS, A	LS, A	LS, A
3. Vibration	N	LS, A	LS, A	LS, A	LS, A	LS, A
4. Lighting	N	LS, A	LS, A	LS, A	LS, A	LS, A
5. Substrate Change at Borrow Sites	N	LS, A	LS, A	LS, A	LS, A	LS, A
6. Depth Change at Borrow Sites	N	LS, A	LS, A	LS, A	LS, A	LS, A
7. Fuseplug Spillway	N	LS, A	LS, A	N	N	N
8. JFP Spillway	N	N	N	LS, A	LA, A	N
9. Dewatering Stilling Basin	N	N	N	LS, A	LS, A	LS, A
10. Direct or indirect impacts to protected vernal pool invertebrates or their habitat due to temporary or permanent alteration of habitat by construction activities.	N	SM, A	SM, A	SM, A	SM, A	SM, A
11. Direct or indirect impacts protected vernal pool invertebrates or their habitat due to temporary flooding of habitat by a large hydrologic event.	N	N	SM, A	SM, A	SM, A	SM, A
12. Direct or indirect impacts to MIAD wetlands due to release of jet grout mixture into emergent groundwater	N	SM, A	N	SM, A	SM, A	N
13. Direct or indirect impacts to MIAD wetlands due to dewatering of groundwater to facilitate foundation replacement.	N	N	SM, A	N	N	SM, A

Key:
SU = Significant and Unavoidable Impact (CEQA)
SM = Significant but mitigable Impact (CEQA)
LS, A = Less than Significant Impact (CEQA)
N = No Impact (CEQA, NEPA)
B = Beneficial Impact (NEPA)
A = Adverse Impact (NEPA)

3.4.4 Mitigation Measures

Implementation of Mitigation Measures AQINV-1a, AQINV-1b, and AQINV-1c, would reduce impacts to aquatic resources to a less than significant level.

AQINV-1a: Protocol surveys for special-status branchiopods will be completed prior to any grading or other construction activities in potential habitat for these species.

*AQINV-1b***:** Potential vernal pool habitat will be avoided (preserved) by placing fencing and a suitable buffer area around the vernal pool area to prevent effects from vehicles and other construction-related activities. For vernal pool habitat that is to be avoided, an approved biologist (monitor) will inspect construction-related activities to ensure that no unnecessary take or destruction of habitat occurs. The biologist will contact the construction representative who has the authority to stop activities that may result in such take or destruction until corrective measures have been taken. The biologist will also be required to report immediately any unauthorized effects to Reclamation or the Corps, and to the USFWS and CDFG.

*AQINV-1c***:** On-site construction personnel will receive instruction (from Reclamation, Corps, or trained representative) regarding the potential presence of listed species and the importance of avoiding impacts.

*AQINV-1d***:** Adverse impacts to potential vernal pool habitat in the Folsom DS/FDR footprint will be compensated in a manner agreed upon by the responsible Federal agency and the USFWS. For example, for habitat that is directly or indirectly affected, vernal pool credits will be dedicated within a USFWS-approved ecosystem preservation bank. Based on a USFWS evaluation of conservation values of the affected habitat, vernal pool habitat will be preserved, or created and monitored, on the Folsom DS/FDR site, or on another non-bank site approved by the USFWS. Vernal pool habitat and associated upland habitat used as on-site mitigation will be protected from adverse effects and managed in perpetuity or until the responsible Federal agency and USFWS agree on a process to exchange such areas for credits within a USFWS-approved mitigation banking system.

*AQINV-1e***:** Effects caused by emergency retention of floodwaters will be minimized by conducting baseline surveys below the maximum potential surface elevation. Protocol surveys for vernal pool fairy shrimp and California vernal pool tadpole shrimp will be conducted by a USFWS-approved biologist at seasonal pools capable of supporting these vernal pool species.

- If these vernal pool species are not found, no additional minimization measures will be required.
- If vernal pool fairy shrimp and/or California vernal pool tadpole shrimp are found, sites supporting populations will be recorded.
- Following a large hydrologic event that temporarily increases Folsom reservoir surface elevation above the normal operations maximum, affected pools supporting vernal pool fairy shrimp and/or vernal pool tadpole shrimp

populations will be again surveyed by an approved biologist for presence/absence, and the responsible Federal agency will re-initiated consultation with the USFWS if necessary or appropriate.

AQINV-2: In the event of emergency operations, supplemental environmental compliance will be completed. It is anticipated that surveys would be completed after the event. Based on the results of these surveys, formal Section 7 consultation would be reinitiated by the responsible federal agency.

*FISH-1***:** A fish removal plan will be developed prior to dewatering of the existing Stilling Basin and implemented at the time of dewatering.

3.4.5 Cumulative Effects

The following analysis evaluates the impacts of the Folsom DS/FDR actions when considered together with related past, present, and reasonably foreseeable projects. Of the cumulative projects described in Chapter 5, only the Folsom Bridge Project is relevant to the evaluation presented herein. All of the other projects are located away from the Reservoir and, therefore, would not contribute to impacts to aquatic resources.

The Folsom Bridge Project is expected to result in limited impacts to fishery resources, in part in areas also potentially affected by the Folsom DS/FDR actions. Therefore, the cumulative effects of the Folsom Bridge Project and the Folsom DS/FDR actions would not be cumulatively considerable for fishery resources in general.

The DEIS/EIR for the Folsom Bridge Project (Corps 2006b) found there would be no adverse effects to the vernal pool fairy shrimp, or the California vernal pool tadpole shrimp from any of the alternatives evaluated for that project because "…no suitable habitat for special-status reptiles, amphibians, or invertebrates was noted during the wetland delineation for the proposed project".

Therefore, the effects of this project in combination with the Folsom DS/FDR actions would not be cumulatively considerable for fisheries resources or aquatic invertebrates in general or for special-status invertebrates.