Volume I:
Draft Environmental Impact Report/ Environmental Impact Statement

Freeport Regional Water Project

State Clearinghouse No. 2002032132

July 2003

U.S. Department of the Interior
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REGIONAL WATER AUTHORITY

Sacramento County Water Agency
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DRAFT

Environmental Impact Report/Environmental Impact Statement

Freeport Regional Water Project
being jointly pursued by the U.S. Department of Interior, Bureau of Reclamation,
and the Freeport Regional Water Authority

The U.S. Department of Interior, Bureau of Reclamation (Reclamation) and the Freeport Regional Water Authority (FRWA) have prepared this joint environmental impact report/environmental impact statement (EIR/EIS) on the proposed Freeport Regional Water Project to construct and operate a water supply project to meet regional water supply needs. FRWA, a joint powers agency formed under state law by the Sacramento County Water Agency (SCWA) and the East Bay Municipal Utility District (EBMUD), is the state lead agency, and Reclamation is the federal lead agency for this EIR/EIS, pursuant to the California Environmental Quality Act and the National Environmental Policy Act, respectively.

FRWA's member agencies, SCWA and EBMUD, currently hold contracts with Reclamation allowing them to divert at the location identified as Freeport on the Sacramento River south of downtown Sacramento. FRWA=s project objectives are to support acquisition of additional SCWA surface water entitlements to promote efficient conjunctive use of groundwater in its Zone 40 area, consistent with the Sacramento Area Water Forum Agreement and County of Sacramento General Plan policies; provide facilities through which SCWA can deliver existing and anticipated surface water entitlements to Zone 40 area; provide facilities through which EBMUD can take delivery of a supplemental supply of water that would substantially meet its need for water and reduce existing and future customer deficiencies during droughts; and improve EBMUD system reliability and operational flexibility during droughts, catastrophic events, and scheduled major maintenance at Pardee Dam or Reservoir. In addition to the No Action alternative, five primary alternatives are under consideration.

Alternatives 2–5 represent a water supply project with a design capacity of 185 MGD. These alternatives differ from one another in that the pipelines have different alignments under each alternative. Up to 85 MGD would be diverted under Sacramento County's existing Reclamation water service contract and other anticipated water entitlements and up to 100 MGD of water would be diverted under EBMUD's amended Reclamation water service contract. The primary components of Alternatives 2–5 are an intake facility on the Sacramento River near Freeport, the Zone 40 Surface Water Treatment Plant located in central Sacramento County, a terminal facility at the point of delivery to the Folsom South Canal, a canal pumping plant at the terminus of the Folsom South Canal, an aqueduct pumping plant and pretreatment facility near Camanche Reservoir, and a series of pipelines carrying water from the intake facility to the Zone 40 Surface Water Treatment Plant and to the Mokelumne Aqueducts. The existing Folsom South Canal is part of the water conveyance system.

Under Alternative 6, SCWA water needs would be met by conveying water from the Sacramento River, and EBMUD water needs would be met by enlarging its Pardee Reservoir water storage facility on the Mokelumne River. The primary components of Alternative 6 are the Freeport intake facility; the Zone 40 Surface Water Treatment Plant; and pipeline connecting the two; and an enlarged Pardee Reservoir, which includes replacement of the concrete dam and spillway, powerhouse, and saddle dams; modifications to the intake tower and Pardee Tunnel; a new pressure reduction facility; relocation of roads and bridges; removal of the Middle Bar Bridge and construction of fishing piers; relocation of utilities; and replacement of the Pardee Reservoir recreation areas.

This EIR/EIS describes the environmental effects of taking delivery of water under SCWA's and EBMUD=s existing and anticipated contracts/entitlements from the Sacramento River near Freeport. Emphasis is directed toward potential effects related to Sacramento River fisheries, endangered species, CVP water users, pipeline construction, and biological resources. The EIR/EIS also fulfills the requirements of Executive Order 11988 (Floodplain Management), 11990 (Protection of Wetlands), and 12898 (Environmental Justice).

For further information on this EIR/EIS, contact Mr. Eric Mische, General Manager, FRWA, 1510 J Street, #140, Sacramento, CA 95814, telephone (916) 326-5480, or Mr. Rob Schroeder, Contract Specialist, U.S. Department of Interior, Bureau of Reclamation, Central California Area Office, 7794 Folsom Dam Road, Folsom, CA 95630, telephone (916) 989-7274.

Comments on the EIR/EIS must be provided by October 7, 2003.

Summary

Introduction

The Freeport Regional Water Authority (FRWA) was created by exercise of a joint powers agreement between the Sacramento County Water Agency (SCWA) and the East Bay Municipal Utility District (EBMUD). FRWA's basic project purpose is to increase water service reliability for customers, reduce rationing during droughts, and facilitate conjunctive use of surface water and groundwater supplies in central Sacramento County. FRWA is proposing the Freeport Regional Water Project (FRWP) to meet this basic project purpose and others summarized under Project Purpose/Objectives and Need below.

FRWA Member Agencies

Sacramento County Water Agency

SCWA provides water to areas in central Sacramento County. SCWA is responsible for providing water supplies and facilities throughout these areas, including the Laguna, Vineyard, Elk Grove, and Mather Field communities, through a capital funding zone known as *Zone 40*.

The long-term master plan for Zone 40 envisions meeting present and future water needs through a program of conjunctive use of groundwater and surface water. SCWA presently has a Central Valley Project (CVP) entitlement of 22,000 acre-feet (af) through the Bureau of Reclamation (Reclamation). SCWA has subcontracted 7,000 af of this entitlement to the City of Folsom. CVP water for SCWA is currently delivered through the City of Sacramento's intake and treatment facilities based on SCWA need and available City capacity. SCWA's CVP contract also allows it to divert at the location identified as *Freeport* on the Sacramento River south of downtown Sacramento. SCWA expects to be able to provide additional anticipated surface water entitlements to serve Zone 40 demands, including an assignment of a portion of SMUD's existing CVP water supply contract, potential appropriative water rights on the American and Sacramento Rivers, and potential transfers of water from areas within Sacramento Valley. Total long-term average Zone 40 water demand is estimated to be 109,500 acre-feet per year (AFA). Long-term average surface water use is expected to be 68,500 AFA.

East Bay Municipal Utility District

EBMUD is a multipurpose regional agency that provides water to more than 1.3 million municipal and industrial customers in portions of Contra Costa and Alameda Counties in the region east of San Francisco Bay (East Bay). EBMUD obtains most of its supply from Pardee Reservoir on the Mokelumne River, with the remainder collected from local runoff in East Bay terminal reservoirs. On July 26, 2001, EBMUD and Reclamation entered into an amendatory CVP contract that sets forth three potential diversion locations to allow EBMUD to receive its CVP supply. One of these locations is Freeport. EBMUD's CVP supply is 133,000 af in any 1 year, not to exceed 165,000 af in any consecutive 3-year period of drought when EBMUD total system storage is forecast to be less than 500,000 af. Subject to certain limitations, the contract also provides for a delivery location on the lower American River, and EBMUD retains the opportunity to take delivery of water at the Folsom South Canal should other alternatives prove infeasible. Additional environmental review is required prior to diversion under the contract.

City of Sacramento

The City of Sacramento has joined FRWA as an Associate Member. The City's main interests lie in the design and construction of FRWA project facilities that may be located in the City or on various City properties or rights-of-way. A City representative sits on the FRWA Board of Directors as a nonvoting member.

Project Purpose/Objectives and Need

The FRWP is intended to contribute to meeting the objectives of SCWA and EBMUD. The primary purposes, objectives, and needs of the project are as follows.

Needs

- SCWA and Sacramento County have concluded that reliance solely on groundwater to serve development authorized in Sacramento County's General Plan will deplete the central county groundwater aquifer, resulting in shallow wells drying up, degradation of groundwater quality, increased pumping costs, land subsidence, and potential changes to local floodplains, and that the provision of surface water is necessary to meet the anticipated demand;
- EBMUD forecasts water shortages during drought periods, based on maintenance of existing Mokelumne River basin supply, or catastrophic

events exacerbated by increased flows for senior water right holders, resource protection, and increasing population.

Purposes/Objectives

- support acquisition of additional SCWA surface water entitlements to promote efficient conjunctive use of groundwater in its Zone 40 area, consistent with the Sacramento Area Water Forum Agreement and County of Sacramento General Plan policies;
- provide facilities through which SCWA can deliver existing and anticipated surface water entitlements to Zone 40 area;
- provide facilities through which EBMUD can take delivery of a supplemental supply of water that would substantially meet its need for water and reduce existing and future customer deficiencies during droughts; and
- improve EBMUD system reliability and operational flexibility during droughts, catastrophic events, and scheduled major maintenance at Pardee Dam or Reservoir.

Background

Sacramento County Water Agency

SCWA was formed in 1952 by a special legislative act of the State of California. Among SCWA's purposes are:

- to make water available for any beneficial use of lands and inhabitants, and
- to produce, store, transmit, and distribute groundwater.

SCWA is governed by the Sacramento County Board of Supervisors, acting as the SCWA's Board of Directors. SCWA is legally authorized to purchase, sell, or acquire water, including acquiring water through contract with either the federal government or the State of California. SCWA also may construct and operate facilities.

In 1985, the SCWA Act was amended by the California Legislature, granting SCWA the authority to establish groundwater management zones for the purpose of distributing surface water to replenish the groundwater basin and to stabilize groundwater levels. The SCWA Act allows for collecting fees from the beneficiaries of these activities. A groundwater management zone is authorized to be formed in any area that would benefit from the importation and distribution of surface water for municipal and industrial uses.

Zone 40 was formed in May 1985, by SCWA Resolution No. 663, for the purpose of constructing facilities for the production, conservation, transmittal, distribution, and sale of surface water and groundwater for conjunctive use in the Zone 40 area. In 1987, SCWA adopted a Zone 40 Water Supply Master Plan, a long-term plan for meeting future water needs in the newly developing Laguna and Vineyard areas, which historically have depended on groundwater. The plan was updated in 1995. On March 23, 1999, SCWA expanded the Zone 40 boundaries to the extent they exist today, as shown in Figure 1-1. SCWA is preparing an update of the Water Supply Master Plan based on these new boundaries; it was published in draft form in December 2002.

Historical groundwater use in Zone 40 was composed of agricultural, rural, and municipal pumping. Long-term reliance on groundwater has formed a groundwater cone of depression, known as the *Elk Grove cone of depression*, within Zone 40. Groundwater in this central Sacramento basin moves toward the center of the cone of depression, and groundwater extracted from the basin contributes to further declines at the cone of depression.

Management of the central groundwater basin is being considered under a successor process to the Sacramento Area Water Forum Agreement known as the Groundwater Forum. SCWA is a major sponsor and stakeholder in this broadly shared process.

In 1993, Sacramento County approved a general plan that changed the land use designation of large areas of central Sacramento County from agricultural uses to residential, commercial, and industrial uses. As a result, on March 23, 1999, SCWA expanded the boundary of Zone 40 as discussed above. The expanded boundary includes the urban policy area of the County's general plan and areas studied in previous master planning efforts. Recently, a combination of wet weather and the transition of land from agricultural uses to urban development has contributed to the stabilization of groundwater elevations in the central county groundwater basin. However, if buildout of the Sacramento County General Plan relied solely on groundwater, groundwater levels would decline an additional 160 feet, causing shallow wells to dry up, groundwater quality to become degraded, pumping costs to increase, land to subside, and local floodplains potentially to change. To avoid adversely affecting groundwater, it is necessary to use surface water supplies in conjunction with available groundwater supplies to meet the projected buildout demands in Zone 40.

East Bay Municipal Utility District

EBMUD needs a supplemental water supply both to avoid water shortages during drought periods and to provide a supply during times when the Mokelumne River Basin supply is not available. Each of these scenarios is described below.

Need during Drought Periods

When the original EBMUD system was planned in the early 1920s, the utility acquired rights to 200 million gallons per day (MGD) of water from the Mokelumne River. Pardee Dam was built to store that water during high river flows from spring snowmelt and rains. After World War II, the East Bay population grew rapidly, and EBMUD was granted water rights for another 125 MGD of Mokelumne River water. By the early 1960s, EBMUD planners were predicting more shortages as growth continued in the East Bay.

In 1964, completion of Camanche Reservoir below Pardee Reservoir provided some relief by giving EBMUD more ways to regulate Mokelumne River flows. Camanche's 417,000-af capacity is used to meet agricultural and fishery needs on the lower Mokelumne River, provide flood control, and allow EBMUD to hold a larger supply of high-quality water in Pardee Reservoir. Briones Reservoir, north of Orinda, was also completed in 1964 and provides another 60,000 af of backup water supplies in the East Bay.

Since 1964, no new water supply or storage has been added to the EBMUD system, and the population in the EBMUD service area has grown by nearly 250,000 people. Despite successful water conservation and reclamation programs, EBMUD's Mokelumne River supply is no longer sufficient to provide reliable water supplies during a drought without resulting in substantial hardship and economic impacts on its customers. Because EBMUD already has undertaken extensive conservation measures, it is more difficult to achieve additional water savings during droughts.

At the same time, demands on the Mokelumne River have increased. In 1996, EBMUD, in consultation with state and federal resource agencies, agreed to increase releases from Camanche Reservoir to provide higher flows for fish in the lower Mokelumne River and to contribute 20% (up to 20,000 af) of any actual yield from new water projects to Mokelumne River fishery flows.

The needs of new residential, business, and industrial customers within the EBMUD service area would be almost entirely offset in normal years by existing and planned conservation and water reclamation projects. However, over the next 20 years increased flows for senior water right holders and for resource protection in the Mokelumne River and the San Francisco Bay/Sacramento–San Joaquin River Delta (Delta) will reduce the available supply of water for the EBMUD service area.

Besides obtaining more water, it is EBMUD's policy to maintain a high-quality water source to meet customer expectations and best protect public health. Like other agencies throughout the state and nation, EBMUD must meet increasingly stringent drinking water standards set by U.S Environmental Protection Agency (EPA) and the California Department of Health Services. General agreement exists among water users and the regulatory community that the highest quality water source provides the safest end product for municipal consumers.

California drinking water quality laws and regulations set a tougher standard than federal law.

Need during Mokelumne Supply Outages

EBMUD needs a supplemental water supply not only to reduce deficiencies during a drought, but also as an alternative supply in case of a catastrophic event or major maintenance at Pardee Dam or Reservoir. Currently, EBMUD is dependent on the Mokelumne River system to meet almost all of its customer needs. If Pardee Dam or Reservoir is damaged by a natural disaster or through other means, or if major scheduled repair or maintenance is required, most of EBMUD's water supply could be temporarily interrupted. EBMUD would be required to obtain its full needed supply from the terminal storage reservoirs in its service area. The amount of water available in these reservoirs is limited (only 138,000 af).

Under current conditions, if the terminal reservoirs could not meet customer demand until the Pardee delivery facilities resumed operation, no other source of water would be available to EBMUD; its customers could experience severe shortages in supply. Use of terminal reservoir supplies also could substantially reduce the water supply available for use during subsequent dry seasons. Provision of a supplemental water supply that is not dependent on operation of Pardee facilities would reduce the risk of diminished supplies during emergencies or other facility shutdowns.

Public and Agency Involvement

Public involvement in the FRWP has been significant. FRWA and Reclamation have made substantial efforts to solicit public input on the project through public hearings, public workshops, small group meetings, and scoping meetings. Since initiation of the project, FRWA has continually updated the public on the progress of the project by conducting small group meetings and publishing fact sheets.

In March 2002, FRWA and Reclamation issued an notice of preparation of an EIR and a notice of intent to prepare an EIS for the FRWP informing agencies and the general public that a joint EIR/EIS was being prepared and inviting specific comments on the scope and content of the document. The NOP and NOI also requested participation at public scoping meetings.

The NOP/NOI was mailed to an extensive list of recipients, and notices of the scoping meetings were published in local newspapers. FRWA held five formal scoping meetings in April 2002 to solicit public comments in determining the scope of the FRWP EIR/EIS. Scoping meetings were held in Oakland, Sacramento, and Herald. Attendees were given the opportunity to provide both written and oral comments. A summary of comments received during scoping meetings and copies of correspondence received are included in Volume 2, Appendix E of the EIR/EIS.

Approach to Alternatives Development

CEQA and NEPA require that EIRs and EISs describe and evaluate reasonable alternatives to a proposed action, and both must describe an alternative that assumes that the proposed action and alternatives would not be implemented. To comply with these regulations, FRWA has prepared an alternatives screening report (Volume 2, Appendix B) to evaluate a range of alternatives and to identify the most promising alternatives for detailed study.

Alternatives Considered in Detail in the EIR/EIS

FRWA and Reclamation have undertaken considerable work in formulating the alternatives evaluated in this EIR/EIS. Cost and engineering factors, water quality and reliability objectives, institutional considerations, and many environmental factors have had substantial influence in shaping the alternatives summarized below.

Alternative 1: No Action

Under Alternative 1, FRWA does not implement a project. SCWA will divert its existing Fazio entitlement through City of Sacramento facilities based on existing agreements with the City of Sacramento. EBMUD would not divert water from the Sacramento River, nor would EBMUD enlarge Pardee Reservoir.

Alternative 2: Freeport Intake Facility to Mokelumne Aqueducts—with the Meadowview/ Mack/Gerber/Florin Pipeline Alignment

Alternative 2 represents a water supply project for achieving the identified water delivery needs of FRWA. The design capacity of the system is 185 MGD. Up to 85 MGD of water would be diverted under Sacramento County's existing Reclamation water service contract and other anticipated water entitlements. This water would be used to meet municipal and industrial demands in the Zone 40 area of south Sacramento County, consistent with the Water Forum Agreement.

Up to 100 MGD of water also would be diverted under EBMUD's amended Reclamation water service contract. This supplemental water would be used to reduce existing and future EBMUD customer deficiencies to manageable levels during drought conditions and would provide an alternative water supply in case of planned or unplanned outages at EBMUD's Mokelumne River diversion facilities.

The primary features of Alternative 2 include the following components:

- a 185 MGD–capacity intake facility (Freeport Intake Facility) and pumping plant located on the Sacramento River near the community of Freeport;
- a reservoir and a water treatment plant (known as the Zone 40 Surface Water Treatment Plant [WTP]) located in central Sacramento County;
- a terminal facility located at the point of delivery to the Folsom South Canal (FSC);
- a canal pumping plant located at the FSC terminus;
- a series of settling basins;
- an aqueduct pumping plant and pretreatment facility situated near the Mokelumne Aqueducts/Camanche Reservoir area;
- four pipelines carrying the water from the intake facility to the Zone 40 Surface WTP and to the Mokelumne Aqueducts:
  - a 185 MGD–capacity (84-inch) pipeline from the intake facility to the turnout to the Zone 40 Surface WTP,
  - an 85 MGD–capacity (60-inch) pipeline from the turnout to the Zone 40 Surface WTP,
  - a 100 MGD–capacity (66-inch) pipeline from the turnout to FSC, and
  - a 100 MGD–capacity (66-inch) pipeline from the terminus of the FSC to the Mokelumne Aqueducts.

Alternatives 3–5: Freeport Intake Facility to Mokelumne Aqueducts—with Various Pipeline Alignments

The project components proposed under Alternatives 3–5 are the same as those described above for Alternative 2. Alternatives 2, 3, 4, and 5 differ from one another in that the pipelines have different alignments under each alternative.

Alternative 6: Freeport Intake to Zone 40 Surface Water Treatment Plant/Enlarge Pardee Reservoir

Under Alternative 6, SCWA water needs would be met by conveying water from the Sacramento River, and EBMUD water needs would be met by enlarging its Pardee Reservoir water storage facility on the Mokelumne River. Alternative 6 would consist of the following components:

- Freeport intake facility, including settling basins;
- pipeline from the intake facility to the Zone 40 Surface WTP, including the pipeline from the turnout to the WTP;
- Zone 40 Surface WTP; and
- enlarge Pardee Reservoir (which includes the addition and relocation of facilities, such as dams, roads, etc.).

The location and design of the intake facility, the pipeline from the intake facility to the Zone 40 Surface WTP, and the Zone 40 Surface WTP would be the same as described for Alternative 5.

For the enlarge Pardee Reservoir component, Alternative 6 would increase the storage capacity of Pardee Reservoir by 172,000 af; no water would be diverted under EBMUD's amended Reclamation water service contract.

The maximum water supply storage elevation of Pardee Reservoir would be raised about 33 feet (ft), and the maximum flood control elevation would be raised about 46 ft. The storage capacity of the reservoir would increase approximately 87%, from 198,000 af to 370,000 af.

Major components for the proposed reservoir enlargement under Alternative 6 include:

- replacement of the concrete dam and spillway, powerhouse, and saddle dams;
- modifications to the intake tower and Pardee Tunnel;
- a new pressure reduction facility;
- relocation of roads and bridges, including the State Route (SR) 49 bridge, Pardee Dam Road, and Stony Creek Road;
- removal of the Middle Bar Bridge and construction of fishing piers;
- relocation of utilities; and
- replacement of the existing Pardee Reservoir recreation areas.

Preferred Alternative

FRWA and Reclamation have identified Alternative 5 as the preferred alternative. The selection was made based on Alternative 5's ability to fully meet the project purpose and objectives, engineering and economic feasibility, minimization of environmental impacts, and input received during the public scoping process. Additionally, the selection of Alternative 5 as the preferred alternative is based on the conclusions of the impact analysis presented in Chapters 3 through 20.

Environmentally Superior Alternative

Alternative 5 is environmentally superior. While there are many similarities between the environmental impacts associated with Alternatives 2 through 5, Alternative 5 is preferred because it minimizes construction-related impacts associated with traffic, air quality, and noise and is the most consistent with community input received during the public scoping process. Alternatives 2 through 5 are identical with regard to hydrology, water supply, and power; water quality; and fish; and generally have fewer impacts on reservoir levels, river flows, and water temperatures than Alternative 6. Although the No Action Alternative would cause fewer direct environmental impacts, it would not meet the purpose and need or objectives of the proposed project.

Summary of Environmental Impacts and Available Mitigation Measures

Table S-1 summarizes the significant environmental impacts and table S-2 summarizes the less-than-significant environmental impacts of the FRWP alternatives. Table S-3 summarizes significant cumulative impacts. The tables are organized to present impacts by environmental topic area and to indicate the significance of each impact, available mitigation measures, and the significance of each impact if mitigation is implemented.

FRWA and Reclamation have incorporated certain mitigation measures into the project description as environmental commitments. These commitments include preparation and implementation of the following:

- general construction measures
- erosion and sediment control plan
- storm water pollution prevention plan
- traffic control plan

- dust suppression plan
- fire control plan
- Phase I and Phase II hazardous materials studies
- hazardous materials management plan
- channel and levee restoration plan
- hydrologic simulation modeling and scour analysis
- agricultural land restoration
- spoils disposal plan
- environmental training
- access point/staging areas plan
- trench safety plan
- private property acquisition and access
- noise compliance
- coordinated operations between FRWA and SRCSD
- project planning, coordination, and communication plan

Areas of Controversy

Primary areas of controversy include:

- disruption in urban areas during construction of the project, particularly under Alternatives 2 and 3;
- increased noise levels as a result of project construction and operation;
- potential effects of the alternatives on river flows and water temperatures and related effects on important fish species;
- potential effects on water supply and water quality for the Delta and downstream water users;
- potential effects on whitewater recreational activities on the Mokelumne River upstream of the existing Pardee Reservoir; and
- potential growth-related effects within Sacramento County’s Zone 40 area and EBMUD’s service area.

Table S-1. Summary of Significant Impacts and Mitigation Measures for the Freeport Regional Water Project

Resource Topic/Impact	Applicable Alternative	Mitigation Measure	Level of Significance after Mitigation
Hydrology, Water Supply, and Power—No significant impacts			
Water Quality—No significant impacts			
Fish—No significant impacts			
Recreation			
Loss of recreational area from inundation of a segment of the Mokelumne Coast to Crest Trail	Alternative 6	Implement Mitigation Measure 6-1: Relocate a portion of the Mokelumne Coast to Crest Trail	LS
Loss of the New Middle Bar take-out facility because of inundation	Alternative 6	Implement Mitigation Measure 6-2: Replace necessary Middle Bar Take-Out Facility amenities	LS
Loss of whitewater boating on the Upper Mokelumne River Electra Run	Alternative 6	Implement Mitigation Measure 6-3: Ensure availability of a take-out on the Electra Run	SU
Loss of whitewater boating on the Upper Mokelumne River between Middle Bar Bridge and SR 49 Bridge	Alternative 6	No mitigation available	SU
Vegetation and Wetland Resources			
Temporary disturbance to or potential loss of sensitive vegetation and wetland resources near active construction areas	Alternatives 2–6	Implement Mitigation Measure 7-1: Confine construction activities and equipment to the designated construction work area	LS
		Implement Mitigation Measure 7-2: Avoid and protect sensitive vegetation and wetland resources near designated construction work areas	
		Implement Mitigation Measure 7-3: Reestablish preconstruction site conditions to allow natural colonization of plant species and reseed, if necessary	
Potential introduction and spread of noxious weeds	Alternatives 2–6	Implement Mitigation Measure 7-4: Implement best management practices during construction activities	LS

Resource Topic/Impact	Applicable Alternative	Mitigation Measure	Level of Significance after Mitigation
Degradation of blue oak woodlands and loss of individual locally protected trees	Alternatives 2–6	Implement Mitigation Measure 7-5: Identify and avoid oak woodland and individual locally protected trees	LS
		Implement Mitigation Measure 7-6: Obtain and comply with county tree removal permits and implement conditions of permits	
Loss of or disturbance to riparian communities	Alternatives 2–6	Implement Mitigation Measure 7-7: Establish a protection buffer around woody riparian communities	LS
		Implement Mitigation Measure 7-8: Compensate for unavoidable riparian woodland losses	
Loss of or disturbance to jurisdictional waters of the United States, including wetlands	Alternatives 2–6	Implement Mitigation Measure 7-9: Avoid and minimize impacts on jurisdictional waters of the United States, including wetlands, by installing protective barriers and implementing best management practices	LS
		Implement Mitigation Measure 7-10: Obtain and comply with state and federal wetland permits	
		Implement Mitigation Measure 7-11: Compensate for unavoidable impacts on jurisdictional waters of the United States	
Potential loss of special-status plant populations	Alternatives 2–6	Implement Mitigation Measure 7-12: Conduct preconstruction surveys in areas not previously inventoried	LS
		Implement Mitigation Measure 7-13: Avoid known special-status plant populations during project design	
		Implement Mitigation Measure 7-14: Compensate for impacts on special-status plant populations	
Permanent loss of riparian woodland and riparian scrub communities within the inundation zone	Alternative 6	Implement Mitigation Measure 7-15: Compensate for unavoidable riparian habitat losses	LS
Potential impacts on jurisdictional waters of the United States, including wetlands and riparian woodland, within the water fluctuation zone	Alternative 6	Implement Mitigation Measure 7-16: Monitor and adaptively manage vegetation affected by inundation	LS

Resource Topic/Impact	Applicable Alternative	Mitigation Measure	Level of Significance after Mitigation
Loss of or disturbance to jurisdictional waters of the United States, including wetlands, as a result of inundation	Alternative 6	Implement Mitigation Measures 7-9 through 7-11	LS
Permanent loss of oak woodland communities within the inundation and flood zone	Alternative 6	Implement Mitigation Measure 7-17: Replace individual trees	LS
		Implement Mitigation Measure 7-18: Permanently preserve intact blue oak woodland	
Loss of or disturbance to oak woodland communities with the water fluctuation zone	Alternative 6	Implement Mitigation Measures 7-16 through 7-18	LS
Permanent loss of special-status plants and habitats within the inundation and flood zone	Alternative 6	Implement Mitigation Measure 7-19: Compensate for impacts on sensitive vegetative communities and associated special-status plants	LS
Wildlife			
Loss or alteration of vernal pools, vernal swales, and other temporary ponds that could provide habitat for vernal pool fairy shrimp, vernal pool tadpole shrimp, midvalley fairy shrimp, and California linderiella	Alternatives 2–6	Implement Mitigation Measure 8-1: Conduct surveys and develop a mitigation plan for vernal pool fairy shrimp and vernal pool tadpole shrimp	LS
Potential mortality of, disturbance to, or removal of habitat of the valley elderberry longhorn beetle during construction	Alternatives 2–6	Implement Mitigation Measure 8-2: Conduct preconstruction surveys for valley elderberry longhorn beetle and avoid or compensate for loss of habitat	LS
Potential mortality of, disturbance to, or loss of habitat for giant garter snake and western pond turtle	Alternatives 2–6	Implement Mitigation Measure 8-3: Avoid, minimize, and compensate for unavoidable impacts on jurisdictional waters of the United States, including wetlands, and implement associated wildlife protection and compensation measures	LS
Potential mortality of, disturbance to, or loss of habitat for the California tiger salamander and western spadefoot	Alternatives 2–6	Implement Mitigation Measure 8-4: Conduct preconstruction surveys and compensate for loss of California tiger salamander and western spadefoot habitat if these species are present	LS
Loss of or disturbance to active raptor nests or tricolored blackbird nests	Alternatives 2–6	Implement Mitigation Measure 8-5: Conduct surveys for nesting raptors and tricolored blackbirds	LS

Resource Topic/Impact	Applicable Alternative	Mitigation Measure	Level of Significance after Mitigation
Disturbance of nesting Swainson's hawks	Alternatives 2–6	Implement Mitigation Measure 8-5	LS
		Implement Mitigation Measure 8-6: Consult with the California Department of Fish and Game if hawks are present and follow mitigation guidelines to avoid disturbance of nesting hawks	
Loss of Swainson's hawk foraging habitat	Alternatives 2–6	Implement Mitigation Measure 8-7: Consult with California Department of Fish and Game and Sacramento County and compensate for loss of foraging habitat	LS
Loss of or disturbance to nesting western burrowing owls	Alternatives 2–6	Implement Mitigation Measure 8-5	LS
		Implement Mitigation Measure 8-8: Consult with California Department of Fish and Game and follow the burrowing owl mitigation guidelines	
Potential loss of habitat for Sacramento anthicid beetle and Sacramento valley tiger beetle	Alternatives 2–6	Implement Mitigation Measures 7-7 and 7-8	LS
Loss of or alteration to riparian wildlife habitat	Alternative 6	Implement Mitigation Measures 7-15 and 7-8	LS
Potential mortality to or disturbance of nesting cliff swallows	Alternative 6	Implement Mitigation Measure 8-9: Conduct preconstruction surveys for nesting birds	LS
		Implement Mitigation Measure 8-10: Avoid active nests during the breeding season	
Mortality or disturbance of nesting birds in the vegetation clearance and inundation zone	Alternative 6	Implement Mitigation Measure 8-11: Avoid removal of trees and other vegetation during the bird breeding season	LS
Potential mortality to roosting bat species of concern	Alternative 6	Implement Mitigation Measure 8-12: Conduct preconstruction bat clearance surveys	LS
Geology, Soils, Seismicity, and Groundwater			
Inadvertent soil loss from clearing operations	Alternative 6	Implement Mitigation Measure 9-1: Prevent inadvertent soil loss from clearing operations	LS
Land Use—No significant impacts			
Agricultural Resources			

Resource Topic/Impact	Applicable Alternative	Mitigation Measure	Level of Significance after Mitigation
Loss or conversion of prime farmland and farmland of statewide importance	Alternatives 2–6	Implement Mitigation Measure 11-1: Comply with Sacramento County General Plan requirements	LS
Traffic and Transportation			
Reduced access options for area residents	Alternative 6	Implement Mitigation Measure 12-1: Replace the Middle Bar Bridge with a new bridge	LS
Air Quality			
Short-term increase in NOx and CO emissions in Sacramento County	Alternatives 2–5	Implement Mitigation Measure 13-1: Include air quality mitigation measures as part of the proposed project's construction management plan	LS
Short-term increase in NOx emissions in San Joaquin County	Alternatives 2–5	Implement Mitigation Measure 13-1	LS
Short-term increase in PM10 emissions in San Joaquin County	Alternatives 2–5	Implement Mitigation Measure 13-2: Comply with Regulation VIII for control measures of fugitive PM10	LS
Short-term increase in NOx emissions in Sacramento County	Alternative 6	Implement Mitigation Measure 13-1	LS
Short-term increase in PM10 emissions in Amador and Calaveras Counties	Alternative 6	Implement Mitigation Measure 13-3: Implement dust control measures	LS
Noise			
Short-term increases in construction noise levels during daytime hours	Alternatives 2–6	Implement Mitigation Measure 14-1: Provide public notice of proposed activities and provide noise shielding to the extent feasible	SU
Exposure of noise-sensitive land uses to general construction noise at night	Alternatives 2–6	Implement Mitigation Measure 14-1 Implement Mitigation Measure 14-2: Minimize nighttime construction activity	SU
Increase in noise levels from facility operation	Alternatives 2–6	Implementation of noise attenuation environmental commitment could minimize this impact	SU
Public Health and Safety—No significant impacts			

Resource Topic/Impact	Applicable Alternative	Mitigation Measure	Level of Significance after Mitigation
Visual Resources			
Adverse impacts on views of the Zone 40 Surface WTP	Alternatives 2–6	Implement Mitigation Measure 16-1: Reduce visual intrusion by preparing design plans consistent with rural visual character, providing vegetative buffer	LS
Adverse change to views of the canal pumping plant site	Alternatives 2–5	Implement Mitigation Measure 16-1	LS
Adverse change to views of the aqueduct pumping plant and pretreatment facility site (Camanche site and optional Brandt site)	Alternatives 2–5	Implement Mitigation Meaure16-2: Implement appropriate aesthetic treatment at the aqueduct pumping plant and pretreatment facility site	LS
Changes in visual resources from inundation of the area upstream of the existing Pardee Reservoir (Upper Mokelumne River)	Alternative 6	No mitigation available	SU
Cultural Resources			
Disturbance of known cultural resources	Alternatives 2–5	Implement Mitigation Measure 17-1: Prepare and implement a cultural resources significance evaluation, effects analysis, and mitigation plan for known cultural resources	LS
Disturbance of unidentified cultural resources	Alternatives 2–5	Implement Mitigation Measure 17-2: Prepare and implement a cultural resources inventory, significance evaluation, effects analysis, and mitigation plan for unidentified cultural resources Implement Mitigation Measure 17-3: Prepare and implement a plan for unanticipated discovery of cultural resources	LS
Disturbance of known cultural resources at Pardee Reservoir that are listed on the National Register of Historic Places	Alternative 6	Implement Mitigation Measure 17-4: Conduct Historic American Engineering Record documentation where avoidance to structures is impossible	LS
Disturbance to other known cultural resources from the intake facility to the Zone 40 Surface WTP and at Pardee Reservoir	Alternative 6	Implement Mitigation Measure 17-1	LS

Resource Topic/Impact	Applicable Alternative	Mitigation Measure	Level of Significance after Mitigation
Disturbance of unidentified cultural resources from the intake facility to the Zone 40 Surface WTP and at Pardee Reservoir	Alternative 6	Implement Mitigation Measures 17-2 and 17-3	LS

LS = Less than significant

SU = Significant and unavoidable

Table S-2. Summary of Less-than-Significant Impacts and Mitigation Measures for the Freeport Regional Water Project

Resource Topic/Impact	Applicable Alternative	Mitigation Measure
Hydrology, Water Supply, and Power		
Changes in Upper Sacramento River Basin hydrologic conditions	Alternatives 2–6	No mitigation required
Changes in Lower Sacramento River, Delta Inflow, and Delta Outflow hydrologic conditions	Alternatives 2–6	No mitigation required
Changes in Mokelumne River Basin hydrologic conditions	Alternatives 2–6	No mitigation required
Changes in south-of-Delta water supply delivery operations	Alternatives 2–6	No mitigation required
Hydropower and energy production changes at CVP facilities	Alternatives 2–6	No mitigation required
Water Quality		
Potential contaminant discharges during construction could occur for approximately 2 years, and disturbed construction areas would be exposed to storms that could transport materials	Alternatives 2–5	No mitigation required
Operational effects during reverse flow in the Sacramento River associated with diversion of water from the Freeport intake facility could result in diluted discharges	Alternatives 2–5	No mitigation required
Operational effects on water quality in the Sacramento River downstream of the diversion (the Freeport intake facility) could result due to reduced background streamflow and increased SRWWTP effluent discharges	Alternatives 2–5	No mitigation required
Changes to reservoir temperature patterns for Camanche and Pardee Reservoirs attributable to project-related diversions of Sacramento River water	Alternatives 2–5	No mitigation required
Increased inorganic mineral content and nutrients could incrementally increase the frequency or duration of adverse taste and odor events in EBMUD terminal reservoirs	Alternatives 2–5	No mitigation required
Changes to Folsom South Canal water quality, attributable to project-related diversions of Sacramento River water that will be discharged to the FSC	Alternatives 2–5	No mitigation required
Operation effects on Delta water quality	Alternatives 2–5	No mitigation required
Pipeline operation effects on surface drainages attributable to change in discharge levels	Alternatives 2–5	No mitigation required

Resource Topic/Impact	Applicable Alternative	Mitigation Measure
Freeport Intake Facility to Zone 40 Surface WTP/Enlarge Pardee Reservoir has potential for contaminant discharges hazardous to aquatic habitats and existing vegetation during construction	Alternative 6	No mitigation required
Operating effects during reverse flow in the Sacramento River could reduce or increase the distance of travel and/or limit dilution water in the river that is available for SRWWTP effluent discharge compliance	Alternative 6	No mitigation required
Operational effects on water quality in the Sacramento River downstream of the diversion (the Freeport intake facility) could result due to reduced background streamflow and increased SRWWTP effluent discharges	Alternative 6	No mitigation required
Changes to reservoir temperature patterns	Alternative 6	No mitigation required
Discharges of contaminants during construction of Pardee Dam	Alternative 6	No mitigation required
Operational effects of chloride and EC differences on Delta water quality	Alternative 6	No mitigation required
Fish		
Negative impact on spawning habitat of fish species from construction-related activities	Alternatives 2–6	No mitigation required
Negative impact on rearing habitat of fish species from construction-related activities	Alternatives 2–6	No mitigation required
Negative impact on migration habitat of fish species from construction-related activities	Alternatives 2–6	No mitigation required
Introduction of contaminants harmful to fish populations during construction	Alternatives 2–6	No mitigation required
Creation of additional habitat for predators of native fish populations from temporary structures	Alternatives 2–6	No mitigation required
Direct injury to fish from construction activities	Alternatives 2–6	No mitigation required
Adverse impacts on spawning habitat of fish resulting from decreased flows during ongoing operations	Alternatives 2–6	No mitigation required
Adverse impacts on rearing habitat of fish resulting from decreased flows during ongoing operations	Alternatives 2–6	No mitigation required
Adverse impacts on migration habitat of fish resulting from decreased flows during ongoing operations	Alternatives 2–6	No mitigation required
Adverse impacts on water temperature resulting from changes in reservoir storage and river flow during operations	Alternatives 2–6	No mitigation required

Resource Topic/Impact	Applicable Alternative	Mitigation Measure
Potential risk of fish entrainment at the intake facility	Alternatives 2–6	No mitigation required
Adverse impacts on fish habitat resulting from changes in reservoir storage during project operations	Alternatives 2–6	No mitigation required
Recreation		
Temporary disruption to recreational opportunities during construction of the intake facility	Alternatives 2–6	No mitigation required
Temporary disruption to recreational opportunities during construction of the pipeline from the intake facility to Zone 40 Surface WTP/FSC	Alternatives 2–6	No mitigation required
Temporary disruption to recreational opportunities along the Folsom South Canal	Alternatives 2–5	No mitigation required
Temporary disruption to recreational opportunities during construction of the pipeline from the Folsom South Canal to the Mokelumne Aqueducts	Alternatives 2–5	No mitigation required
Change in water-dependent and water-enhanced recreation opportunities at Shasta, Oroville, and Trinity Reservoirs and the Sacramento River	Alternatives 2–6	No mitigation required
Change in water-dependent and water-enhanced recreation opportunities at Folsom Reservoir	Alternatives 2–6	No mitigation required
Change in water-dependent recreation opportunities on the lower American River	Alternatives 2–6	No mitigation required
Disruption to recreation opportunities on the Sacramento River associated with location of the intake facility	Alternatives 2–6	No mitigation required
Potential inconsistency with local plans and policies addressing recreation	Alternatives 2–6	No mitigation required
Temporary disruption of whitewater use along the Electra Run near State Route 49	Alternative 6	No mitigation required
Temporary disruption of water-dependent recreation activities near Pardee Dam	Alternative 6	No mitigation required
Temporary disruption to water-dependent and water-enhanced recreation activities on Pardee Reservoir	Alternative 6	No mitigation required
Change in water-dependent recreation opportunities on Pardee Reservoir	Alternative 6	No mitigation required
Change in recreation opportunities at Camanche Reservoir from increased storage	Alternative 6	No mitigation required
Change in recreation opportunities on the Lower Mokelumne River from increased water release	Alternative 6	No mitigation required
Loss of recreation area from inundation of the Pardee Recreation Area	Alternative 6	No mitigation required

Resource Topic/Impact	Applicable Alternative	Mitigation Measure
Loss of fishing access attributable to inundation of Middle Bar Bridge	Alternative 6	No mitigation required
Vegetation and Wetland Resources		
Temporary disturbance to and permanent loss of developed areas, agricultural land, eucalyptus stands, artificially created roadside drainage ditches, and annual grassland habitat within construction corridor	Alternatives 2–6	No mitigation required
Permanent loss of developed areas, non-serpentine chaparral, and annual grassland habitat within the inundation zone	Alternative 6	No mitigation is required
Wildlife		
Loss of or disturbance to developed and agricultural lands and associated wildlife habitats	Alternatives 2–6	No mitigation required
Temporary loss or alteration of Swainson's hawk foraging habitat	Alternative 2–6	No mitigation required
Temporary loss of San Joaquin pocket mouse habitat	Alternative 2–6	No mitigation required
Loss of grassland habitats for wildlife	Alternative 6	No mitigation required
Loss of chaparral-type habitats for wildlife	Alternative 6	No mitigation required
Loss of upland woodland wildlife habitats	Alternative 6	No mitigation required
Loss of perching habitat for bald eagles	Alternative 6	No mitigation required
Increase in open water and shoreline habitat for waterfowl, waterbirds, and associated species	Alternative 6	No mitigation required
Geology, Soils, Seismicity, and Groundwater		
Localized erosion and sedimentation from construction-related activities	Alternatives 2–6	No mitigation required
Threat of hydrological hazards from potential trench dewatering	Alternatives 2–6	No mitigation required
Destruction of unique geological features from construction-related activities	Alternatives 2–6	No mitigation required
Threat of ground shaking and fault rupture	Alternatives 2–6	No mitigation required
Subsidence south of the Delta from increased groundwater pumping	Alternatives 2–6	No mitigation required
Threat of a reservoir-induced seismic event	Alternative 6	No mitigation required
Erosion and sedimentation within the expanded reservoir inundation zone from reservoir operations	Alternative 6	No mitigation required
Land Use		
Construction-period conflicts with residential and urbanized land uses	Alternatives 2–6	No mitigation required

Resource Topic/Impact	Applicable Alternative	Mitigation Measure
Postconstruction conflicts with residential and urbanized land uses	Alternatives 2–6	No mitigation required
Inconsistency with local plans and policies and land use designations	Alternatives 2–6	No mitigation required
Conflicts with planned new land uses	Alternatives 2–6	No mitigation required
Disproportionate impacts on low income residents and other environmental justice considerations	Alternatives 2–6	No mitigation required
Conflict with proposed scenic highway designation for SR 49	Alternative 6	No mitigation required
Loss of land because of inundation associated with enlarging Pardee Reservoir	Alternative 6	No mitigation required
Conflict with mineral resources zone general plan classification	Alternative 6	No mitigation required
Agricultural Resources		
Loss of agricultural production	Alternatives 2–6	No mitigation required
Nonrenewal or termination of Williamson Act Contracts	Alternatives 2–6	No mitigation required
Reduction in agricultural productivity in the San Joaquin Valley	Alternatives 2–6	No mitigation required
Traffic and Transportation		
Alteration of present patterns of vehicular circulation, increased traffic delay, and increased traffic hazards during construction of facilities	Alternatives 2–6	No mitigation required
Damage to the roadway surface during construction of facilities	Alternatives 2–6	No mitigation required
Disruption of rail traffic during construction	Alternatives 2–6	No mitigation required
Interference with emergency response routes during construction	Alternatives 2–6	No mitigation required
Interference with bicycle routes during construction	Alternatives 2–6	No mitigation required
Congestion of roadways and the permanent alteration of present patterns of vehicular circulation from the facility operations	Alternatives 2–6	No mitigation required
Air Quality		
Short-term increase in ROG and PM10 emissions in Sacramento County from construction	Alternatives 2–5	No mitigation required
Short-term increase in ROG and CO emissions in San Joaquin County from construction	Alternatives 2–5	No mitigation required
Long-term increase in emissions in Sacramento and San Joaquin Counties from operations	Alternatives 2–6	No mitigation required

Resource Topic/Impact	Applicable Alternative	Mitigation Measure
Short-term increase in ROG, CO, and PM10 emissions in Sacramento County from construction	Alternative 6	No mitigation required
Short-term increase in ROG, NOx, and CO emissions in Amador and Calaveras Counties from construction	Alternative 6	No mitigation required
Short-term release of NOx, CO, and PM10 from blasting at the existing Pardee Reservoir during construction	Alternative 6	No mitigation required
Long-term increase in emissions in Amador and Calaveras Counties from continued operation	Alternative 6	No mitigation required
Noise		

Resource Topic/Impact	Applicable Alternative	Mitigation Measure
Adverse changes to views along the pipeline from the FSC to the Mokelumne Aqueducts	Alternatives 2–5	No mitigation required
Short-term changes to views associated with construction of project components from the intake facility to the Zone 40 Surface WTP	Alternative 6	No mitigation required
Short-term changes to views associated with construction of the enlarged Pardee Reservoir	Alternative 6	No mitigation required
Adverse changes to views of the intake facility site	Alternative 6	No mitigation required
Adverse changes to views along the pipeline from the intake facility to Zone 40 Surface WTP	Alternative 6	No mitigation required
Adverse impacts on visual resources from raising Pardee Reservoir water elevations	Alternative 6	No mitigation required
Adverse impacts on visual resources from inundation of the area downstream of the existing Pardee Dam (Middle Mokelumne River)	Alternative 6	No mitigation required
Adverse impacts on visual resources from changes in Camanche Reservoir water elevations	Alternative 6	No mitigation required
Change in views of the Pardee replacement dam	Alternative 6	No mitigation required
Change in views of the new Pardee saddle dams	Alternative 6	No mitigation required
Change in view of the new Jackson Creek saddle dams	Alternative 6	No mitigation required
Change in view of the raised intake tower	Alternative 6	No mitigation required
Change in views of raised or relocated utility lines	Alternative 6	No mitigation required
Change in views of new roads and bridges	Alternative 6	No mitigation required
Change in views from the new Pardee Recreation Area	Alternative 6	No mitigation required
Cultural Resources—No less-than-significant impacts		

Table S-3. Summary of Significant Cumulative Impacts and Mitigation Measures for the Freeport Regional Water Project

Resource Topic/Impact	Applicable Alternative	Mitigation Measure	Result
Hydrology, Water Supply, and Power—No project-related contribution			
Water Quality—No project-related contribution			
Fish—No project-related contribution			
Recreation—No project-related contribution			
Vegetation and Wetland Resources			
Effects of local and regional projects and general growth in the region, in combination with the FRWP, on the cumulative loss of identified sensitive resources, including wetlands and riparian woodlands.	Alternatives 2–6	Implementing all mitigation measures described in Chapter 7, "Vegetation and Wetland Resources," will eliminate any contribution to cumulative effects.	Not cumulatively considerable
Wildlife			
Effects of local and regional projects and general growth in the region on the cumulative loss of identified sensitive resources, including habitats for sensitive wildlife species.	Alternatives 2–6	Implementing all mitigation measures described in Chapter 8, "Wildlife," will eliminate any contribution to cumulative effects.	Not cumulatively considerable
Geology, Soils, Seismicity, and Groundwater—No significant impacts			
Land Use—No project-related contribution			
Agricultural Resources			
Effects of local and regional projects and general growth in the region, in combination with the FRWP, on the cumulative loss of prime agricultural lands.	Alternatives 2–6	No mitigation available to reduce effect to less than cumulatively considerable	SU
Traffic and Transportation—No project-related contribution			
Air Quality—No project-related contribution			
Noise—No project-related contribution			

Resource Topic/Impact	Applicable Alternative	Mitigation Measure	Result
Public Health and Safety—No project-related contribution			
Visual Resources—No project-related contribution			
Cultural Resources			
Effects of local and regional projects and general growth in the region on the cumulative loss of cultural (archeological and historic) resources.	Alternatives 2–6	Implementing all mitigation measures described in Chapter 17, "Cultural Resources," will eliminate any contribution to cumulative effects.	Not cumulatively considerable
SU = Significant and unavoidable			

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Acronyms and Abbreviations

: g/L	micrograms per liter
: g/m^3	micrograms per cubic meter
: S/cm	micro Siemens per centimeter
2000 Demand Study	District-wide Update of Water Demand Projections
ACAPCD	Amador County Air Pollution Control District
ACHP	Advisory Council on Historic Preservation
ACWD	Alameda County Water District
ADA	Americans with Disabilities Act
ADT	average daily traffic
af	acre-feet
AFA	acre-feet of water used annually
AFA/ac	acre-feet of water used annually per acre of land
A-G	Agricultural-General
ARB	Air Resources Board
Authority	Southeast Sacramento County Agricultural Water Authority
AVO	average vehicle occupancy
B.P.	Before Present
B/E	banking and exchange
BAAQMD	Bay Area Air Quality Management District
Basin Plan	Water Quality Control Plan
Bixler	Bixler Emergency Pumping Plant
BLM	Bureau of Land Management
BMPs	best management practices
BNSF	Burlington Northern Santa Fe Railway Company
Board	EBMUD Board of Directors
CAA	federal Clean Air Act
CALFED	CALFED Bay-Delta Program
CALSIM	DWR/Reclamation water supply operations model
Caltrans	California Department of Transportation
Caltrans/FHWA	California Department of Transportation/Federal Highway Administration
CCAA	California Clean Air Act of 1988
CCAPCD	Calaveras County Air Pollution Control District
CCC	continuous criteria concentration
CCTRR	Central California Traction Railroad
CCWD	Contra Costa Water District
CDC	California Department of Conservation

CEQA	California Environmental Quality Act
CESA	California Endangered Species Act
CFR	Code of Federal Regulations
cfs	cubic feet per second
CHRIS	California Historical Resources Information System
CLSM	controlled low strength material
CMP	Coordinated Monitoring Program
CNDDB	California Natural Diversity Database
CNEL	Community Noise Equivalent Level
CNPS	California Native Plant Society
CO	carbon monoxide
Corps	U.S. Army Corps of Engineers
CPP	Cosumnes Power Plant
CPUC	California Public Utilities Commission
CRHR	California Register of Historical Resources
CSUS	California State University, Sacramento
CTR	California Toxics Rule
CVP	Central Valley Project
CWA	Clean Water Act
dB	Decibel
dBA	A-Weighted Decibel
DBPs	disinfection byproducts
DCC	Delta Cross Channel
DEIR/EIS	Draft Environmental Impact Report/Environmental Impact Statement
Delta	Sacramento–San Joaquin Delta
DFG	California Department of Fish and Game
DHS	Department of Health Services
District	Southgate Park District
DMC	Delta Mendota Canal
DO	dissolved oxygen
DOSD	Division of Safety of Dams
DPR	California Department of Parks and Recreation
DSM2	Delta Simulation Model
DWR	California Department of Water Resources
EBMUD	East Bay Municipal Utility District
EBMUDSIM	EBMUD's water supply operations model
EC	electrical conductivity
EIR/EIS	environmental impact report/environmental impact statement
EPA	Environmental Protection Agency
ESA	federal Endangered Species Act
ESAs	federal and California Endangered Species Acts
EWA	Environmental Water Account
FDM	Fischer Delta model
fps	foot per second
FRWA	Freeport Regional Water Authority
FRWP	Freeport Regional Water Project
FSC	Folsom South Canal

FSCC	Folsom South Canal Connection
FSCC pipeline alignment	FSC to the Mokelumne Aqueducts
ft	feet
FTA	Federal Transit Administration
GANDA	Garcia and Associates
GLO	U.S. General Land Office
GWF	Groundwater Forum
GWh/yr	gigawatt hours per year
HAER	Historic American Engineering Record
Hz	Hertz
I-5	Interstate-5
ID	Irrigation District
in/sec	inches/second
JSA	Joint Settlement Agreement
JVID	Jackson Valley Irrigation District
kV	kilovolts
L_{dn}	Day-Night Level
L_{eq}	Equivalent Sound Level
L_{max}	Maximum Sound Level
L_{min}	Minimum Sound Level
LOS	level of service
LRT	light rail transit
L_{xx}	Percentile-Exceeded Sound Level
M&I	municipal and industrial
MCAB	Mountain Counties Air Basin
MCE	Maximum Credible Earthquake
MCL	maximum contaminant level
mg/kg	milligrams per kilogram
mg/L	milligrams per liter
MGD	million gallons per day
MOA	Memorandum of Agreement
MOU	Memorandum of Understanding
msl	mean sea level
MW	megawatts
NAAQS	National Ambient Air Quality Standards
NAWQA	National Ambient Water Quality Assessment Program
NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act
NO_2	nitrogen dioxide
NOAA Fisheries	National Oceanic and Atmospheric Administration
NOI	Notice of Intent
NOx	oxides of nitrogen
NPDES	National Pollutant Discharge Elimination System

NRA	National Recreation Area
NRCS	Natural Resources Conservation Service
NRHP	National Register of Historic Places
NRWRP	North Richmond Water Reclamation Plant
NSJWCD	North San Joaquin Water Conservation District
NTU	nephelometric turbidity unit
OCAP	Operations Criteria and Plan
ONC	Office of Noise Control
OSHA	U.S. Occupational Safety and Health Administration
Partnership Agreement	Mokelumne Settlement Agreement
PCBs	polychlorinated biphenyl compounds
PG&E	Pacific Gas and Electric Company
Plan	The Sacramento River Parkway Plan
PM10	particulate matter 10 microns or less in diameter
PM2.5	particles smaller than 2.5 microns in diameter
PMF	probable maximum flood
ppd	parts per day
ppm	parts per million
ppt	parts per thousand
ppv	peak particle velocity
psi	pounds per square inch
RBDD	Red Bluff Diversion Dam
RCC	roller-compacted concrete
Reclamation	Bureau of Reclamation
REIR/SEIS	Recirculated EIR/Supplemental EIS
ROD	Record of Decision
ROG	reactive organic gases
RT	round trip
RV	recreational vehicle
RWA	Regional Water Authority
RWQCB	Regional Water Quality Control Board
SACOG	Sacramento Area Council of Governments
SAFCA	Sacramento Area Flood Control Agency
SCADA	Supervisory Control and Data Acquisition
SCS	Soil Conservation Service
SCWA	Sacramento County Water Agency
SFBAAB	San Francisco Bay Area Air Basin
SGA	Sacramento Groundwater Authority
SHPO	State Historic Preservation Officer
SIP	State Implementation Plan
SJVAB	San Joaquin Valley Air Basin
SJVUAPCD	San Joaquin Valley Unified Air Pollution Control District
SMAQMD	Sacramento Metropolitan Air Quality Management District
SMUD	Sacramento Municipal Utility District
SO_2	sulfur dioxide
SPRR	Southern Pacific Railroad
SR	State Route

SRA	State Recreation Area
SRCSD	Sacramento Regional County Sanitation District
SRWP	Sacramento River Watershed Program
SRWWTP	Sacramento Regional Wastewater Treatment Plant
STAA	Surface Transportation Assistance Act
SVAB	Sacramento Valley Air Basin
SWP	State Water Project
SWPPP	Storm Water Pollution Prevention Plan
SWRCB	State Water Resources Control Board
TAF	thousand acre-feet
TAF/year	thousand acre-feet per year
TCE	trichloroethene
TDS	total dissolved solids
THM	Trihalomethane
tpy	tons per year
TOC	total organic carbon
TSS	Total suspended sediment concentrations
UPRR	Union Pacific Railroad
US 50	U.S. Highway 50
USB	ultimate service boundary
USBM	U.S. Bureau of Mines
USFS	U.S. Forest Service
USGS	U.S. Geological Survey
V/C	Volume to capacity ratios
VELB	valley elderberry longhorn beetle
Water Forum	Sacramento Area Water Forum
WCMP	Water Conservation Master Plan
WD	Water District
WDRs	Waste Discharge Requirements
Western	Western Area Power Administration
WID	Woodbridge Irrigation District
Williamson Act	The California Land Conservation Act
WSMP	Updated Water Supply Management Project
WTP	Water Treatment Plant

Chapter 1

Purpose of and Need for the Freeport Regional Water Project

Chapter 1
Purpose of and Need for the Freeport Regional Water Project

Introduction

The Freeport Regional Water Authority (FRWA) was created by exercise of a joint powers agreement between the Sacramento County Water Agency (SCWA) and the East Bay Municipal Utility District (EBMUD). *FRWA's basic project purpose is to increase water service reliability for customers, reduce rationing during droughts, and facilitate conjunctive use of surface water and groundwater supplies in central Sacramento County*. FRWA is proposing the Freeport Regional Water Project (FRWP) to meet this basic project purpose and others set forth under Project Purpose/Objectives and Need below.

This document is a joint environmental impact report/environmental impact statement (EIR/EIS) and satisfies the requirements of the California Environmental Quality Act (CEQA) and National Environmental Policy Act (NEPA). It will be used by local, state, and federal agencies to identify, evaluate, and disclose significant environmental impacts of the proposed action and alternatives as described below.

FRWA has determined that preparation of an EIR to satisfy CEQA (Public Resources Code, Section 21000 et seq.) is required before approval of the Freeport Regional Water Project. FRWA is the lead agency under CEQA. The primary purpose of an EIR is to identify and publicly disclose any significant environmental impacts that may result from implementation of a project and to identify feasible alternatives, mitigation measures, or revisions to the project that would reduce those impacts.

Pursuant to Section 15126(d) of the State CEQA Guidelines, an EIR must describe and evaluate a reasonable range of alternatives that would feasibly attain most of the basic project objectives, and would avoid or substantially lessen any of the significant impacts of the project as proposed. The guidelines state that the range of alternatives required to be evaluated in an EIR is governed by the "rule of reason": the EIR needs to describe and evaluate only those alternatives necessary to permit a reasoned choice and to foster informed decision making and public participation.

Like CEQA, NEPA and the Council on Environmental Quality's NEPA regulations (Title 40, Code of Federal Regulations [CFR], Section 1500 et seq.) require federal agencies, when proposing to carry out, approve, or fund a project to evaluate the environmental effects of the action, including feasible alternatives and mitigation measures to minimize adverse effects. Federal agencies may need to take action (triggering NEPA) on the Freeport Regional Water Project, depending on the specific configuration of the project for which FRWA eventually seeks approval.

Because many of the alternatives under consideration may require approval from U.S. Department of the Interior, Bureau of Reclamation (Reclamation) with regard to EBMUD's and/or SCWA's water service contracts, water supplies, and facility operations, Reclamation will serve as the federal lead agency under NEPA. These actions may include, but are not limited to, Reclamation's approval of the assignment of a portion of the Sacramento Municipal Utility District's (SMUD's) existing Central Valley Project (CVP) water service contract supply to SCWA. Because of the complex nature of the Freeport Regional Water Project, FRWA and Reclamation have determined that preparation of an EIS is the most expedient form of NEPA compliance. Other federal agencies, such as the U.S. Army Corps of Engineers (Corps), may rely on the EIS to satisfy NEPA for their individual approvals of project components.

Five project alternatives are analyzed in this EIR/EIS at an equal level of detail and compared to a no-action alternative (Alternative 1). Each of the action alternatives are intended to meet the purpose, objectives, and need of both FRWA member agencies. Alternatives 2 through 5 share many common components including an intake facility along the Sacramento River, pipelines, pumping plants, and water treatment plants. The primary differences between these alternatives are the locations of the pipelines. Alternative 6 differs from Alternatives 2 through 5 in that only SCWA would divert water from the Sacramento River while EBMUD would meet its portion of the project purpose and need by enlarging its existing Pardee Reservoir. A programmatic analysis of a groundwater storage/conjunctive use program is also included in Chapter 18, "Programmatic Evaluation of a Groundwater Banking/Exchange Component to the Freeport Regional Water Project."

Project Purpose/Objectives and Need

The FRWP is intended to contribute to meeting the objectives of SCWA and EBMUD. The primary purposes, objectives, and needs of the project are as follows.

Needs

- SCWA and Sacramento County have concluded that reliance solely on groundwater to serve development authorized in Sacramento County's

General Plan will deplete the central county groundwater aquifer, resulting in shallow wells drying up, degradation of groundwater quality, increased pumping costs, land subsidence, and potential changes to local flood plains, and that the provision of surface water is necessary to meet the anticipated demand;

- EBMUD forecasts water shortages during drought periods, based on maintenance of existing Mokelumne River basin supply, or catastrophic events exacerbated by increased flows for senior water right holders, resource protection, and increasing population.

Purposes/Objectives

- support acquisition of additional SCWA surface water entitlements to promote efficient conjunctive use of groundwater in its Zone 40 area, consistent with the Sacramento Area Water Forum Agreement and County of Sacramento General Plan policies;
- provide facilities through which SCWA can deliver existing and anticipated surface water entitlements to Zone 40 area;
- provide facilities through which EBMUD can take delivery of a supplemental supply of water that would substantially meet its need for water and reduce existing and future customer deficiencies during droughts; and
- improve EBMUD system reliability and operational flexibility during droughts, catastrophic events, and scheduled major maintenance at Pardee Dam or Reservoir.

Background of Purpose and Need

Sacramento County Water Agency

SCWA was formed in 1952 by a special legislative act of the State of California. Among SCWA's purposes are:

- to make water available for any beneficial use of lands and inhabitants, and
- to produce, store, transmit, and distribute groundwater.

SCWA is governed by the Sacramento County Board of Supervisors, acting as the SCWA's Board of Directors. SCWA is legally authorized to purchase, sell, or acquire water, including acquiring water through contract with either the federal government or the State of California. SCWA also may construct and operate facilities.

In 1985, the SCWA Act was amended by the California Legislature, granting SCWA the authority to establish groundwater management zones for the purpose of distributing surface water to replenish the groundwater basin and to stabilize groundwater levels. The SCWA Act allows for collecting fees from the beneficiaries of these activities. A groundwater management zone is authorized to be formed in any area that would benefit from the importation and distribution of surface water for municipal and industrial uses.

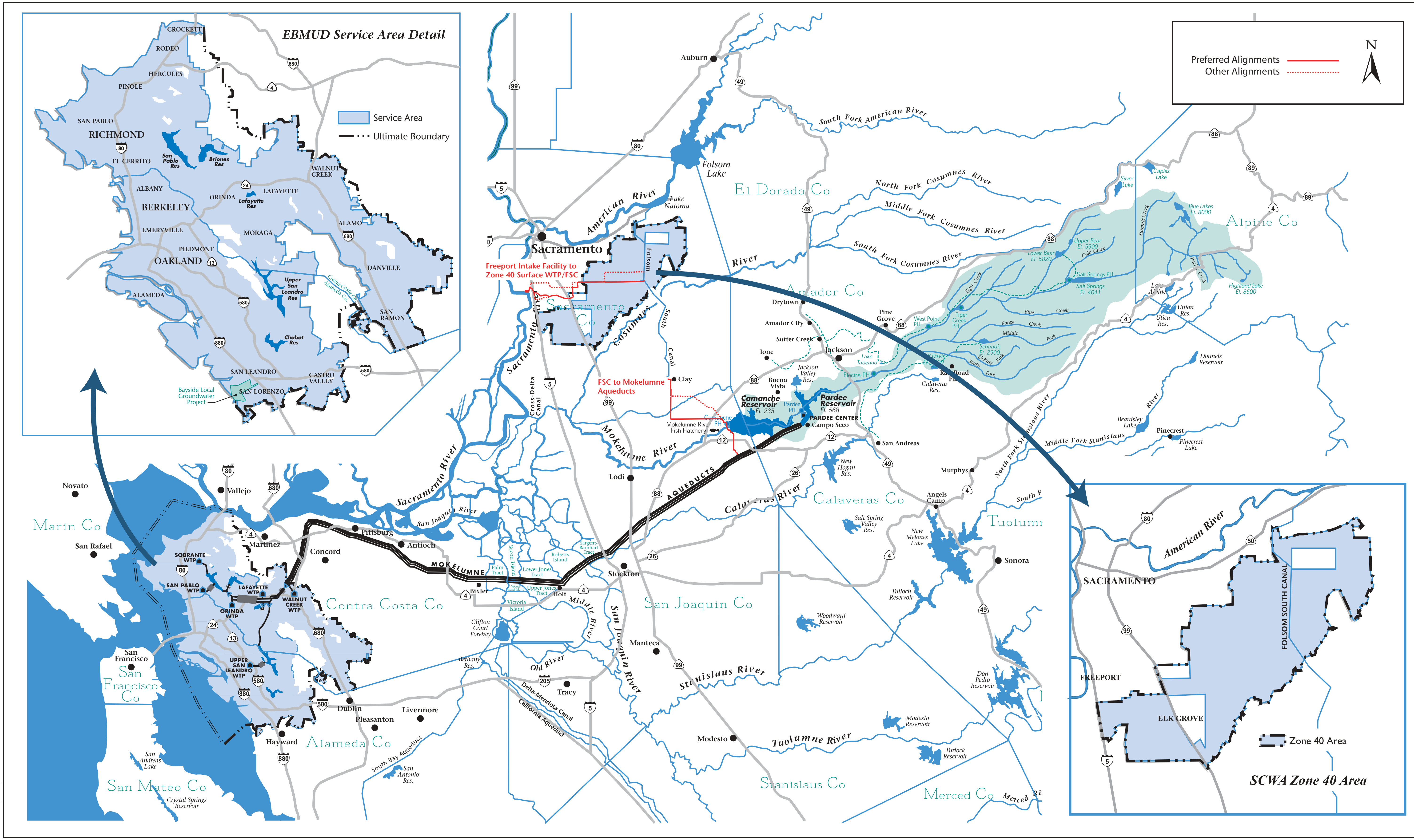
Zone 40 was formed in May 1985 by SCWA Resolution No. 663 for the purpose of constructing facilities for the production, conservation, transmittal, distribution, and sale of surface water and groundwater for conjunctive use in the Zone 40 area. In 1987, SCWA adopted a Zone 40 Water Supply Master Plan, a long-term plan for meeting future water needs in the newly developing Laguna and Vineyard areas, which have historically depended on groundwater. The plan was updated in 1995 but never adopted by the SCWA Board of Directors. On March 23, 1999, SCWA expanded the Zone 40 boundaries to the extent they exist today, as shown in Figure 1-1. SCWA has prepared an update of the Water Supply Master Plan based on these new boundaries a draft of which was released for public review in February of 2003.

Need for the Project

Historical groundwater use in Zone 40 comprised agricultural, rural, and municipal pumping. Long-term reliance on groundwater has formed a groundwater cone of depression, known as the “Elk Grove cone of depression,” within Zone 40. Groundwater in this central Sacramento basin moves toward the center of the cone of depression and groundwater extracted from the basin contributes to further declines at the cone of depression.

Management of the central groundwater basin is being considered under a successor process to the Sacramento Area Water Forum Agreement known as the Central Sacramento County Groundwater Forum. SCWA is a major sponsor and stakeholder in this broadly shared process.

In 1993, Sacramento County approved a general plan that changed the land use designation of large areas of central Sacramento County from agricultural use to residential, commercial, and industrial uses. As a result, on March 23, 1999, SCWA expanded the boundary of Zone 40 as discussed above. The expanded boundary includes the urban policy area of the County’s general plan and areas studied in previous master planning efforts. Recently, a combination of wet weather and the transition of land from agricultural uses to urban development have contributed to the stabilization of groundwater elevations in the central County groundwater basin. However, if buildout of the Sacramento County General Plan relied solely on groundwater, groundwater levels would decline an additional 160 feet, potentially causing shallow wells to dry up, groundwater quality to degrade, pumping costs to increase, and land to subside. To avoid adversely affecting groundwater by maintaining the sustainable yield of the Central County groundwater basin as stipulated in the Water Forum Agreement, it is necessary to use surface water supplies in conjunction with available groundwater supplies to meet the projected buildout demands in Zone 40.



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Jones & Stokes

Figure 1-1
Service Areas

Water Demands

Projected SCWA water demands are typical of Central Valley urban areas. Seasonal variation in rainfall and water use causes the demand to vary. Water use is lowest in winter, while summer water use can be four times higher. In general, the highest monthly water demands in the Sacramento area occur in July and August, when landscape irrigation requirements, a major component of urban water use, are the greatest. Conjunctive use of surface water and groundwater resources is influenced by the seasonal variation in water demands. Because SCWA does not have long-term surface water storage facilities, use of groundwater and surface water supplies must be seasonally regulated.

Water demand projections prepared in 2002 for the Zone 40 area were based on unit water demand factors expressed in acre-feet of water used annually per acre of land (AFA/ac). Unit demand factors for various land use designations were developed in the May 1995 Sacramento Area Water Demand Study developed by Boyle Engineering for the Water Forum. The Zone 40 study area includes the wholesale service areas of Elk Grove Water Service (previously Elk Grove Water Works), and community areas throughout Zone 40 that are projected for development under the County of Sacramento General Plan. A detailed land use analysis in Zone 40 estimated current and future acreage by land use category to develop the total water demand.

The base factors were adjusted slightly to reflect actual production demands by comparing estimated water use demands to the actual water use for each service area in the Zone 40 study area. The unit water demands were then refined so that the estimated total water use matched the actual total water use (using 1992 use levels). Additional information on the development of these factors can be found in the June 1995 Zone 40 Water Supply Master Plan Update (Montgomery Watson 1995) and the 2002 Draft Zone 40 Water Supply Master Plan.

The net estimated water demand of approximately 109,500 AFA for the buildout in Zone 40, considering the use of recycled water, is equivalent to the water demand of approximately 165,000 homes. The water demand estimate is summarized in Table 1-1 below.

Table 1-1. Updated Zone 40 Water Demands

Demand Source	Approximate Water Demand (AFA)
Zone 40 total demand (with 8% level of water conservation)	140,500
Additional water conservation[a]	(26,500)
Recycled water	(4,500)
Total conjunctive use	109,500

[a] Gradual implementation of the 16 best management practices included in the Memorandum of Understanding Regarding Urban Water Conservation, described under "Water Conservation," is expected to increase the level of water conservation from 8% to a maximum of 25.6%. Conversion from 8% to 25.6% water conservation (1-0.256)/(1-0.08)= 0.809. Additional water conservation =Zone 40 Total Demand x (1-0.809)

Source: Sacramento County Water Agency 1998 and the 2002 Zone 40 Water Supply Master Plan Update (draft) (Montgomery Watson Harza 2002).

Water Supply

SCWA's primary sources of water for Zone 40 are its existing P.L. 101-514 CVP water supply contract, commonly known as the Fazio contract, an anticipated assignment of a portion of SMUD's existing CVP water supply contract, potential appropriative water rights on the American and Sacramento Rivers, potential transfers of water from areas within Sacramento Valley, and groundwater in the central County basin. Table 1-2 summarizes the total surface water supplies from these sources assumed for facility planning. Each of these sources is described below, following a brief summary of the Sacramento Area Water Forum Agreement, which sets the stage for some of the information presented later.

Table 1-2. Total SCWA Existing and Anticipated Surface Water Supplies[1]

Surface Water Entitlement	Estimated Long-Term Average Use[2]
P.L. 101-514 CVP water supply contract	12,500[3]
SMUD CVP contract assignments	25,500
Appropriated water	16,000
Other water supplies	14,500
Total long-term average use	68,500

[1] Long-term average use of each individual supply is subject to minor change resulting from refinement of CALSIM modeling runs for FRWP EIS/EIR. Total Long-Term Average Use will remain fixed at 68,500 AFA.

[2] Based on 73-year historical hydrology.

[3] 8,500 AFA to be diverted at SRWTP.

Sacramento Area Water Forum Agreement

Public agencies in the Sacramento area have been involved in a cooperative effort, known as the Sacramento Area Water Forum (Water Forum), designed to explore acceptable project alternatives that could bring additional high-quality water to Sacramento County, the City of Sacramento, and entities in Placer and El Dorado Counties. The common goal is to provide a safe, reliable water supply for the entire region while preserving fishery, wildlife, recreational, and aesthetic values along the lower American River.

The Water Forum is a diverse group of business and agricultural leaders, citizen groups, environmentalists, water managers, and local governments in the Sacramento area. In 1995, these groups were joined by water managers in Placer and El Dorado Counties. The members of the Water Forum developed a Water Forum Proposal for the effective long-term management of the region's water resources. The Water Forum Proposal was analyzed and reviewed in an EIR prepared and certified by the City and County of Sacramento. To signify approval of the Proposal, 40 Water Forum members signed the Water Forum Agreement in April of 2000.

To achieve the Water Forum goals, all signatories of the Water Forum Agreement are committed to support and, where appropriate, participate in seven elements of the agreement. These elements are:

- increased surface water diversions,
- actions to meet customers' needs while reducing diversion impacts on the lower American River in drier years,
- support for an improved pattern of fishery flow releases from Folsom Reservoir,

- lower American River habitat management,
- water conservation,
- groundwater management, and
- participation in Water Forum successor effort.

SCWA participated in the Water Forum process and is a signatory to the Water Forum Agreement. The Water Forum Agreement supports SCWA's pursuit of additional water supplies and includes SCWA's need for increased surface water diversions. SCWA's "Purveyor Specific Agreement" also commits it to certain limitations on its use of water supplies. SCWA agreed to divert surface water at or near the mouth of the American River or from the Sacramento River. It agreed to limit its maximum surface water diversions to 78,000 AFA within the South Municipal and Industrial Users Group Area in Zone 40. An additional area within Zone 40 that overlaps the City of Sacramento's American River Settlement Contract Place of Use is considered in the Water Forum Agreement. This area will need a long-term average of 9,300 AFA of surface water to meet its projected demand and up to 12,000 AFA in any single year. SCWA anticipates diverting up to 90,000 AFA (in any single year) to serve all of Zone 40. It also agreed to meet strict water conservation requirements specified in the Water Forum Agreement that are to be applied throughout the Sacramento region. In addition, the Water Forum Agreement sets the sustainable yield of the central County groundwater basin, from which SCWA pumps, at 273,000 AFA. Of that yield, SCWA expects to use a long-term average of approximately 41,000 AFA.

Central Valley Project Water Supply Contracts

In 1999, SCWA contracted with Reclamation for a CVP water supply under Public Law 101-514. This contract provides for the delivery of up to 22,000 AFA to meet the needs of Sacramento County, with up to 7,000 AFA of this amount delivered to the City of Folsom through a subcontract. Under this contract, SCWA is authorized to receive up to 15,000 AFA depending on actual water needs and provided that it fully uses existing water entitlements within Sacramento County, implements water conservation and metering programs within the contract service area, and implements programs to maximize the conjunctive use of surface water and groundwater. This contract provides for Reclamation to reduce deliveries by up to 25% from the contract maximum during years when low runoff limits CVP supplies.

Sacramento Municipal Utility District Central Valley Project Contract Assignments

The Sacramento Area Water Forum supports the development of water transfers and water contracts with existing entitlement holders. Consistent with the Water Forum Agreement, an agreement-in-principle has been signed between SMUD, the City of Sacramento, and SCWA. SMUD has an existing Reclamation contract. Under that contract, two assignments totaling 30,000 AFA of water would be made to SCWA. As part of the Water Forum Agreement, SCWA's Zone 40 would provide groundwater supply and delivery facilities to meet SMUD's dry-year water shortages.

The agreement to effectuate both assignments is currently being negotiated. The potential environmental effects of both assignments are undergoing CEQA environmental review and are addressed in this EIR/EIS. The quantity of water to be obtained under the SMUD assignment could be offset completely or in part by some or all of the other water supplies described below.

Appropriative Water Rights

On May 30, 1995, the Sacramento County Board of Supervisors approved the submittal of an application to the State Water Resources Control Board (SWRCB) for the appropriation of water from the American and Sacramento Rivers. The amount of water available would be determined after an evidentiary hearing before the SWRCB, wherein environmental and public interests will be balanced with SCWA's need for water. This water, estimated to be diverted at an average rate of 16,000 AFA, could be used in conjunction with existing groundwater supplies to increase long-term groundwater yields. This quantity of water could be offset completely or in part by some or all of the other water supplies described below. The potential environmental effects of using this supply are assessed in the EIR/EIS for the FRWP.

Other Water Supplies

As Zone 40 approaches buildout conditions in the future, more reliance on other sources of water or methods of supplementing groundwater yields will be necessary to comply with long-term average operational groundwater yield limitations while meeting build-out demand. Possible options for meeting this demand could involve the following actions:

- supplementing natural recharge with existing supplies during wet years,
- acquiring water through transfers from other water users upstream of SCWA diversion points,
- using the City of Sacramento's American River entitlements in that area of Zone 40 that is within the City's authorized American River Place of Use,
- using reclaimed water from the Sacramento Regional Wastewater Treatment Plant (SRWWTP)on an exchange basis, or
- acquiring additional appropriated water.

Water Conservation and Reclamation

Introduction

Section 10610.4 of the California Urban Water Management Planning Act specifies that “Urban Water Suppliers shall be required to develop water management plans to actively pursue the efficient use of available supplies.” The act became part of the California Water Code with the passage of Assembly Bill 797 in 1983. Various bills amended the act; the latest was Senate Bill 553 in 1999–2000. The amendments expanded the issues to be addressed in the Urban Water Management Plan.

The Act recognizes that water is a limited and renewable resource subject to ever-increasing demands and that conservation and efficient use of urban water supplies is a statewide concern. The Act also recognizes that planning for efficient use and implementation of those plans can best be accomplished at the local level.

Both SCWA and EBMUD participated in a statewide process of policy planning on conservation practices. This process culminated in 1991 with the drafting of the statewide Memorandum of Understanding (MOU) Regarding Urban Water Conservation, developed by the California Department of Water Resources (DWR) and the California Urban Water Conservation Council. The purpose of the MOU was to gain consensus among California urban water agencies and districts that long-term water conservation programs are viable means of reducing water demand and that conservation should be considered on an equal basis with other water management options (Montgomery Watson 1995).

Included in the MOU were best management practices (BMPs) developed by a group of water agencies, public interest groups, and other interested parties to achieve effective water conservation by urban users. SCWA and EBMUD, as well as other agencies, have signed the MOU. SCWA and EBMUD use water conservation as a component of their water supply plans to reduce the overall demand for water. Each agency has integrated water conservation efforts into estimates of demand for water in its service area, as described below for SCWA and later in the document for EBMUD.

SCWA Water Conservation Program

Water conservation is integrated into SCWA’s existing water demand assumptions. Consistent with the California Urban Water Management Planning Act, SCWA has prepared a comprehensive water conservation plan based on Reclamation guidelines. The plan describes the implementation process of the BMPs developed by the California Urban Water Conservation Council. By 2010, SCWA intends to phase in, for Zone 40, all of the BMPs listed in the MOU. SCWA first focused conservation efforts on requiring ultra-low-flow toilets and service connection meters on new construction, eliminating water waste, and ensuring low water use in nonresidential landscaping. To integrate the remaining BMPs by 2010, SCWA developed a schedule of implementation broken into three phases:

- Phase I included school education programs, conservation pricing for metered commercial users, and nonresidential landscape and indoor audits. This phase took place from 1996 through 1997.
- Phase II, currently underway, includes residential metering and billing based on metered usage for homes with meters already installed, as well as distribution system audits and repairs.
- Phase III, to be implemented in 2005–2010, includes:
  - retrofitting residential houses with meters where meters currently are not present,
  - billing based on metered usage,
  - auditing and retrofitting residential plumbing,
  - mandating replacement of non-ULF toilets upon transfer of ownership, and
  - providing financial incentives to encourage the purchasing of water conservation devices.

After all conservation phases are implemented, water conservation is expected to increase from the current 8% conservation level to a maximum conservation level of 25.6% consistent with the Water Forum Agreement.

Water Recycling

Water recycling relies on the use of treated wastewater. Recycled water is water that, as a result of treatment of waste, is suitable for a direct beneficial use or a controlled use that would otherwise not occur, and is therefore considered a valuable resource. The intent of using recycled water is to supplement existing potable water sources to meet future water demands and reduce demands for potable water supplies.

SCWA is implementing recycling activities in the western portion of Zone 40 and is investigating the potential to incorporate additional recycled water use into its long-term water supply management strategy. Currently, regulations limit the use of recycled water for certain purposes, such as the California Department of Health Services prohibition against using reclaimed water for domestic consumption. Water reclamation activities currently in use are integrated into the water demand assumptions described below and listed in Table 1-1.

Current projects, which use recycled water from the SRWWTP, will serve public landscaped areas such as parks and roadway medians in the Laguna and Franklin communities that are east of Interstate-5 (I-5) and south of Elk Grove Boulevard between I-5 and State Route (SR) 99. The potential to use additional recycled or remediated water throughout Zone 40 is being studied. Recycled water from the SRWWTP could be used to meet additional irrigation, nonresidential, commercial, and industrial demand in central Zone 40 and for either in-lieu groundwater recharge in agricultural areas or for artificial recharge. Remediated groundwater from the Aerojet and Boeing groundwater extraction and treatment activities could serve nonpotable uses in eastern Zone 40.

Comparison of Future Water Supply and Demand

The estimated net average water demand of approximately 109,500 AFA for the Zone 40 area will be supplied by a combination of groundwater and surface water. The long-term average groundwater use is projected to be 41,000 AFA. This is consistent with SCWA's allocation of the sustainable yield of the central county aquifer, as indicated in the Water Forum process. In dry years, there will be more reliance on groundwater because reductions in surface water supplies are expected to occur. Conversely, in wet years, when full surface water supplies are available, groundwater use can be reduced. The Water Forum stakeholders agreed that a supplemental surface water supply of up to 78,000 AFA is reasonable to meet the projected buildout demands of SCWA in Zone 40 in the "South County M&I Users Group" area. Up to an additional 12,000 AFA of surface water for Zone 40 outside this area will be needed. Thus, the maximum SCWA may divert in any single year could be up to 90,000 af in Zone 40. On the average, SCWA will require 68,500 AFA of surface water to meet Zone 40 water demands.

East Bay Municipal Utility District

EBMUD is a multipurpose, regional agency that serves as a water purveyor to an estimated 1.3 million municipal and industrial water users throughout portions of Contra Costa and Alameda counties in the East Bay region of the San Francisco Bay Area. No new water supply or storage has been added to the EBMUD system since 1964, during which time the population within its service area has grown by 250,000 people. EBMUD needs a supplemental water supply both to avoid water shortages during drought periods and to provide a supply during times when the Mokelumne River Basin supply is not available. Each is described below.

Need for the Project

When the original EBMUD system was planned in the early 1920s, the utility acquired rights to 200 million gallons per day (MGD) of water from the Mokelumne River. Pardee Dam was built to store that water during high river flows from spring snowmelt and rains. After World War II, the East Bay population grew rapidly, and EBMUD was granted water rights for another 125

MGD of Mokelumne River water. By the early 1960s, EBMUD was predicting more shortages as growth continued in the East Bay.

In 1964, completion of Camanche Reservoir below Pardee Reservoir provided more ways to regulate Mokelumne River flows. Camanche's 417,000-af capacity is used to meet agricultural and fishery needs on the lower Mokelumne River, provide flood control, and allows EBMUD to hold a larger supply of high-quality water in Pardee Reservoir. Briones Reservoir, north of Orinda, was also completed in 1964, and provides another 60,000 af of storage for water supplies in the East Bay.

Despite successful water conservation and water recycling programs, EBMUD's Mokelumne River supply is no longer sufficient to provide reliable water supplies during a drought without resulting in substantial economic impacts on its customers. Because EBMUD already has undertaken extensive conservation measures, it is more difficult to achieve additional water savings during droughts.

At the same time, demands on the Mokelumne River have increased. In 1996, EBMUD, in consultation with state and federal resources agencies, agreed to increase releases from Camanche Reservoir to provide higher flows for fish in the lower Mokelumne River and to contribute 20% (up to 20,000 af) of any actual yield from new water projects to Mokelumne River fishery flows.

The needs of new residential, business, and industrial customers within the EBMUD service area would be almost entirely offset in normal years by existing and planned conservation and water recycling projects. However, in drought years EBMUD's present supply is not sufficient to meet its needs, even with substantial rationing. Moreover, in the next 20 years increased diversions by senior water rights holders and increased flows for resource protection in the Mokelumne River and the San Francisco Bay/Sacramento–San Joaquin River Delta will decrease the available supply of water for the EBMUD service area.

Besides obtaining more water, EBMUD policies require a high-quality water source to meet customer expectations and, like other agencies throughout the state and nation, must meet increasingly stringent drinking water standards set by EPA and the California Department of Health Services. General agreement exists among water users and the regulatory community that the highest-quality water source provides the safest end product for municipal consumers. California drinking water quality laws and regulations set a tougher standard than federal law.

Need during Mokelumne Supply Outages

EBMUD needs a supplemental water supply not only to reduce deficiencies during droughts, but as an alternative supply in case of a catastrophic event or major maintenance at Pardee Dam or Reservoir. Currently, EBMUD is dependent on the Mokelumne River system to meet almost all of its customer needs. If Pardee Dam or Reservoir is damaged by a natural disaster or through other means, or if major scheduled repair or maintenance is required, most of EBMUD's water supply could be temporarily interrupted. EBMUD would be required to obtain its full needed supply from the terminal storage reservoirs in its service area. The amount of water available in these reservoirs is limited to only 138,000 af. Under current conditions, if the terminal reservoirs could not meet customer demand until the Pardee delivery facilities resumed operation, no other source of water would be available to EBMUD; its customers could experience severe shortages in supply. Use of terminal reservoir supplies also could substantially reduce the water supply available for use during subsequent dry seasons. Provision of a supplemental water supply that is not dependent on operation of Pardee facilities would reduce the risk of diminished supplies during emergencies or other facility shutdowns.

Water Demands

The anticipated water demands for EBMUD customers are described below. Water demands take into account the conservation and water recycling activities, described later in this chapter.

EBMUD experienced a rapid increase in water use between 1950 and 1970, with demand at 200–220 MGD in nondrought years after 1970. Sharp reductions in demand occurred as a result of cutbacks during the two most recent droughts, in 1976–1977 and 1987–1992. Lower demand levels in wetter years immediately following these droughts reflected changes in customer water use and success in implementing conservation practices. Although much of the drought management efforts in 1977 were aimed at short-term demand reductions in response to the drought, long-term reductions were realized because of structural changes, such as modification by industries of water-using equipment.

EBMUD's estimations of water demand over time are supported by two previous studies: the 1993 Updated Water Supply Management Project (WSMP) and the District-wide Update of Water Demand Projections (2000 Demand Study). Both the 1993 WSMP and the 2000 Demand Study based water demand projections on population growth. However, the 2000 Demand Study employed an improved method, basing projected demands on 17 different land use categories—5 residential and 12 nonresidential. This method allowed for a more detailed and potentially more accurate demand projection by breaking down the regional characteristics of land use categories and reflecting future land uses designated in adopted general and specific plans of cities and counties in the EBMUD service area. The 2000 Demand Study forecast a demand of 277 MGD by 2020, adjusted to 229 MGD when savings from conservation and recycled water programs were taken into account. Table 1-3 summarizes the water demand projections in 5-year increments.

Table 1-3. Projected Demand

	Demand in Millions of Gallons per Day, by Year				
	2000	2005	2010	2015	2020
Customer demand[a]	230	242	257	267	277
Adjusted for conservation[b]	(8)	(14)	(20)	(27)	(34)
Adjusted for recycled water[c]	(6)	(9)	(11)	(12)	(14)
Planning level of demand	216	219	226	228	229

[a] Demand taken from the 2000 Demand Study.

[b] Conservation water savings taken from the Water Conservation Master Plan 1999 Annual Report. Two MGD in 1999 and 34 MGD for 2020. Linearly interpolated into 5-year increments.

[c] Recycled water use was obtained from staff in the Office of Recycling and from Chapter 5 of the UWMP.

Source: East Bay Municipal Utility District 2001.

The increase in district-wide demand between 2000 and 2010 reflects the relatively rapid rate of development anticipated by many of the cities in the service area. The continued but slower increase in demand beyond 2010 reflects a more built-out service area, with changes in land uses resulting in higher densities of use (East Bay Municipal Utility District 2001). These results are consistent with projections in the 1993 updated WSMP, which forecast a 229-MGD demand for 2020 with conservation and recycling (East Bay Municipal Utility District 2001).

Water Supply

Approximately 95% of EBMUD's water supply is Mokelumne River water collected in Pardee Reservoir. The remaining estimated 5% of the supply is local runoff collected in terminal storage reservoirs owned and operated by EBMUD in its service area. EBMUD also has signed an amendatory contract with Reclamation for a supply of CVP water. All of these sources are described in greater detail below.

Mokelumne River System Water Supply

EBMUD has water rights and facilities to divert up to 325 MGD from the Mokelumne River, subject to the availability of Mokelumne River runoff and the prior water rights of other users. EBMUD's position in the hierarchy of Mokelumne River water users is determined by a variety of agreements between Mokelumne River water rights holders, the appropriative water rights permits and licenses that have been issued by the state, pre-1914 rights, and riparian rights. The following directly affect the amount of water available to EBMUD for diversion under its 325-MGD entitlement:

- upstream water use by prior right holders;
- downstream water use by riparian and senior appropriators, as well as other downstream obligations, including protection of public trust resources;
- drought, or less-than-normal rainfall, for more than a year; and
- emergency outage.

EBMUD is active in projects in the Mokelumne Basin that will improve management of the available water supply. One example is an agreement between EBMUD and Amador Water Agency that EBMUD will share in funding the Amador Water Transmission Project, with the primary objective of eliminating the current substantial leakage in the Amador Canal.

Pardee Dam and Reservoir

Mokelumne River water from the 575-square-mile watershed on the western slope of the Sierra Nevada is collected at Pardee Dam and Reservoir, 38 miles northeast of Stockton, near the town of Jackson. The reservoir has a maximum capacity of 197,950 af at spillway crest elevation. Pardee Reservoir is used principally for municipal water supply. Other uses include flood control, power generation, recreation, and water temperature management. Raw water from Pardee Reservoir is transported 91.5 miles to East Bay water treatment plants and terminal reservoirs through the Pardee Tunnel, the Mokelumne Aqueducts, and the Lafayette Aqueducts. EBMUD takes its full Mokelumne River allocation out of Pardee Reservoir. Water leaving Pardee Reservoir takes 30 to 45 hours, flowing by gravity, to reach the Bay Area.

Camanche Dam and Reservoir

Camanche Dam is located 10 miles downstream of Pardee Dam on the Mokelumne River. Capacity at the spillway crest elevation is 417,120 af. Camanche Reservoir, operated jointly with Pardee Reservoir, stores water for irrigation and streamflow regulation, thereby providing flood protection, water to meet the needs of downstream water rights holders, and water for fisheries and riparian habitat. Operation of Camanche Reservoir allows EBMUD to increase its deliveries from Pardee Reservoir to its East Bay service area.

Mokelumne Aqueducts

Raw water from Pardee Reservoir moves through the Pardee Tunnel to the three Mokelumne Aqueducts near Valley Springs in Calaveras County. The Mokelumne Aqueducts consist of three steel pipelines extending 82.2 miles from the Pardee Tunnel to the east end of two Lafayette Aqueducts in Walnut Creek. The Lafayette Aqueducts extend about 7.1 miles to Orinda. From Walnut Creek, the water is directed into three filter plants and/or to EBMUD's five terminal storage reservoirs. The system can operate at a maximum of 200 MGD under gravity flow. By operating the Walnut Creek Pumping Plant, aqueduct capacity can be increased to 326 MGD.

Terminal Storage Reservoirs

EBMUD maintains five terminal reservoirs in its East Bay service area: Briones, Chabot, Lafayette, San Pablo, and Upper San Leandro Reservoirs. These reservoirs are used for several functions:

- to regulate EBMUD's Mokelumne River supply in the winter and spring—Mokelumne River water is stored in winter and spring, when Sierra Nevada runoff occurs and demand is low, for use during the high-demand period in summer.
- to augment EBMUD's water supply with local runoff—storm runoff is collected and stored from the reservoir watersheds.
- as emergency sources of supply in case of extended drought or damage to tunnels, pumping plants, or aqueducts.
- for environmental and recreational benefits to the communities of the East Bay—the 26,000 acres of watershed land on which these reservoirs are located provide open space and water-related recreational opportunities.

Two of the terminal reservoirs, Upper San Leandro and San Pablo Reservoirs, convey water to three treatment plants that serve the northern and southern portions of the EBMUD distribution system west of the Oakland–Berkeley Hills. These two reservoirs and a third, Briones Reservoir, are used to store water before treatment and to further regulate the Mokelumne River supply to provide emergency water and store local runoff. The remaining two reservoirs, Lafayette and Chabot Reservoirs, are reserved for emergency standby supply and, along with San Pablo Reservoir, are used extensively for recreation.

Capacities of the terminal reservoirs are listed in Table 1-4. Together, the terminal reservoirs have a usable capacity of approximately 138,000 af.

Table 1-4. Terminal Reservoir Characteristics

Reservoir	Capacity (TAF)	Water Sources
Briones	60.5	Mokelumne Aqueducts, Bear Creek
Chabot	10.4	Mokelumne Aqueducts, San Leandro Creek, Upper San Leandro Reservoir
Lafayette	4.3	Lafayette Creek [a]
San Pablo	38.6	Mokelumne Aqueducts, San Pablo Creek, Bear Creek, Briones Reservoir
Upper San Leandro	41.4	Mokelumne Aqueducts, San Leandro Creek and tributaries

[a] The raw water line for the Mokelumne Aqueducts was disconnected from the Lafayette Reservoir in 1971.

TAF = thousand acre feet

Source: East Bay Municipal Utility District 2001.

Bixler Emergency Pumping Plant

EBMUD facilities also formerly included the Bixler Emergency Pumping Plant (Bixler), located in Werner Dredger Cut, Mile 2.9 (Indian Slough), approximately 5 miles east of Brentwood. Completed in 1989, the Bixler facility was intended for emergency purposes when EBMUD's normal water supply was disrupted or inadequate to meet customer needs. On February 22, 1989, the Corps issued a permit with an expiration date of December 31, 1989, to operate Bixler. Bixler was never operated and the permit expired. Subsequently, permits were renewed twice, with the last renewal expiring on December 31, 1993. These facilities have been dismantled and are no longer operational.

Existing East Bay Municipal Utility District–Reclamation Amendatory Water Service Contract

In 1970, EBMUD signed a water services contract with Reclamation, which administers the CVP, for the delivery of American River water from the Folsom South Canal. In 2001, this contract was amended to provide for delivery of water from three possible diversion points, with defined water amounts for each location. At Freeport on the Sacramento River, EBMUD can take delivery of up to 133,000 af of American River water annually, not to exceed a total of 165,000 af in a 3-consecutive-year period of drought in any year when EBMUD's total system storage is forecast to be below 500,000 af. At Site 5 on the American River (upstream of I-5 crossing), as defined in the December 2000 EIS for the Amendatory Contract, and from the Folsom South Canal diverting water from the Nimbus Dam, EBMUD can take delivery of up to 150,000 af annually. The contract details the required conditions specific to each diversion point that must be met before taking delivery of the entitled water.

EBMUD has been paying for water under the contract since shortly after signing the original water services contract with Reclamation in 1970, although only a very small quantity of water has been delivered under the contract.

Water Conservation

Introduction

The information in this section was taken primarily from the UWMP (East Bay Municipal Utility District 2001). This document is available for inspection at EBMUD's headquarters in Oakland, California. EBMUD also participates extensively in statewide water conservation planning efforts. (See the introduction to the Water Conservation section under SCWA for information.)

EBMUD has been a leader in water conservation for more than 30 years and currently supports one of the largest and most comprehensive demand management programs in California. EBMUD adopted UWMPs in 1985, 1991, 1996, and 2000. The latest UWMP is a revision and update of the 1996 adopted plan. It was designed not only to satisfy the requirements of the California Urban Water Management Planning Act but also to provide the public with an account of EBMUD's efforts in conservation and water recycling (East Bay Municipal Utility District 2001).

EBMUD's water conservation programs address both supply and demand. Demand-side conservation programs improve customer water-use efficiency and include incentives, education, support, and regulation. Supply-side water conservation programs improve water-use efficiency before or after use by the customer, and include distribution-system leak detection, repair programs, and water recycling programs.

For fiscal years 1990 through 2000, EBMUD dedicated $26.1 million toward the operating and capital expenses of its water conservation program. More information on EBMUD's efforts to promote both demand-side and supply-side conservation is provided in this section.

Demand-Side Water Conservation

In October 1993, the EBMUD Board of Directors (Board) approved the updated WSMP, which set a conservation goal of 33 MGD for 2020. The Board directed staff to prepare a Water Conservation Master Plan (WCMP) and to report annually on the status of the conservation program. The WCMP was designed to meet 2020 water savings goals through a cost-effective conservation program while maintaining EBMUD's long-standing emphasis on voluntary conservation by customers. The WCMP was adopted in May 1994, and a pilot program was implemented. The programs defined in the WCMP were projected to save 16 MGD. An additional 17 MGD was expected to result from "natural replacement," the installation of conservation hardware such as toilets, showerheads, and faucets independent of an EBMUD program. In 1998, the water savings goal was increased to 34 MGD to offset demand from anticipated annexations to EBMUD's service area.

An evaluation of the pilot program effort (over three years) determined that the conservation program was not on target to meet the 2020 water savings goals. Five alternative programs were presented to the Board, and one program, which increased the conservation budget by 86% and staffing by 46%, was approved in 1999. This expanded program was designed to meet the 2020 goals.

Incentives are part of EBMUD's demand-side conservation program to improve customer water-use efficiency. Incentives include residential, industrial, commercial, and institutional audit and rebate programs; water-saving device distribution programs; and education and outreach activities, including publications, presentations, community events, and displays.

As part of current planning efforts, and through the development of the WCMP, EBMUD continues to participate in a statewide process of policy planning on conservation practices. BMPs to achieve effective water conservation by urban users were developed by a group of water agencies, public interest groups, and other interested parties. The statewide MOU to implement the BMPs was signed by EBMUD in 1993. EBMUD is in full compliance with the MOU.

Supply-Side Conservation

EBMUD's water distribution system includes more than 3,980 miles of pipeline. The pipelines are vulnerable to leaks, corrosion, and other damage or water loss. EBMUD has two crews equipped with electronic sound detection equipment that survey approximately 300 miles of pipeline per year for leaks. Systematic replacement of troublesome pipes, cathodic protection, and improved leak detection methods have stabilized the leak rate, indicating that the overall system rate of deterioration is not increasing with time. EBMUD's Pipeline Replacement Program documents main failure through the maintenance and evaluation of leak records. Recurring leaks on any segment of pipeline trigger an economic evaluation that compares the cost of replacement to the present worth of projected costs associated with continued maintenance of the pipeline. EBMUD's current goal is a renewal rate of 10 miles per year. The estimated water saved as a result of the leak detection program ranges from 0.5 to 1.5 MGD each year.

EBMUD's corrosion control program encompasses the Mokelumne Aqueducts, distribution piping, and facilities, and has effectively reduced corrosion-related deterioration of EBMUD's infrastructure, resulting in substantial leak reduction and savings of water.

Recycled Water

EBMUD completed a draft Water Reclamation Master Plan in 1991. The District currently has six recycled water projects in place, which result in savings of approximately 6 MGD of potable water. Future water recycling efforts are expected to reduce demands on potable water by an additional 8 MGD. The six existing projects use wastewater from four treatment facilities owned and operated by three different utilities in EBMUD's service area, and were selected because they are cost effective.

In addition to the fact that recycled water is essentially a drought-proof supply, there are economic incentives for current customers to convert from potable to recycled water. Current EBMUD policy is that the District will pay for customer retrofits to convert a potable water system to a recycled water system if determined to be cost-effective. In addition, recycled-water customers are not subject to the 4% Seismic Improvement Program surcharge or to any drought surcharge that the EBMUD Board might impose.

For fiscal years 1990 through 2000, EBMUD spent $89.4 million on the operating and capital expenses related to its recycled water program.

Future Recycled Water Projects

As part of the WSMP, seven geographical areas or Water Reuse Zones were established within EBMUD's ultimate water service boundary, based on water supply and demand locations. The zones also were established based on proximity to existing supply sources. The wastewater treatment plants that were identified as feasible sources of recycled water for each Water Reuse Zone are listed in Table 1-5. Recycled water projects were proposed for each of the seven Water Reuse Zones. (The recycled water project in Zone G, which provided irrigation water for California Department of Transportation (Caltrans), is no longer in operation.) Project objectives include maximizing the volume of recycled water delivered to meet customer demands for irrigation, commercial, and industrial uses while maintaining economic feasibility.

Table 1-5. Recycled Water Supply for Each Water Reuse Zone

Water Reuse Zone Designation	Water Reuse Zone	Recycled Water Supply Source
A	Oakland/Berkeley	EBMUD's Main Wastewater Treatment Plant
B	San Leandro/Alameda	San Leandro Water Pollution Control Plant
C	Hercules/Pinole/Rodeo	Rodeo/Hercules/Pinole Joint Outfall
D	Richmond	West County Wastewater District
E	San Ramon Valley	Dublin San Ramon Services District Wastewater Treatment Plant
F	Central Contra Costa	Central Contra Costa Sanitary District
G	Castro Valley	Livermore–Amador Valley Wastewater Management Agency Export Facilities

EBMUD has two water recycling projects scheduled for implementation before 2010. The East Bayshore Recycled Water Project is currently under construction and the San Ramon Valley Recycled Water Project is in the design phase.

Also, EBMUD has four water recycling projects in the planning stage. These projects are the Franklin Canyon Project (Phases I and II), the Lamorinda Project (Phase I), the San Leandro Expansion Project (Phase III), and the North Richmond Water Reclamation Plant (NRWRP) Expansion Project.

Table 1-6 summarizes the projected demands for recycled water for existing and proposed recycled water projects through 2020.

Table 1-6. Projected Quantity of Recycled Water Needed for Existing and Proposed Projects

	Recycled Water Needs in MGD, by Year				
Project	2000	2005	2010	2015	2020
Existing Projects					
EBMUD Main Wastewater Treatment Plant	1.9	1.9	1.9	1.9	1.9
Richmond Country Club	0.15	0.15	0.15	0.15	0.15
Metropolitan Golf Links	0	0.16	0.16	0.16	0.16
Chuck Corica Golf Complex	0.36	0.36	0.36	0.36	0.36
Harbor Bay Parkway	0.02	0.02	0.02	0.02	0.02
Caltrans I-580 and I-880	0.04	0.0	0.0	0.0	0.0
Chevron Refinery (3 cooling towers)	3.4	3.4	3.4	3.4	3.4
Subtotal of Existing Projects	*5.87*	*5.99*	*5.99*	*5.99*	*5.99*
Proposed Projects					
Lamorinda	0	0	1.0	1.0	1.0
San Ramon Valley Phases I and II	0	1.1	2.4	2.4	2.4
East Bayshore Phases IA, IB, and II	0	0.7	2.2	2.5	2.5
San Leandro Phase III	0	0	0	0.8	0.8
Franklin Canyon Phases I and II	0	0	0	0	0.3
NRWRP Expansion Project	0	0	1.0	1.0	1.0
Subtotal of Proposed Projects	*0*	*1.1*	*6.6*	*7.7*	*8.0*
Total	**5.87**	**8.73**	**11.73**	**12.43**	**13.99**

Mokelumne Water Supply Reliability

EBMUD's existing system reliability is discussed in detail in Appendix A to this EIR/EIS. EBMUD's experiences during recent droughts demonstrate that its water supply system is not sufficiently reliable to provide safe, continuous water service during droughts.

`The District's "Water Supply Availability and Deficiency" policy limits drought demand reductions to no more than 25%. This drought rationing level is imposed in addition to the District's long-term conservation and reclamation programs that are projected to save 48 MGD every year, reducing 2020 demand levels from 277 MGD to 229 MGD. Instead of immediately imposing 25% rationing whenever dry periods occur or postponing action until drought conditions are severe and supplies severely depleted, the District has developed guidelines that call for increasing amounts of rationing as supplies become increasingly diminished. By imposing some rationing in early years of potentially prolonged drought periods, the necessity of more severe rationing in subsequent years is minimized. These guidelines are shown in Table 1-7 below.

Table 1-7. Drought Management Program Guidelines

Drought Stage	Projected End-of-September Total System Carryover Storage	Reduction Goal
None	500 TAF or more	None
Moderate	500–450 TAF	0 to 15%
Severe	450–300 TAF	15 to 25%
Critical	300 TAF or less	25%

Source: East Bay Municipal Utility District 2001

In a span of 17 years between 1976 and 1992, EBMUD experienced the most extreme two-year drought and the most extreme six-year drought since records of precipitation and runoff have been kept for the Mokelumne basin. During the 47 years prior to 1976, the Mokelumne River was able to meet the full water supply demand of District customers in every year. In contrast, the District has had to ration customers in 6 of the 27 years since 1976.

The worst drought event in EBMUD's history was the 1976–1977 drought, when runoff was only 25% of average and total reservoir storage decreased to 39% of normal, despite EBMUD's customers' 39% rationing efforts (Figure 1-2). During this drought, the critically dry year of 1977 was followed by a very wet year (1978), allowing the system to recover rapidly. However, at the end of the 1977 water year, in September 1977, EBMUD could not know how much precipitation and runoff would occur the next year. Thus, EBMUD, as well as all other water suppliers in the State, could not allow its storage to become fully depleted at the end of 1977 in anticipation of plentiful water the following year. Had it done so, and if 1978 had turned out to be a third dry year, EBMUD would not have had sufficient water to meet its needs or its downstream obligations.

While 1976–1977 was the worst drought on record, it is prudent to assume that a similar event will occur at some time in the future but without a very wet year like 1978 immediately following it. To plan for the possibility of such an event in the future, EBMUD has developed a three-year drought planning sequence. The first and second years of this drought planning sequence have the same runoff as occurred in 1976 and 1977, respectively. Although the District could have assumed that the third year runoff could have been as low as the second year (i.e. use the historic low of 1977 runoff of 129 TAF), it instead assumed a higher runoff by averaging the first and second year, which results in the third-year amount of 185 TAF. It was further assumed that such a severe drought would not continue beyond the third year of this sequence and that all accessible water in storage in EBMUD water supply system, including all water in its East Bay Reservoirs, would be depleted by the end of the third drought year. Therefore, the minimum storage level under this planning event is equal to the aggregate total amount of EBMUD's inaccessible, or dead, storage of 35.4 TAF.

Given the degree of uncertainty in calculating drought probabilities, the lack of redundancy in the EBMUD water supply system, and the inability to predict the end of droughts during real-time events, EBMUD selected the drought planning sequence described above for long term water supply reliability planning. This long-term planning process, however, should not be construed to eliminate the immediate need for supplemental water based on actual historical conditions. In recent years, the Mokelumne River supply has not been sufficient to meet even existing needs during droughts without rationing. After comparing water supply reliability planning approaches taken by other California water agencies, and after exhaustive studies of its own system reliability, EBMUD concludes that prudent planning requires it to obtain a supplemental source of water to provide a reliable water supply for meeting future drought conditions. Based on its long term water supply planning the District has determined that a supplemental supply of 185 TAF would be sufficient to meet the District's water supply needs during dry periods, taking into account implementation of the District's expanded conservation and reclamation programs. This determination also assumes implementation of emergency water use–reduction programs during droughts to reduce demand by an additional 25%. The earlier a supplemental water supply is delivered during a drought, the more effective it becomes for water supply purposes. The District's long-term supplemental supply needs are tabulated in Table 1-8 below.

Table 1-8. Supplemental Supply Needs

Type of Need	Supplemental Supply
For consumptive use reliability	109 TAF
For public trust resources	33 TAF
For public trust gainsharing	20 TAF
Inability to achieve full 25% rationing in first drought year	13 TAF
For increased evaporation	10 TAF
Total	**185 TAF**

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Figure 1-2
Pardee Reservoir on March 25, 1977
with 47,000 Acre-Feet in Storage

Organization of EIR/EIS

This EIR/EIS is organized in the following sections:

- Chapter 1, Purpose of and Need for the Freeport Regional Water Project;
- Chapter 2, Project Description;
- Chapter 3, Hydrology, Water Supply, and Power;
- Chapter 4, Water Quality;
- Chapter 5, Fish;
- Chapter 6, Recreation;
- Chapter 7, Vegetation and Wetland Resources;
- Chapter 8, Wildlife;
- Chapter 9, Geology, Soils, Seismicity, and Groundwater;
- Chapter 10, Land Use;
- Chapter 11, Agricultural Resources;
- Chapter 12, Traffic and Transportation;
- Chapter 13, Air Quality;
- Chapter 14, Noise;
- Chapter 15, Public Health and Safety;
- Chapter 16, Visual Resources;
- Chapter 17, Cultural Resources;
- Chapter 18, Programmatic Evaluation of a Groundwater Banking/Exchange Component to the Freeport Regional Water Project;
- Chapter 19, Cumulative Effects
- Chapter 20, Growth-Related Effects;
- Chapter 21, Impact Conclusions;
- Chapter 22, Consultation and Coordination;
- Chapter 23, References; and
- Chapter 24, List of Preparers.

Chapter 2

Project Description

Chapter 2
Project Description

Project Background

EBMUD, SCWA, and Reclamation have agreed to jointly pursue development of a regional project to divert water from the Sacramento River. The FRWP is being proposed by FRWA, a joint powers agency formed under state law by SCWA and EBMUD, to construct and operate a water supply project to meet regional water supply needs.

Project Purpose and Objectives

The FRWP is intended to contribute to meeting the objectives of FRWA. The primary purposes and objectives of the project are to:

- support acquisition of additional SCWA surface water entitlements to facilitate efficient conjunctive use of groundwater in its Zone 40 area, consistent with the Sacramento Area Water Forum Agreement and County of Sacramento General Plan policies;
- provide facilities through which SCWA can deliver existing and anticipated surface water entitlements to its Zone 40 area;
- provide facilities through which EBMUD can take delivery of a supplemental supply of water that would substantially meet its need for water and reduce existing and future customer deficiencies during droughts; and
- improve EBMUD system reliability and operational flexibility during droughts, catastrophic events, and scheduled major maintenance at Pardee Dam or Reservoir.

Project Facility Components

The project consists of one or more of the following new components, which are identified in Table 2-1 and described in detail in the alternatives:

- a 185 MGD–capacity intake facility (Freeport Intake Facility) and pumping plant located on the Sacramento River near the community of Freeport;
- a reservoir and a water treatment plant (known as the Zone 40 Surface Water Treatment Plant [WTP]) located in central Sacramento County;
- a terminal facility located at the point of delivery to the Folsom South Canal (FSC);
- a canal pumping plant located at the FSC terminus;
- a series of settling basins;
- an aqueduct pumping plant and pretreatment facility situated near the Mokelumne Aqueducts/Camanche Reservoir area;
- four pipelines carrying the water from the intake facility to the Zone 40 Surface WTP and to the Mokelumne Aqueducts:
    - a 185 MGD–capacity (84-inch) pipeline from the intake facility to the turnout to the Zone 40 Surface WTP,
    - an 85 MGD–capacity (60-inch) pipeline from the turnout to the Zone 40 Surface WTP,
    - a 100 MGD–capacity (66-inch) pipeline from the turnout to FSC, and
    - a 100 MGD–capacity (66-inch) pipeline from the terminus of the FSC to the Mokelumne Aqueducts.

The FSC, Mokelumne Aqueducts, and Pardee Reservoir are additional, existing facilities that would be used and, under some alternatives, modified to meet the project objectives. The existing Pardee Reservoir would be modified to create the enlarge Pardee Reservoir component, which would include the following:

- replacement of the existing concrete dam and spillway, powerhouse, and saddle dams;
- modifications to the existing intake tower and Pardee Tunnel;
- a new pressure reduction facility;
- relocation of existing roads and bridges, including the SR 49 bridge, Pardee Dam Road, and Stony Creek Road;
- removal of the existing Middle Bar Bridge and construction of fishing piers;
- relocation of utilities; and
- replacement of the existing Pardee Reservoir recreation areas.

Table 2-1. Freeport Regional Water Project Components

Component	Segments	Action Alternative/Option 2	3	4	5	6	Figure	Location
Freeport intake facility (185 MGD capacity bank intake facility and pumping plant)		X	X	X	X	X (Size of facility reduced)	2-1, 2-4, 2-5	6,500 feet upstream from the Freeport Bridge on the left bank of Sacramento River
On-site settling basins		X	X	X	X	X (Size of basins reduced)	2-6	At intake facility site
Pipeline from Freeport intake facility to Zone 40 Surface WTP turnout (185 MGD capacity (84-inch) raw water pipeline)	A, B, C, D, E, F (or Option 2), G, H, I	X	X				2-1	From intake facility northeast to Freeport Boulevard, east to I-5; from Freeport Boulevard north to Meadowview Road, east and southeast across Franklin Boulevard to Mack/Power Inn Road intersection; from Mack/Power Inn Road intersection east to Elsie Road, north at Elsie/Wilbur Way intersection to Gerber Road/Wilbur Way intersection (or from Mack/Power Inn Road intersection north to Gerber Road, east to Gerber Road/Wilbur Way intersection); from Gerber Road/Wilbur Way intersection east to Gerber/Bradshaw Road intersection
	A, P, Q, R (or Option 1), S, T, U, F (or Option 2), G, H, I			X	X	X (Size of pipeline reduced to 60-inch)	2-1	From intake facility northeast to Freeport Boulevard, east to I-5; from I-5 south to I-5/proposed future extension of Cosumnes River Boulevard intersection; from I-5 east along the proposed Cosumnes River Boulevard extension to UPRR/Morrison Creek crossing (or from I-5/proposed future extension of Cosumnes River Boulevard intersection south to Bufferlands levee, east along levee to UPRR/Morrison Creek crossing); from UPRR/Morrison Creek crossing east along proposed Cosumnes River Boulevard extension to Franklin Boulevard, east on existing Cosumnes River Boulevard to Bruceville Road, northeast crossing Highway 99 to Power Inn Road/Stockton Boulevard intersection, north on Power Inn Road to Power Inn/Mack Road intersection; from Mack/Power Inn Road intersection east to Elsie Road, north at Elsie/Wilbur Way intersection to Gerber Road/Wilbur Way intersection (or from Mack/Power Inn Road intersection north to Gerber Road, east to Gerber Road/Wilbur Way intersection); from Gerber Road/Wilbur Way intersection east to Gerber/Bradshaw Road intersection

Component	Segments	Action Alternative/Option 2	3	4	5	6	Figure	Location
Pipeline from turnout to the Zone 40 Surface WTP (85 MGD capacity (60-inch) pipeline)	WTP pipeline only, segment depends on WTP site	X	X	X	X	X	2-1	From Gerber/Bradshaw Road intersection to WTP
Zone 40 Surface WTP		X	X	X	X	X	2-1, 2-10	An 80-100 acre parcel located somewhere between Elder Creek Road on the north, Gerber Road on the south, Bradshaw Road on the west, and Excelsior Road on the east
Pipeline from Zone 40 Surface WTP turnout to FSC (100 MGD capacity (66-inch) pipeline)	J, K	X		X			2-1	From turnout east along Florin Road to FSC
	L, M, N, O		X		X		2-1	From turnout east along Gerber Road to terminus, east cross country to Grant Line Road intersection, northeast on Grant Line Road to FSC
Terminal Facility		X		X			2-1, 2-11	At high point of the pipeline between the Zone 40 Surface WTP and the FSC , approximately 30 feet off the side of the Florin Road right-of-way east of the intersection with the FSC
			X		X		2-1, 2-11	At high point of the pipeline between the Zone 40 Surface WTP and the FSC, within the Gerber Road right-of-way east of the intersection with Grant Line Road
Optional terminal facility settling basin – if FSC is not used for sediment management		X		X			2-11	Florin Road
			X		X		2-11	Gerber Road right-of-way
Pipeline from FSC to the Mokelumne Aqueducts (100 MGD capacity (66-inch) pipeline)	V, W (or Option 3), X	X	X	X	X		2-2	From FSC terminus east to Clay Station Road, south to along Clay Station Road and Elliott Road, east on Liberty Road to just east of Liberty Road/Hwy 88 intersection (or from Clay Station/Angrave Road intersection east to Dry Creek, southeast along PG&E transmission line ROW to Hwy 88, southeast to Liberty Road); from Liberty Road southeast to East Buena Vista Road, south across the Mokelumne River to Hwy 12, south to Acampo, south to the Mokelumne Aqueducts
Canal Pumping Plant		X	X	X	X		2-2, 2-12	At terminus of FSC, at the connection to the pipeline from FSC to the Mokelumne Aqueducts

Table 2-1. Continued

Component	Segments	Action Alternative/Option 2	3	4	5	6	Figure	Location
Aqueduct Pumping Plant and Pretreatment Facility		X	X	X	X		2-2, 2-13	Camanche site (assumed location for alternatives): Just west of the Camanche Reservoir dike, along the pipeline from FSC to the Mokelumne Aqueducts
							2-2, 2-13	Optional Brandt site: At terminus of the pipeline from FSC to the Mokelumne Aqueducts, at connection to Mokelumne Aqueducts
Enlarge Pardee Reservoir (Enlarging the reservoir would include additional components, such as a replacement dam, new powerhouse, new saddle dams, etc.)						X	2-3	At Pardee Reservoir and the area surrounding the reservoir

Project Alternatives

CEQA/NEPA Requirements

CEQA and NEPA generally require consideration of a range of alternatives to a proposed project that would feasibly attain most of the basic project objectives and accomplish the project purpose and need while avoiding or substantially lessening project impacts. The purpose of alternatives is to offer a reasoned choice in making the decision whether to proceed with the project or action. Alternatives may include on-site or off-site alternatives. The CEQA/NEPA analysis must also include an analysis of the no-project or no-action alternative.

CEQA requires that the lead agency consider alternatives that would avoid or reduce one or more of the significant impacts identified for the project in an EIR. The State CEQA Guidelines state that the range of alternatives required to be evaluated in an EIR is governed by the "rule of reason"; the EIR needs to describe and evaluate only those alternatives necessary to permit a reasoned choice and to foster informed decision making and informed public participation (Section 15126.6[f]). Consideration of alternatives focuses on those that can either eliminate significant adverse environmental impacts or reduce them to less-than-significant levels; alternatives considered in this context may include those that are more costly and those that could impede to some degree the attainment of all the project objectives (Section 15126.6[b]). CEQA does not require the alternatives to be evaluated in the same level of detail as the proposed project.

Similarly, the Council on Environmental Quality regulations for implementing NEPA (40 CFR 1502.14) requires all reasonable alternatives to be objectively evaluated in an EIS. Alternatives that cannot reasonably meet project objectives need be evaluated only to the extent necessary to allow a complete and objective evaluation and a fully informed decision by the lead agency. An EIS must briefly describe alternatives to the proposed action where there exist unresolved resource conflicts. NEPA does not require alternatives to offer some environmental benefit over the proposed action; however, neither does it discourage consideration of alternatives with lesser effects. NEPA requires that alternatives be evaluated in the same level of detail (40 CFR 1502.14[b]). Alternatives considered but eliminated because they were found to be impracticable for meeting the project objectives are summarized at the end of this chapter under "Alternatives Considered but Not Included in Detailed Analysis."

Alternatives Screening

To comply with the CEQA and NEPA regulations described above, FRWA prepared an Alternatives Screening Report (Volume 2, Appendix B) describing the process by which alternatives have undergone screening as part of the identification of practicable alternatives for the project.

Project Alternatives

The following alternatives were identified during the screening process as capable of meeting the project purpose and objectives and are fully evaluated in this EIR/EIS:

- Alternative 1: No Action
- Alternative 2: Freeport Intake Facility to Mokelumne Aqueducts—Along the Meadowview/Mack/Gerber/Florin Alignment
- Alternative 3: Freeport Intake Facility to Mokelumne Aqueducts—Along the Meadowview/Mack/Gerber Alignment
- Alternative 4: Freeport Intake Facility to Mokelumne Aqueducts—Along the Cosumnes River/Power Inn/Gerber/Florin Alignment
- Alternative 5 (Preferred Alternative): Freeport Intake Facility to Mokelumne Aqueducts—Along the Cosumnes River/Power Inn/Gerber Alignment
- Alternative 6: Freeport Intake Facility to Zone 40 Surface WTP/Enlarge Pardee Reservoir

The five action alternatives—Alternatives 2, 3, 4, 5, and 6—would meet the project objectives of both FRWA member agencies. Alternatives 2, 3, 4, and 5 would carry water from the intake facility on the Sacramento River to SCWA's Zone 40 Surface WTP and to EBMUD's Mokelumne Aqueducts. Figure 2-1 shows the pipeline alignments from the intake facility to the FSC, and Figure 2-2 shows the pipeline alignments from the FSC to the Mokelumne Aqueducts. In addition, there are optional locations or segments for some project components. These are identified in Table 2-1 and illustrated in Figures 2-1 and 2-2.

Alternative 6 would carry water from an intake facility on the Sacramento River solely to SCWA's Zone 40 Surface WTP and would enlarge the existing Pardee Reservoir to deliver additional water to EBMUD's Mokelumne Aqueducts to meet EBMUD's objectives. Figure 2-3 shows the general modifications to Pardee Dam and Reservoir.

To identify potential alignments for the pipeline, FRWA evaluated numerous alignment segments that could be used to create a complete alignment alternative. Each of these alignment segments was evaluated in a non-cost rating process for environmental and other factors and assigned an overall rating of "neutral," "less favorable," or "more favorable." Evaluation rating categories included the potential for the various segments to have environmental effects on water quality, fisheries, recreation, vegetation and wetlands, wildlife, geology and hydrology, air quality, noise, land use, transportation, public health and safety, and visual

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Figure 2-1
Pipeline Alignments from the Freeport Intake Facility to the Zone 40 Surface WTP / Folsom South Canal

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Figure 2-2
Pipeline Alignments from the Folsom South Canal to the Mokelumne Aqueducts

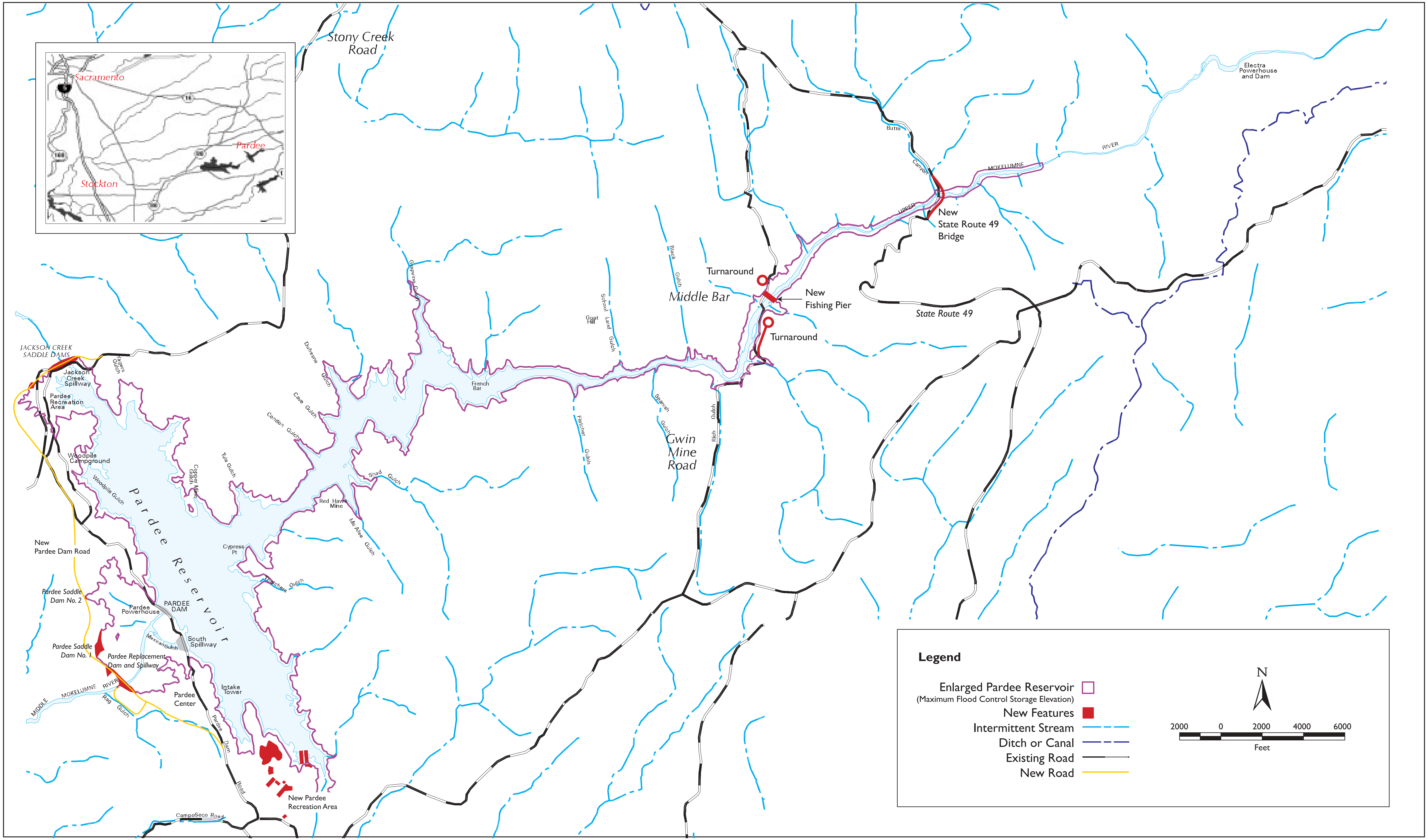

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Figure 2-3
Enlarged Pardee Reservoir

and cultural resources, as well as engineering and right-of-way feasibility. The alignments ultimately selected to create the alternatives carried forward for analysis were those that minimized environmental impacts to the extent possible, and were feasible from an engineering design, construction, and cost standpoint.

Four sites were investigated for construction of the intake facility (Figure 2-1). Technical investigations indicated that the intake facility would have to be located at a place where the river is relatively deep and where sufficient land is available. Environmental and cost factors were also considered. Two of the sites were determined not feasible because the river was not sufficiently deep and relocation of well-traveled roads would be required. Furthermore, these sites would have required construction of a more costly pier or in-river structure rather than a bank-side structure. A third site, although sufficient for a bank-side structure and advantageous regarding its location relative to the SRCSD outfall, was eliminated because it would require substantially more money to construct a long pipeline and relocate a levee road.

A single intake location was determined to meet project objectives and other engineering and environmental considerations. The site chosen for the intake facility is in the City of Sacramento on the left bank of the Sacramento River, approximately 6,500 feet upstream of the Freeport Bridge and the town of Freeport, California (Figure 2-1). The site would require construction of ballast storage ponds at the Zone 40 Surface WTP to store a quantity of untreated water sufficient to keep the Zone 40 Surface WTP operating through outages. Outages may be necessary during reverse flow conditions to ensure that effluent from Sacramento Regional County Sanitation District (SRCSD) discharges and City of Sacramento stormwater discharges do not enter the system.

Preferred Alternative

FRWA and Reclamation have identified Alternative 5 as the preferred alternative. The selection was made based on Alternative 5's ability to fully meet the project purpose and objectives, engineering and economic feasibility, minimization of environmental impacts, and input received during the public scoping process.Additionally, the selection of Alternative 5 as the preferred alternative is based on the conclusions of the impact analysis presented in Chapters 3 through 20.

Environmentally Superior Alternative

Alternative 5 is environmentally superior. While there are many similarities between the environmental impacts associated with Alternatives 2 through 5, Alternative 5 is preferred because it minimizes construction-related impacts associated with traffic, air quality, and noise and is the most consistent with community input received during the public scoping process. Alternatives 2 through 5 are identical with regard to hydrology, water supply, and power; water quality; and fish; and generally have fewer impacts on reservoir levels, river flows, and water temperatures than Alternative 6. Although the No Action Alternative would cause fewer direct environmental impacts, it would not meet the purpose and need or objectives of the proposed project.

Alternative 1: No Action

If the project were not implemented, the project components described below, including the intake facility, pipeline, pumping, and treatment facilities, would not be built. SCWA would divert its existing Fazio entitlement through City of Sacramento facilities based on existing agreements with the City of Sacramento. EBMUD would not divert water from the Sacramento River, nor would EBMUD enlarge Pardee Reservoir.

Alternative 2: Freeport Intake Facility—with the Meadowview/Mack/Gerber/Florin Pipeline Alignment

Alternative 2 represents a water supply project for achieving the identified water delivery needs of the FRWA. The design capacity of the system is 185 MGD. Up to 85 MGD of water would be diverted under Sacramento County's existing Reclamation water service contract and other anticipated water entitlements. This water would be used to meet municipal and industrial demands in the Zone 40 area of south Sacramento County, consistent with the Water Forum Agreement.

Up to 100 MGD of water also would be diverted under EBMUD's amended Reclamation water service contract. This supplemental water would be used to reduce existing and future EBMUD customer deficiencies to manageable levels during drought conditions and would provide an alternative water supply in case of planned or unplanned outages at EBMUD's Mokelumne River diversion facilities.

Freeport Intake Facility

Location

An intake facility and pumping plant would be constructed on the Sacramento River to divert water from the river. In identifying potential locations for the intake facility, several factors were considered to minimize the potential for water quality issues:

- To minimize potential for intake of treated effluent from the SRCSD discharges during a reverse flow event, the intake point would need to be located at least 3,500 feet (ft) upstream from the SRCSD discharge point.
- To minimize water quality issues from the combined sewer outfall near the Pioneer Bridge, the intake would need to be located at least 9,000 ft downstream of the point of full mixing during low-flow events.
- To avoid water quality impacts associated with discharges from the Sacramento Yacht Club (e.g., fuel spills, solid wastes, sanitary wastes), the intake would need to be located at least 9,000 ft downstream of the marina.

The intake site is located on the left, or northeast, bank in the City of Sacramento, approximately 6,500 ft upstream of the Freeport Bridge. (The left bank is the left side of the river when facing downstream.)

Design

The intake facility would be located on the riverbank. Site features would include an intake and pump station, electrical switchyard, chemical storage and injection facility, surge tanks, air compressor station, security fencing, parking, and access pathways (Figure 2-4). The pump station would be located within the intake facility, and the remaining features would be located behind the intake facility. The entire facility, including the intake facility and associated features (e.g., electrical switchyard, chemical injection facility, surge tanks, air compressor station), would require approximately 10 acres. A general cross section of the intake facility is shown in Figure 2-5.

The recommended foundation for the intake is a pile foundation with steel H-piles, precast concrete piles, or concrete filled pipe piles. Each pile type has advantages and disadvantages and is best determined by load, soil conditions, and driving conditions. Given the need for more precise soil conditions and structural loadings, the type, size, spacing, and depth of piles must be determined in final design. Some of the sheet piles that would be built to facilitate construction of the intake would be left in place, and stone riprap would be installed around the intake. The riprap would be 3 ft thick and would extend approximately 200 ft into the river from the sheet piling to the toe of the embankment. Riprap would also extend approximately 50 ft upstream and downstream beyond the sheet piling.

The intake facility would include a fish exclusion system designed to meet DFG, National Marine Fisheries Service, a branch of National Oceanic and Atmospheric Administration (NOAA Fisheries), and USFWS criteria for adequate screen area, maintenance features, and facility hydraulics. The fish screen could be as long as 175 ft. A floating log boom would be installed on the river side of the intake facility to protect the fish screen from damage by floating debris and boaters.

The pump station would have seven to nine vertical turbine pumps with a total capacity of 185 MGD. The overall structure would be approximately 225 ft long and would accommodate a pump spacing of about 15 ft, assuming nine pumps.

Low-wattage fascia wash lighting fixtures would be installed on the river-facing walls of the intake facility and fish screen. The debris boom would be fitted with a strobe light in accordance with U.S. Coast Guard requirements. Exterior doors would be equipped with photocell/motion detector–controlled downlighting.

Operation and Maintenance

The new intake facility and pumping plant would allow the delivery of up to 185 MGD of water and would be capable of diverting water under all river hydraulic conditions.

A source of electrical power would be required to operate the new intake facility. Because of the semi-industrial nature of the surrounding land uses, many options for power supply are available.

The intake facility, including screens and pumping equipment, would be accessible year-round from the levee bank for operations and maintenance. The screen face would be oriented parallel to the river flow and would extend into the river section to allow adequate water depth at the screen (10 ft minimum). The orientation would also allow suitable sweeping flows across the screens, reduce the overall screen length needs, and reduce maintenance requirements. The pumping wet well would be located on the water side of the levee section. Discharge lines would cross over the levee bank.

Construction Considerations

The first phase of the intake construction would involve construction of a temporary ring levee, followed by construction of a sheetpile cofferdam. Excavation within the area enclosed by the cofferdam and levee would proceed next followed by installation of structural piles. Following pile placement, a concrete tremie seal would be placed to allow dewatering inside the cofferdam. Following dewatering, actual construction of the intake would begin. Construction materials may be brought to the site by water or from the banks of the river. Some dredging of the site may be required.

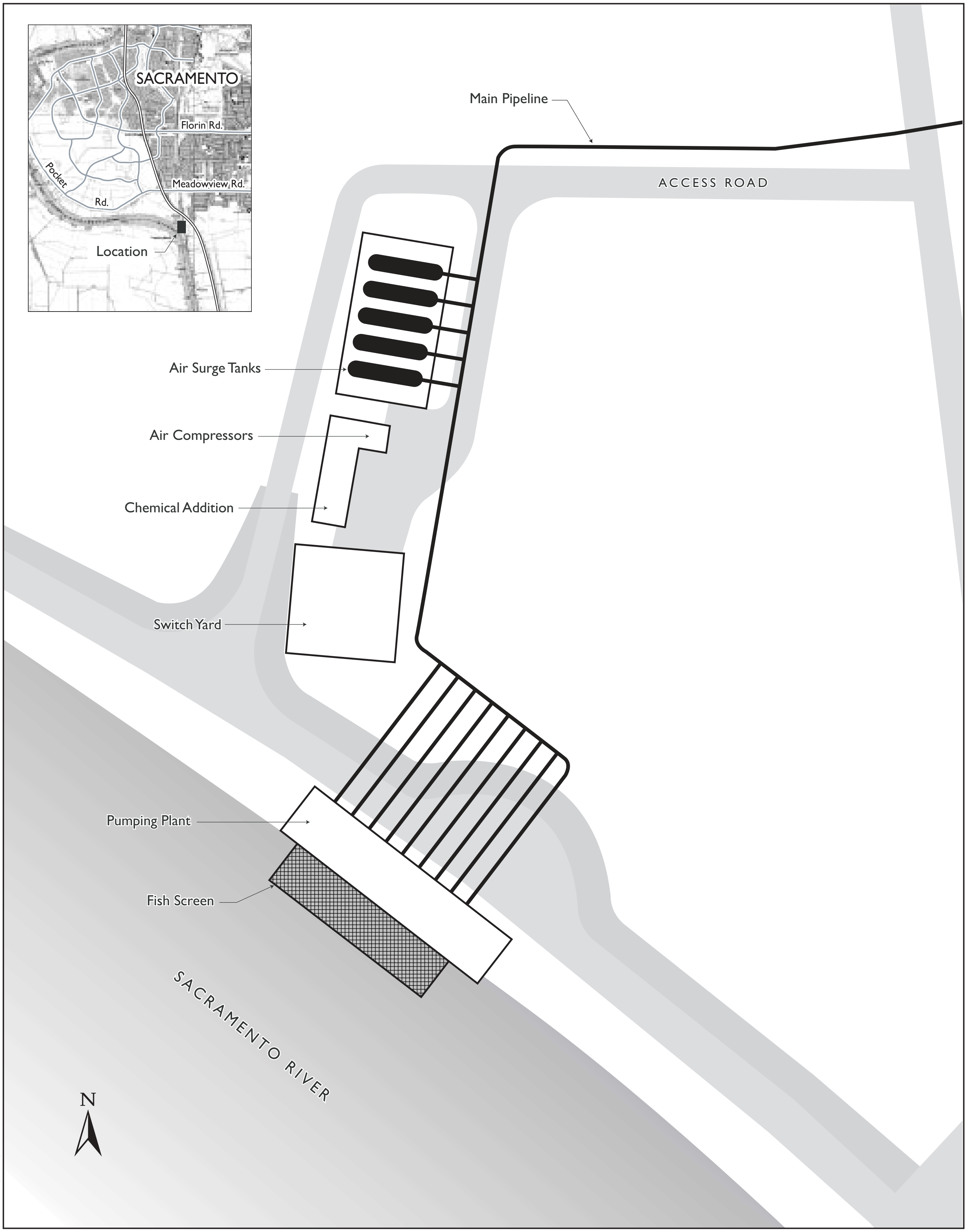

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Figure 2-4
Freeport Intake Facility Site Plan

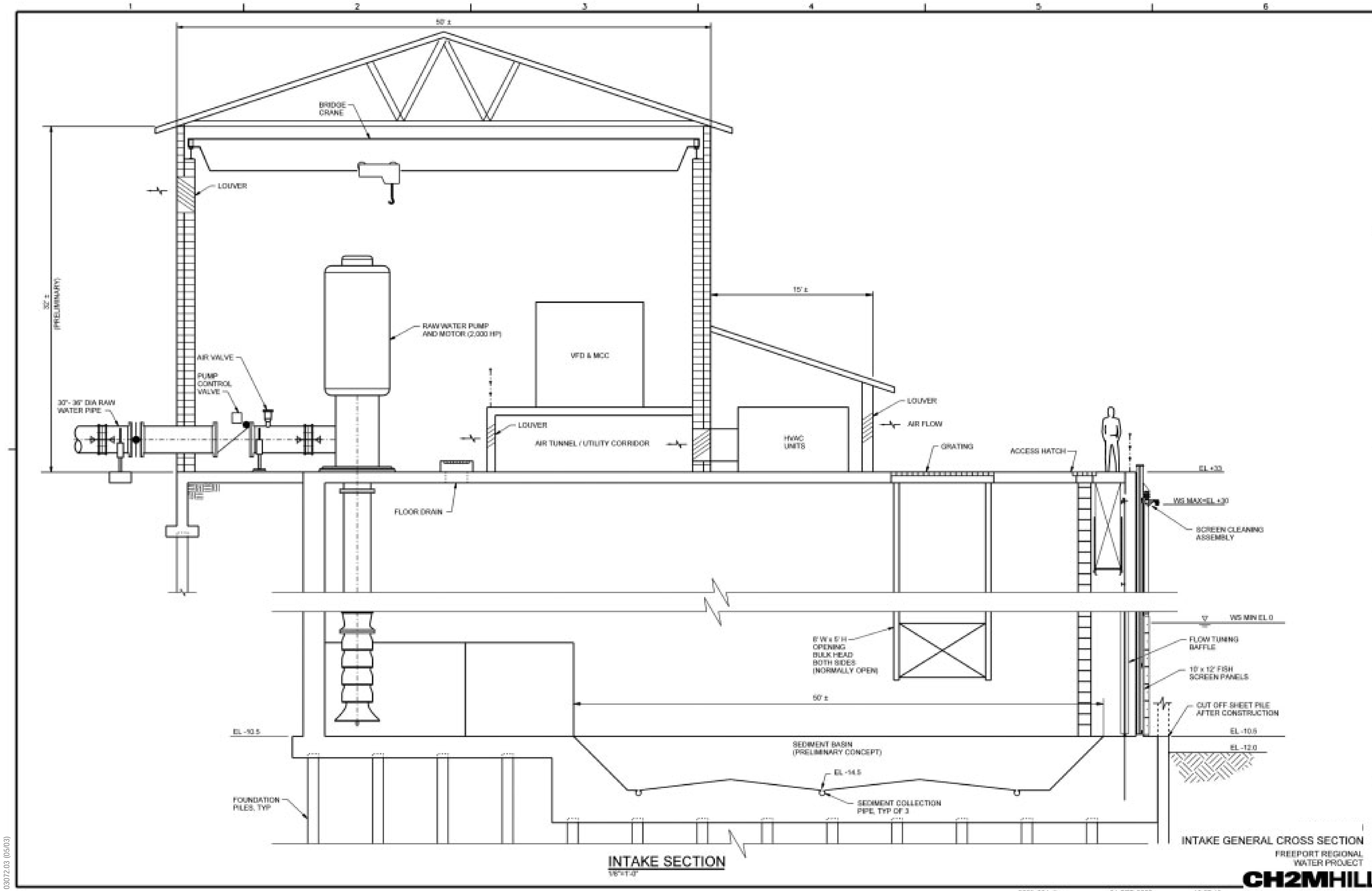

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Figure 2-5
Freeport Intake Facility General Cross Section

Settling Basins

Location

Because the intake facility would be used under a wide range of river-flow conditions, there is potential for grit and sediment to enter the intake facility and pipelines. A sediment management system may be necessary to minimize the deposition of suspended sediments in the system. Use of settling basins was determined to be the most feasible method to manage sediment deposition, possibly in combination with dredging.

Sediment may be deposited in the forebay of the intake. Such deposits would need to be removed to keep the forebay clear and to keep approach velocities at the fish screen relatively uniform along all parts of the screen. If required, a set of settling basins, located near the intake facility site, would screen out the relatively large-diameter sediments (Figure 2-6). Small colloidal particles (less than 0.002 mm) would likely continue into the pipelines. These sediments would be carried to the Zone 40 Surface WTP ballast ponds and the FSC, where, in both locations, suspended sediment would settle out and periodically be removed by dredging. In addition to dredging of the FSC, silt blocks would be placed along the bottom of the FSC.

Design

If it is determined during design that settling basins are required at the intake facility, they would consist of two concrete-lined basins with discharge piping from the intake forebays to the basins and return lines from the basins back to the intake forebays. Access ramps would be installed in each basin for cleaning purposes. Preliminary plans indicate that the total area required for these settling basins would be approximately 2 acres. For purposes of this analysis it is assumed that settling basins would be required at the intake facility.

Use of the FSC as a sediment management facility would include the placement of silt blocks at four locations within the first few miles of the pipeline connection with the FSC. These blocks would help arrest the migration of silt along the bottom of the canal and encourage buildup in focused locations. The exact location and configuration of the silt blocks would depend on the final design decisions.

As an option to managing sediment in the FSC, settling basins could be constructed near the terminal facility. The optional settling basins would consist of four concrete-lined basins with discharge piping from the terminal facility through a flow-control box and into the basins and a discharge pipeline carrying flows to the outfall structure and into the FSC. Preliminary engineering plans indicate that the total area required for the settling basins would be approximately 20 acres and may include chemical addition as a part of the process. The optional settling basins are shown in Figure 2-11.

Operation and Maintenance

The amount of sediment will vary with the amount of water diverted, the time of year it is diverted, and the sediment load in the river. The basins would be configured with several cells so that individual cells could be drained and dried out. Depending on the final design of the basins, actual operational practices, and other factors, the frequency of basin cleaning may vary from year to year. However, for the purpose of this analysis, annual cleaning has been assumed.

At the intake facility, potential estimated annual sediment accumulation could range from 310 tons under minimum conditions (a uniform 10 MGD per year to SCWA only) to 4,540 tons under severe conditions (125% of median flows to both SCWA and EBMUD and double the median suspended solids concentrations in the river). Under average conditions (full time SCWA diversion and EBMUD diversions every 3.3 years), annual sediment accumulation would be approximately 1,910 tons. At the optional terminal facility settling basins, the quantities of settled materials would be significantly larger because of the addition of a coagulant such as aluminum sulfate. Annual sediment accumulation would range from 0 tons under minimum conditions to 18,610 tons under severe conditions. Under average conditions, annual sediment accumulation would be approximately 2,220 tons.

Each cell of the settling basins would be dewatered and dried out prior to cleaning. Drying is expected to require several weeks during summer; mechanical assistance may be used to enhance the drying. At the optional terminal facility settling basins, the coagulant would be stored on site in six outdoor chemical storage tanks surrounded by a containment basin.

Following removal, the collected sediment would be excavated and hauled to the nearest landfill (assumed to be located off Kiefer Road near Grant Line Road). The principal equipment required for cleaning and hauling the sediment basins at the intake and terminal facilities includes wheeled front-end loaders, dozers, and tractor-trailer dump trucks. The hours of equipment usage would depend on the rate that material can be loaded into the trucks and the haul distance/round trip time for the tractor-trailer rigs.

Construction Considerations

The material excavated for construction of the settling basins would be stockpiled and used as embankment fill, and any excess material would be hauled off site to an approved landfill.

Pipelines

Up to 185 MGD of water diverted at the intake facility on the Sacramento River would be transported east to the Zone 40 Surface WTP and Mokelumne

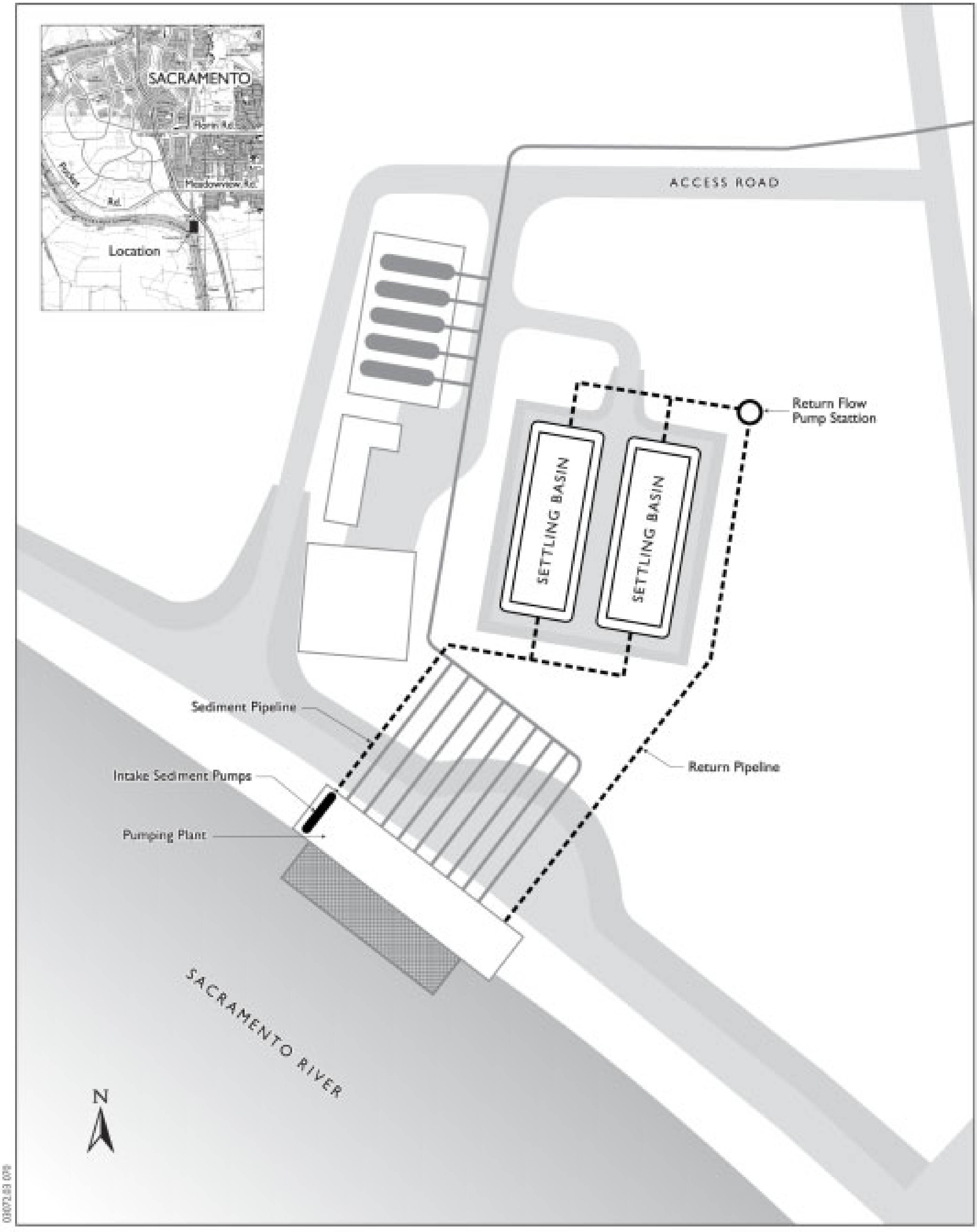

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Figure 2-6
Freeport Intake Facility On-Site Settling Basins

Aqueducts via a network of pipelines, as described below. The length of the pipeline varies from 15 to 19 miles, depending on the alignment.

Freeport Intake Facility to the Zone 40 Surface Water Treatment Plant/Folsom South Canal Pipeline

Location

The alignment under Alternative 2 would traverse different settings, including urban streets, rural roads, and open space/agricultural lands, as shown on Figure 2-1 and described in Table 2-1. Typical pipeline cross sections are shown in Figures 2-7, 8, and 9.

From the intake facility site on the Sacramento River, the alignment for the 84-inch pipeline would travel northeast to Freeport Boulevard and north along Freeport Boulevard to the Freeport Boulevard/Meadowview Road intersection. From this intersection, the alignment would travel east/southeast on Meadowview/Mack Road, crossing beneath Franklin Boulevard and continuing east on Mack Road to the Mack/Power Inn Road intersection. At this intersection, the alignment would continue east on Elsie Road, turn north at the Elsie/Wilbur Way intersection, travel north on Wilbur to the Gerber Road/Wilbur Way intersection, and continue east on Gerber Road to the Gerber/Bradshaw Road intersection (the turnout for the Zone 40 Surface WTP).

Under Segment Option 2, instead of continuing on Mack Road past the intersection with Power Inn Road, the alignment for the 84-inch pipeline would turn north on Power Inn Road to Gerber Road and travel east on Gerber Road to the Gerber Road/Wilbur Way intersection, where it would rejoin the Alternative 2 alignment.

The 60-inch pipeline would connect the turnout for the Zone 40 Surface WTP to the plant site located somewhere on an 80–100-acre parcel bounded by Elder Creek Road on the north, Gerber Road on the south, Bradshaw Road on the west, and Excelsior Road on the east. From the Zone 40 Surface WTP turnout at the Gerber/Bradshaw Road intersection, the alignment for the 66-inch pipeline would travel north on Bradshaw Road to the intersection with Florin Road, and then east on Florin Road to the FSC.

In general, construction would occur primarily within existing road rights-of-way that are either controlled or owned outright by city or county entities. Most of the urban streets are heavily traveled, multi-lane thoroughfares with heavy commute traffic, such as Meadowview, Mack, and Power Inn Roads, or connecting neighborhood streets such as Wilbur Way or Elsie Road. Gerber Road is a more rural roadway on its eastern end.

Design

Water would be conveyed from the intake facility approximately 10 miles to the Zone 40 Surface WTP turnout through one 185 MGD–capacity (84-inch-diameter) pipeline. Water would be conveyed approximately 2–4 miles from the Zone 40 Surface WTP turnout to the Zone 40 Surface WTP through an 85 MGD–capacity (60-inch-diameter) pipeline, and approximately 5 miles from the Zone 40 Surface WTP turnout to the FSC through a 100 MGD–capacity (66-inch-diameter) pipeline.

Operation and Maintenance

It is unlikely that biofouling problems from the untreated river water in the pipeline will occur. However, the pipeline system may be designed to accommodate a mechanical pigging device that can be launched inside of a pipeline for the purpose of cleaning or inspecting the pipeline for debris. If determined to be necessary, pigging would be used in combination with the methods previously described under the discussion of “settling basins” to reduce accumulated sediments in the pipeline. Chemical injection ports could also be accommodated at the intake and at the turnout to the Zone 40 Surface WTP to introduce chloramines or similar biological growth controls into the pipeline if determined necessary in the future.

Construction Considerations

Most pipeline construction would be conducted by trenching in paved and unpaved areas, with a small amount of tunneling in strategic areas where trenching is not practical. Construction within urban street settings presents the following potential issues:

- utility interference,
- traffic management,
- impact on businesses and residences, and
- pavement restoration.

A majority of the pipeline would be installed by unsupported, sloped trenching. In areas where the trench width is limited or soil conditions necessitate (e.g., city streets or road shoulders), a shielded/shored trench would be used. For most street installations, one or two lanes would be closed during construction and traffic would be controlled with flaggers or traffic control devices. Road closures would be kept to a minimum and appropriate detours would be provided.

Special construction methods such as trenchless construction may be used in sensitive areas, such as major stream crossings, major intersections, and at railroad and highway crossings to avoid impacts on these sites. Trenchless construction methods could include microtunneling, shielded or unshielded jack and bore, ramming, and other similar below-ground installation methods that would disturb less surface area than installation by open-cut trenching. Potential areas for trenchless construction within this segment of the pipeline include Freeport Boulevard (SR 160), I-5, Morrison Creek, SR 99, railroad crossings, bridges, and some major surface street intersections. Additionally, trenchless construction may be used to cross some wetlands and drainages.

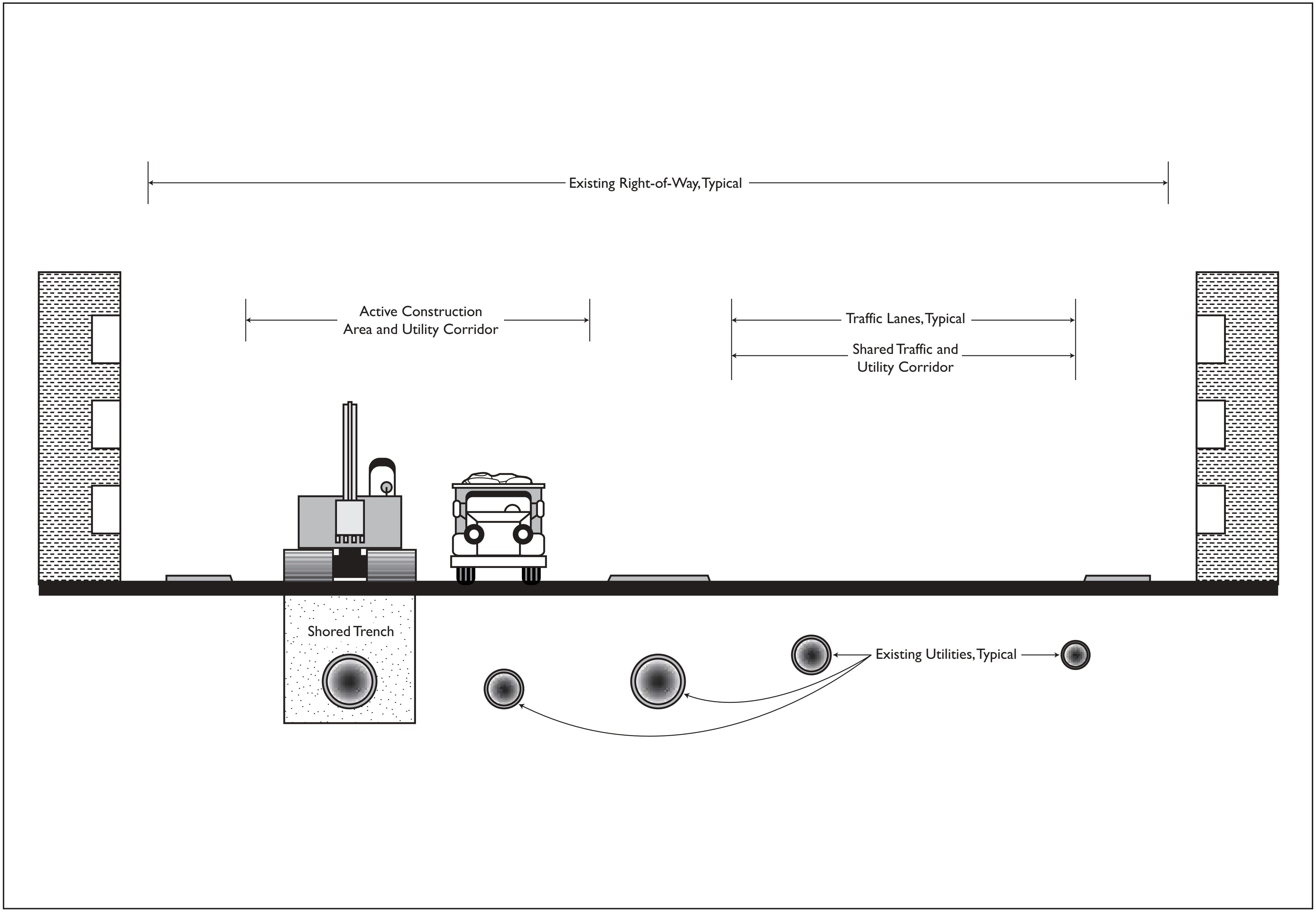

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Figure 2-7
Pipeline Cross-sections Within Urban Roadways

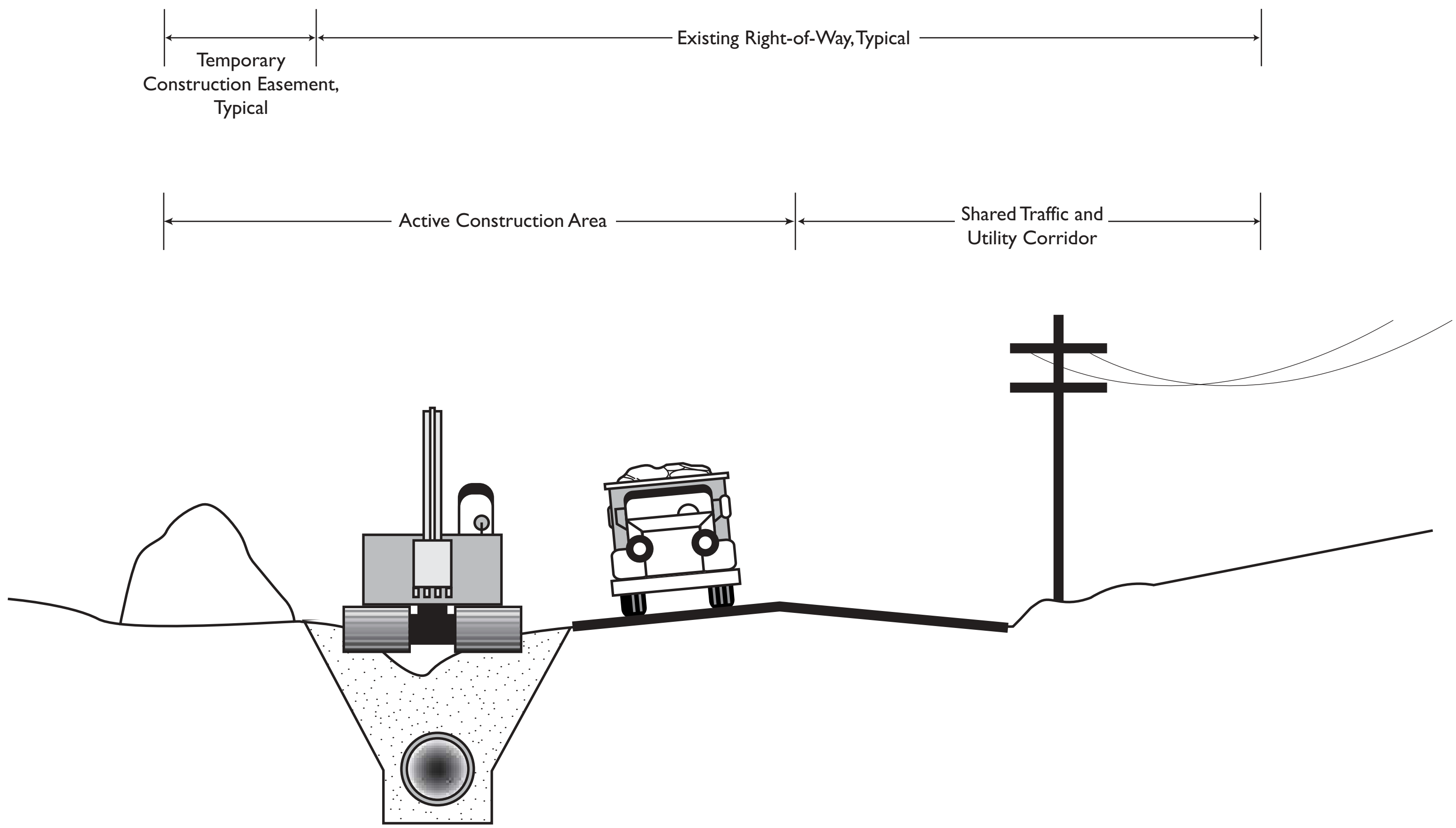

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Figure 2-8
Pipeline Cross-sections Within Rural Roadways (within existing right-of-ways)

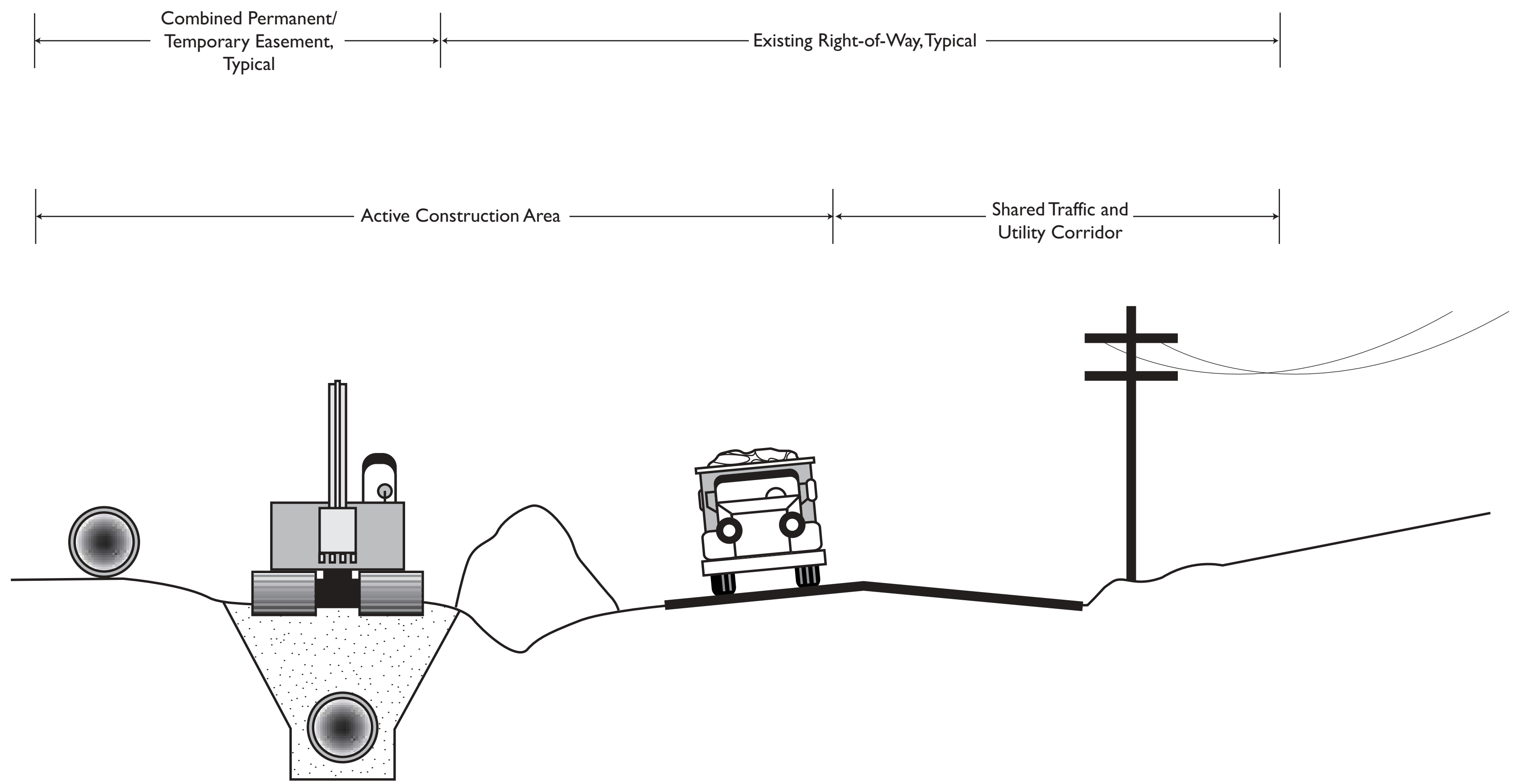

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Figure 2-9
Pipeline Cross-sections Within Rural Roadways
(within new right-of-ways)

Folsom South Canal to the Mokelumne Aqueducts Pipeline

Location

Water would be conveyed through the FSC from the delivery point to the terminus of the FSC. Extending from a new turnout near the southern end of the existing FSC to the Mokelumne Aqueducts, a new pipeline alignment would be constructed (commonly referred to as the Folsom South Canal Connection [FSCC] pipeline).

This portion of the pipeline would be approximately 16.9 miles long and traverse creek, cross-country, and street settings (Figure 2-2). From the new turnout near the southern end of the existing FSC, the pipeline alignment would extend east to Clay Station Road then turn south, continuing along Clay Station Road to the intersection with Liberty Road, turn east, and travel along Liberty Road to just east of the intersection with SR 88. From Liberty Road, the pipeline alignment would continue southeast to East Buena Vista Road, paralleling the road to the east, to EBMUD’s property line. From East Buena Vista Road, the pipeline alignment would head south, crossing the Mokelumne River, traversing EBMUD’s Camanche Reservoir property to SR 12, crossing SR 12, and following the east side of Cord Road to Acampo Road. From Acampo Road, the reach would extend southeast 4,500 ft to the Mokelumne Aqueducts.

One optional segment (Segment Option 3) is proposed for a portion of the pipeline alignment between the FSC and the aqueducts (Figure 2-2). Under Segment Option 3, instead of continuing south along Clay Station Road, the FSCC pipeline alignment would turn east on Angrave Road, continuing east along Angrave Road to Dry Creek and, south of Dry Creek, continue southeast generally adjacent to a Pacific Gas and Electric Company (PG&E) transmission line right-of-way. The pipeline alignment would follow the PG&E line right-of-way to its intersection with SR 88 and then head southeasterly to Liberty Road. At this point, Segment Option 3 would rejoin the main FSCC pipeline alignment. Under Segment Option 3, the FSCC pipeline alignment would require that a surge tank be located at the highpoint of the optional segment. The surge tank would be approximately 56 feet in diameter and a 32 feet high.

Design

The proposed FSCC pipeline configuration consists of an approximately 66-inch-diameter pipe with a capacity of 100 MGD, buried beneath a minimum of 5 ft of cover material.

Operation and Maintenance

Operation and maintenance issues are the same as described above with one exception. The FSC section of the pipeline would need to be drained and/or pumped to existing drainages periodically when not in use.

Construction Considerations

Construction methods for the pipeline from the FSC to the Mokelumne Aqueducts would be the same as described above for the segment from the intake to the FSC. However, most of this pipeline would be installed in open cut trenches without shoring. Potential areas for trenchless construction within this segment include SR 88 and the Mokelumne River.

Zone 40 Surface Water Treatment Plant

Location

The general area for the WTP site is an 80- to 100-acre parcel within the area bounded by Elder Creek Road on the north, Gerber Road on the south, Bradshaw Road on the west, and Excelsior Road on the east (Figure 2-1). The exact site has yet to be determined.

Design

The Zone 40 Surface WTP would be owned and operated by SCWA and would have a capacity of 85 MGD. Recommended preliminary design criteria for the WTP include a storage reservoir, flash mix system, flocculation basins, sedimentation basins, possible intermediate ozonation, filters, and a clearwell. The general plant facility layout is shown in Figure 2-10.

Diversion water would be carried to the Zone 40 Surface WTP in a pipeline (described previously). The 60-inch turnout pipeline to the WTP would be designed for an 85-MGD capacity to allow for buildout water demands of Sacramento County. Ballast storage ponds would be used during reverse river flows to provide raw water to the plant, as the intake would shut down during these events.

The Zone 40 Surface WTP site would also be used as a corporation yard with facilities for staff and maintenance vehicles. The corporation yard would serve as the central location for staging operations and maintenance activities of the SCWA's potable water treatment and distribution facilities. In addition, it may serve as the central location for operations and maintenance of the FRWA facilities and infrastructure. The corporation yard would occupy approximately 15 of the 80- to100-acre Zone 40 Surface WTP site. The corporation yard would include buildings, materials and equipment storage yards, parking facilities, and other ancillary facilities. Activities at the corporation yard would be related to operation and maintenance of a water treatment and distribution system and would include administrative offices, equipment repair and fueling facilities, and equipment and records storage.

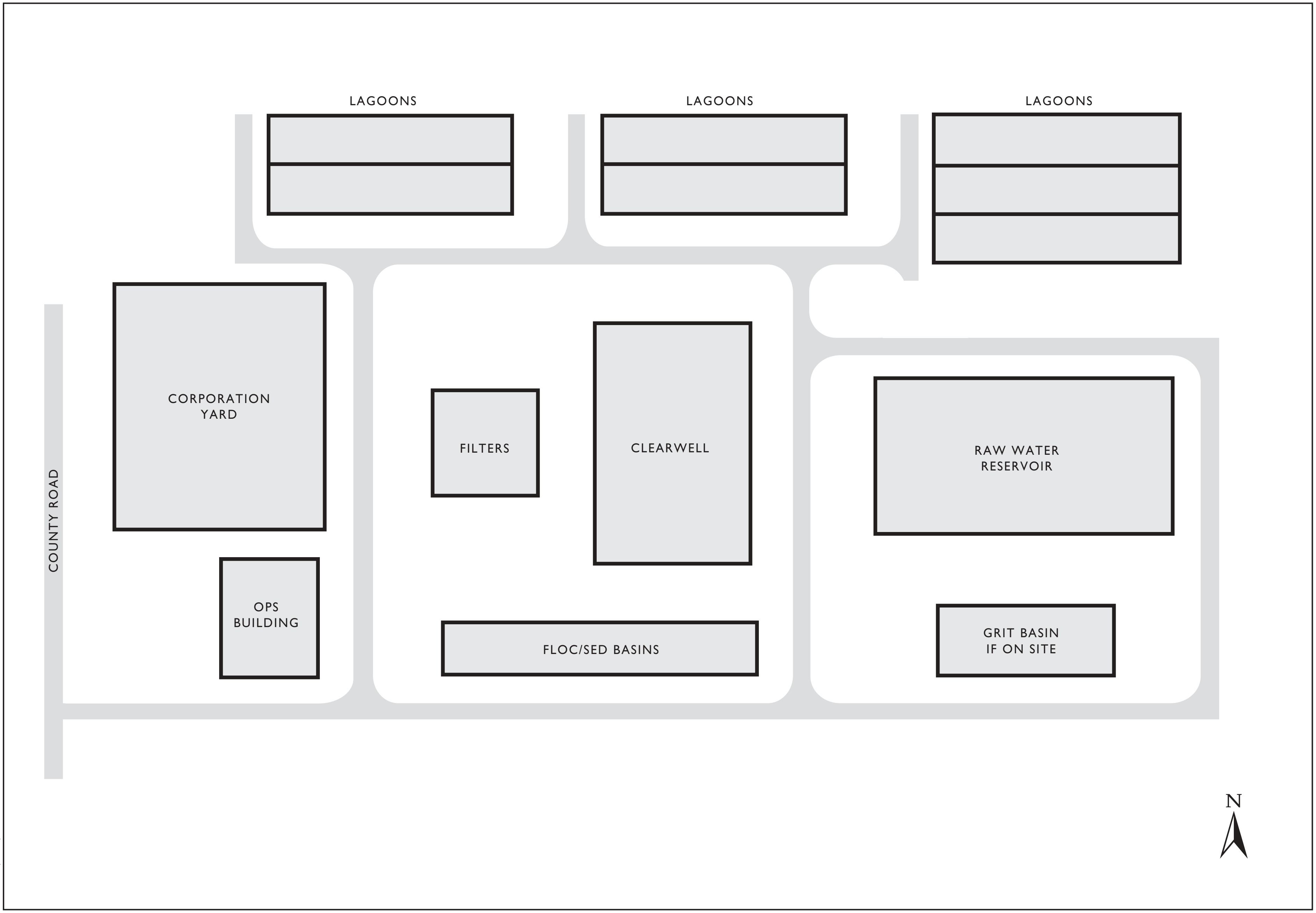

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Figure 2-10
Zone 40 Surface Water Treatment Plant

Construction

The Zone 40 Surface WTP would be constructed and operated in three phases as the Zone 40 area development occurs. The first phase would have a capacity of 30 MGD. The subsequent phase facilities would be 30 MGD and 25 MGD.

Terminal Facility

Location

A terminal facility would be located at the high point of the pipeline between the Zone 40 Surface WTP and the FSC to control discharge from the pipeline into the canal. The exact location of the terminal facility would depend on the raw water–pipeline alignment chosen and would be approximately 30 ft off the side of the Florin Road right-of-way at the FSC for Alternatives 2 and 4. (Figure 2-11).

Design

The terminal facility consists of the weir and outfall structure. The intake pumping plant would be operated to maintain a relatively constant water surface elevation in the terminal facility. Control of the pumps would be facilitated by water level sensors in the terminal facility and a Supervisory Control and Data Acquisition (SCADA) system.

Operation and Maintenance

The terminal facility would provide some protection from surges resulting from a power outage at the pump station or abrupt closing of line valves. Water would be released to the FSC from the outfall.

Canal Pumping Plant

Location

A canal pumping plant would be required to direct water from the existing FSC into the new FSCC pipeline. The canal pumping plant facility would be located near the terminus of the existing FSC where it would connect with the new FSCC pipeline. The general location of the canal pumping plant facility is shown in Figure 2-2.

Design

The plant would be designed with a 100-MGD capacity. The main facilities would include a turnout in the canal, a traveling screen structure used to remove debris in the FSC water, a chain link–fenced electrical substation, surge control features, emergency generators, and the main pumping plant building. In addition to the pumps, the pumping plant building would have a separate control room, meeting/lunchroom, shower/locker room, men's and women's restrooms, electrical room, utility room, ventilation room, work space, and storage rooms (Figure 2-12). The plant site and related facilities, parking, and access road would require approximately 3.2 acres.

Operation and Maintenance

Power for the plant would be obtained from the existing high-voltage SMUD transmission lines located approximately 2.5 miles north of the plant location. A new power line to the plant would be installed along local streets and the FSC.

The main access to the plant would be along the canal levee road. The site would be fenced for security, and an intrusion alarm would be installed on exterior building doors.

Aqueduct Pumping Plant and Pretreatment Facility

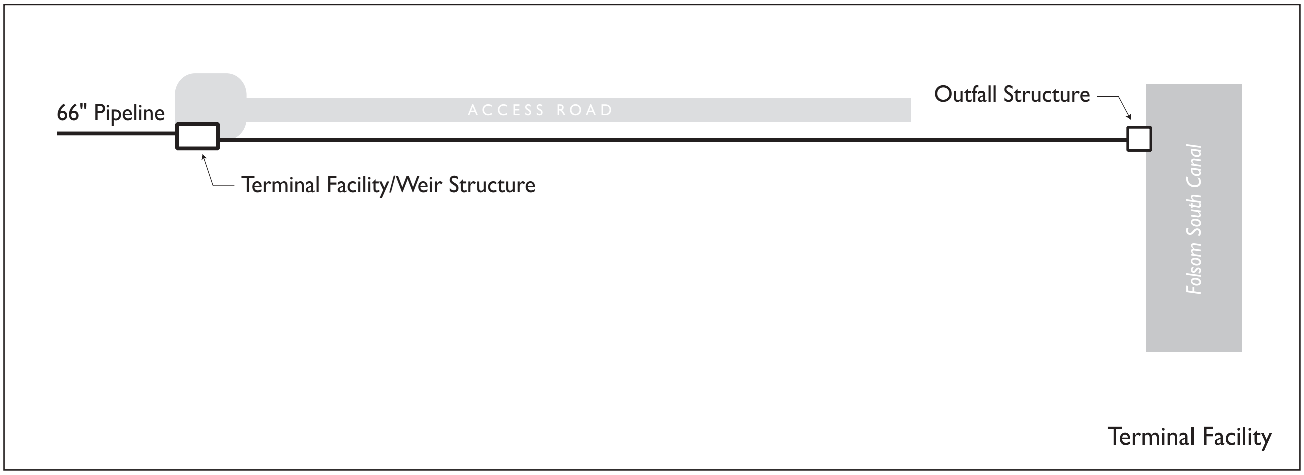
Location

The aqueduct pumping plant and pretreatment facility would be located just west of the Camanche Reservoir dike, on EBMUD property. The general location of the proposed site is provided in Figure 2-2.

Design

The aqueduct pumping plant and pretreatment facility would include the following facilities:

- approximately 5-MG equalization tank
- flocculation basins
- sedimentation basins
- ozone and ultraviolet treatment
- chemical storage and operations building
- electrical substation



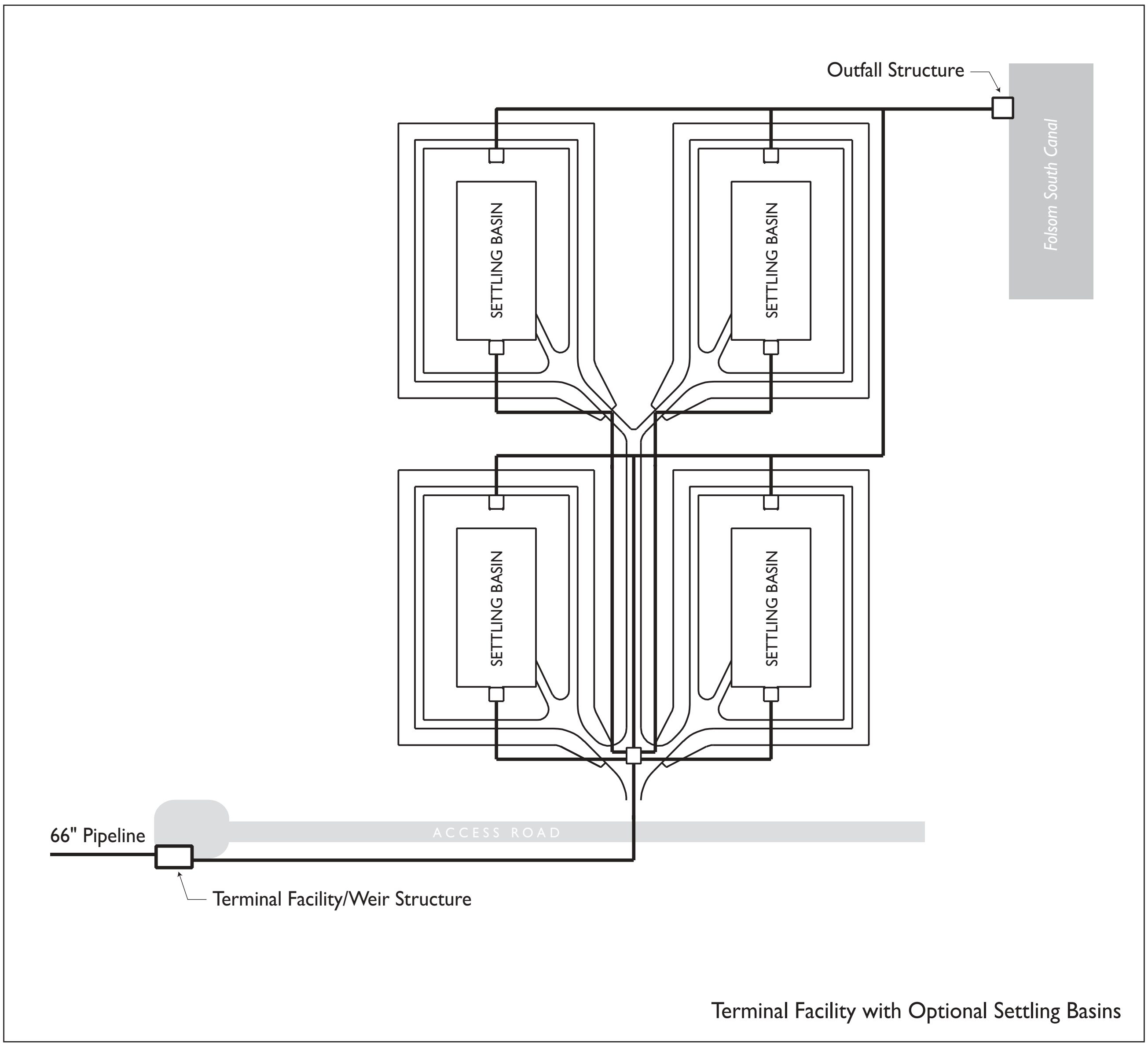


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Figure 2-11
Terminal Facility

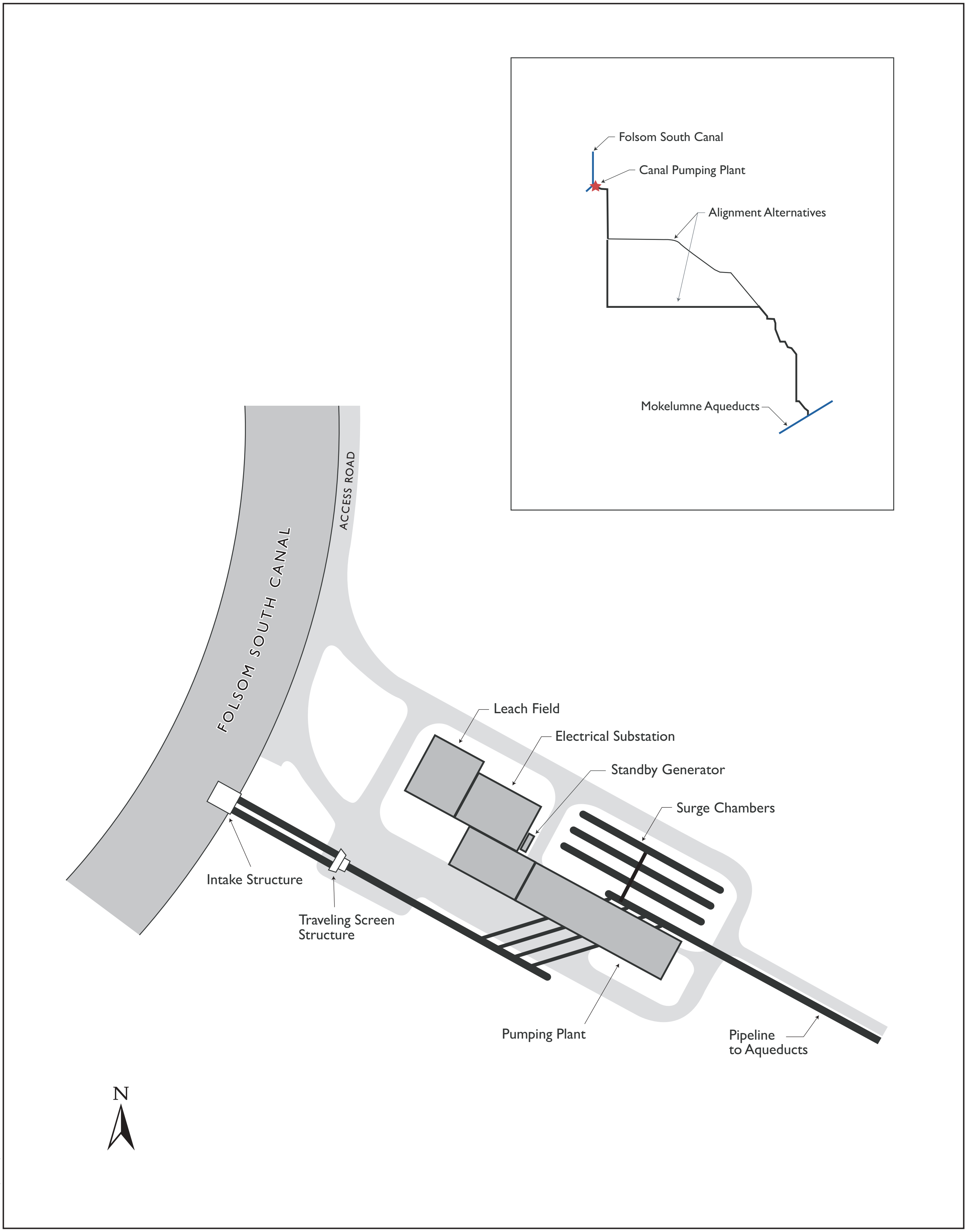

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Figure 2-12
Canal Pumping Plant

- liquid oxygen tank and evaporate
- decant basins
- aqueduct pumping plant
- approximately 8-MG clearwell
- solids handling facility
- access roads and miscellaneous site features

The general layout is shown in Figure 2-13. The treatment basins and tanks would be totally or partially buried, and the chemical building would be designed to minimize aesthetic impacts. The outdoor electrical transformers would be located in a manner that would minimize noise impacts on neighboring properties.

Operation and Maintenance

Water would flow from the canal pumping plant through the FSC pipeline into the equalization tank. The tank will have sufficient volume to compensate for operational flow rate changes and will have additional storage for emergency shutdown. Water will flow by gravity from the tank into the various treatment processes and then into the clearwell of the pumping plant. From there, a flow control structure would split the flow from the pumping plant back into the FSC pipeline and on to the appropriate Mokelumne Aqueduct.

Electrical power would be provided by an existing 230-kV PG&E transmission line, which is located approximately 500 feet from the plant. Telecommunications will be provided by lines along SR 12.

Construction Considerations

Facilities can be built aboveground and excess trench spoils piled around them. There would be minimal need for removal of excavated materials.

Optional Aqueduct Pumping Plant and Pretreatment Facility

There is an optional location (Brandt site) for the aqueduct pumping plant and pretreatment facility at the terminus of the proposed FSCC pipeline alignment, where it connects with the Mokelumne Aqueducts. At this location, facilities may need to be partially buried to achieve the necessary hydraulic gradient for the treatment processes. Approximately 115,000 cubic yards of excavated material would be removed. Electrical power would be provided by an existing

230-kV PG&E transmission line located approximately 2,500 ft from the location. Telecommunications would be provided by lines along Brandt Road.

Alternative 3: Freeport Intake Facility—with the Meadowview/Mack/Gerber Pipeline Alignment

The project components proposed for Alternative 3 are the same as those described above for Alternative 2. Alternative 3 differs from Alternatives 2, 4, and 5 primarily in the location of the pipeline alignments (Figure 2-1) and the terminal facility.

Under Alternative 3, the Zone 40 Surface WTP turnout would still be located at the intersection of Gerber and Bradshaw Roads. However, the 66-inch pipeline would continue east on Gerber Road instead of turning north on Bradshaw. East of the Gerber Road terminus at Excelsior Road, the alignment would continue east to the FSC and be constructed cross country over primarily vacant or undeveloped lands that historically have been in agricultural or open-space uses. The terminal facility would be located within the pipeline right-of-way near the intersection with Grant Line Road for Alternatives 3 and 5 (Figure 2-11). Alternative 3 includes segment Option 2 and Option 3.

To ensure all-weather access in this area, a graveled road surface may be constructed. Potential construction issues include:

- availability of right-of-way,
- maintenance access, and
- higher potential for biological resource sensitivity.

Alternative 4: Freeport Intake Facility—with the Cosumnes River/Power Inn/Gerber/Florin Pipeline Alignment

The project components proposed for Alternative 4 are the same as those described above for Alternative 2. Alternative 4 differs from Alternatives 2, 3, and 5 primarily in the location of the raw water–pipeline alignments (Figure 2-1). From the intake facility site on the Sacramento River, the alignment for the 84-inch pipeline would travel northeast to I-5 and southeast along I-5, crossing under I-5 before reaching the intersection with the future extension of Cosumnes River Boulevard. From this intersection, the alignment follows the proposed future extension of Cosumnes River Boulevard between I-5 on the west and Franklin Boulevard on the east. This road project, a joint effort between the City of Sacramento and the California Department of Transportation/Federal Highway Administration (Caltrans/FHWA), is currently in the design planning phase and

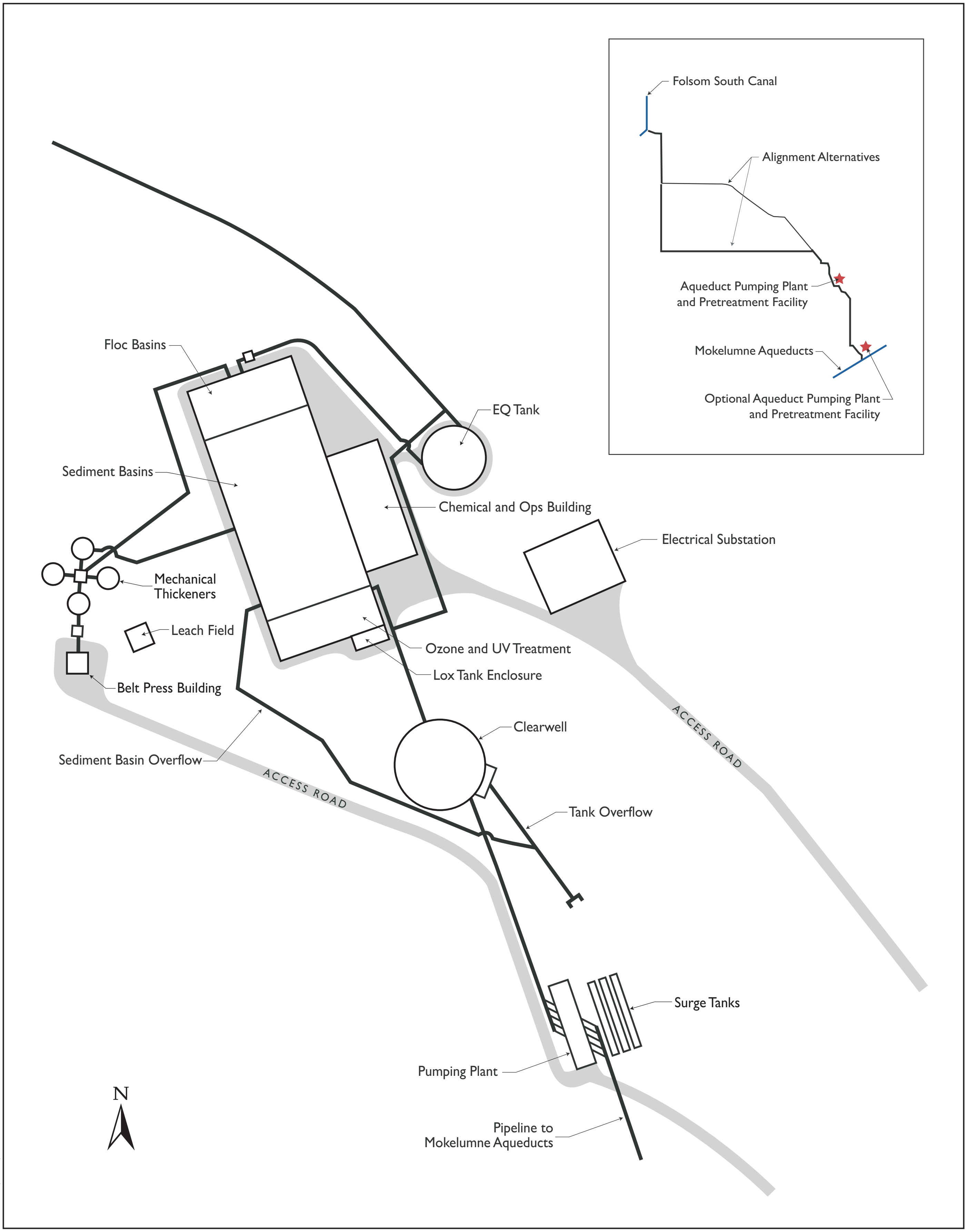

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Figure 2-13
Aqueduct Pumping Plant and Pretreatment Facility

could go to construction at the same time as or before the FRWP. The alignment then crosses portions of the Bufferlands, which are open-space lands surrounding the SRWWTP. The approximately 2,500-acre Bufferlands is managed by the SRCSD to provide a buffer between the plant and the neighboring community and to provide an area for future expansion of the plant. It then continues along the existing Cosumnes River Boulevard, crosses additional open-space land to avoid the SR 99/Cosumnes River Boulevard interchange, crosses under SR 99, then turns north on Power Inn Road to the intersection with Mack Road. From this point on, it is identical to Alternative 2, following Elsie Avenue, Wilbur Way, and Gerber, Bradshaw, and Florin Roads.

Under Alternative 4, the pipeline would involve construction across the Morrison Creek channel. Implementation issues associated with this creek reach include the following:

- replacement of channel lining;
- interface with Reclamation Board/Sacramento Area Flood Control Agency (SAFCA)/Sacramento County Department of Water Resources;
- permanent and construction right-of-way; and
- management of urban drainage and groundwater.

Additionally, Alternative 4 would cross lands north of the SRCSD Bufferlands that historically have been subject to agricultural uses and have minimal existing development. Potential construction issues with this cross-country portion of the alignment include:

- availability of right-of-way;
- maintenance access; and
- higher potential for biological resource sensitivity.

Alternative 4 has an optional segment (Segment Option 1) at its western edge (Figure 2-1). Under Segment Option 1, instead of turning east at the future extension of Cosumnes River Boulevard, the pipeline alignment would continue south along the eastern edge of I-5 and then turn west along the northern boundary of the SRCSD wastewater treatment plant, which is also the north edge of the flood control levee, until it intersects with the Alternative 4 alignment near Morrison Creek. Alternative 4 also includes segment Option 2 and Option 3.

Alternative 5 (Preferred Alternative): Freeport Intake Facility—with the Cosumnes River/Power Inn/ Gerber Pipeline Alignment

The project components proposed for Alternative 5 are the same as those described above for Alternative 2. Alternative 5 differs from Alternatives 2–4 primarily in the location of the raw water–pipeline alignment (Figure 2-1). Alternative 5 is the preferred alternative.

The Alternative 5 alignment is identical to Alternative 4 until it reaches the intersection of Gerber and Bradshaw Roads. Instead of turning north on Bradshaw Road, the Alternative 5 alignment continues east on Gerber Road to its terminus, then cross country to the FSC.

Alternative 5 includes segment Option 1, Option 2, and Option 3.

Alternative 5 would cross lands that historically have been subject to agricultural uses and have minimal existing development, including a portion of the Cosumnes River Boulevard alignment on the west end of the project and the cross-country alignment east of the terminus of Gerber Road at Excelsior Road. Potential construction issues associated with the cross-country portion of this alignment include:

- availability of right-of-way;
- maintenance access; and
- higher potential for biological resource sensitivity.

Alternative 6: Freeport Intake to Zone 40 Surface Water Treatment Plant/Enlarge Pardee Reservoir

Under Alternative 6, SCWA water needs would be met by conveying water from the Sacramento River, and EBMUD water needs would be met by enlarging its Pardee Reservoir water storage facility on the Mokelumne River. Alternative 6 would consist of the following components:

- Freeport intake facility, including settling basins;
- pipeline from the intake facility to the Zone 40 Surface WTP, including the pipeline from the turnout to the WTP;
- Zone 40 Surface WTP; and
- enlarge Pardee Reservoir (which includes the addition and relocation of facilities, such as dams, roads, etc.).

The location and design of the Freeport intake facility, the pipeline from the intake facility to the Zone 40 Surface WTP, and the Zone 40 Surface WTP would be the same as described for Alternatives 2 through 5. Water would be conveyed along the pipeline alignment from the intake facility to the Zone 40 Surface WTP, including from the Zone 40 Surface WTP turnout to the WTP, as described under Alternative 5. The intake facility and pipeline components would be somewhat smaller than those described for Alternatives 2 through 5. Alternative 6 differs from Alternatives 2 through 5 in that no facilities would be built past the turnout to the Zone 40 Surface WTP. Other components of Alternatives 2 through 5 that are needed only by EBMUD, such as the FSCC pipeline, canal pumping plant, aqueduct pumping plant and pretreatment facility, are not included in Alternative 6.

For the enlarge Pardee Reservoir component, Alternative 6 would increase the storage capacity of Pardee Reservoir by 172,000 acre-feet (af); no water would be diverted under EBMUD's amended Reclamation water service contract.

Background

In 1929, Pardee Reservoir was built in the foothills of the Sierra to store some of the seasonal streamflow of the Mokelumne River. Water stored in Pardee Reservoir is diverted into a 91.5-mile-long aqueduct system across the Central Valley (Figure 1-1). This aqueduct delivers water by gravity flow to the East Bay service area. As the population of EBMUD's service area grew, two aqueducts were added. Mokelumne Aqueduct No. 2 was added to the water system in 1949 and Mokelumne Aqueduct No. 3 was added in 1963. Camanche Reservoir was constructed in 1964 to increase the Mokelumne supply and enhance downstream flood control.

During non-drought years, EBMUD supplies its customers with an annual average of about 220 MGD of water. The Mokelumne River supplies approximately 95% of this water. The balance of EBMUD's water supply is collected from local runoff into terminal reservoirs in the East Bay hills.

EBMUD has rights to use up to 325 MGD from the Mokelumne River; however, the ability to use the full entitlement is limited by river hydrology, upstream storage and diversions, seasonal flood control requirements, and downstream flow obligations to protect environmental resources and meet the needs of senior water rights holders. Additional reservoir storage on the Mokelumne River would increase the amount of water available to EBMUD in drought years by storing surplus water from wet years that otherwise would have flowed downstream.

Under Alternative 6, the maximum water supply storage elevation of Pardee Reservoir would be raised about 33 ft, and the maximum flood control elevation would be raised about 46 ft. The storage capacity of the reservoir would increase approximately 87%, from 198,000 af to 370,000 af. The total surface area of the reservoir would increase approximately 55% from 2,250 acres to 3,480 acres. A comparison of the existing Pardee Reservoir and the proposed enlarged Pardee Reservoir is shown in Figure 2-3 and Table 2-2.

Table 2-2. Comparison of Pardee Reservoir Water Elevation, Area, and Capacity

Item	Existing Reservoir	Enlarged Reservoir	Difference
Summer Maximum Storage (water supply)			
Top of Water Supply Pool (ft msl)	568	601	33
Reservoir Area (acres)	2,250	3,180	930
Gross Storage (TAF)	198	326	128
Winter Maximum Storage (flood control)			
Top of Flood Control Pool (ft msl)	568	614	46
Reservoir Area (acres)	2,250	3,480	1,230
Gross Storage (TAF)	198	370	172
Probable Maximum Flood Storage			
PMF Water Surface Elevation (ft msl)	581	617	36
Reservoir Area (acres)	2,470	3,560	1,090
Gross Storage (TAF)	230	380	150

The surface area of the existing reservoir at the maximum controlled water supply storage (568 ft msl) is approximately 2,250 acres. The enlarged reservoir would have a surface area of 3,180 at the proposed normal maximum elevation of 601 ft msl. As a result, an additional 930 acres would be inundated by the enlarged reservoir during normal operation. During major storm events, the surface elevation of the reservoir could reach as high as 614 ft msl, inundating an additional 1,230 acres. In case of a probable maximum flood (PMF), the surface elevation of the reservoirs is estimated to reach 617 ft msl.

Lands around Pardee Reservoir between the 568-ft and 601-ft contours would be cleared of all vegetation, debris, and other materials that may conflict with reservoir operations. Lands between the 601-ft and 614-ft contours would not be cleared. The majority of the land surrounding the existing reservoir between 568 ft msl and 614 ft msl is owned by EBMUD (3,316 acres). Other landowners in the area include the Jackson Valley Irrigation District (JVID) (33 acres), as well as several private parties (134 acres). EBMUD anticipates purchasing or securing easements on non–EBMUD lands that would be needed for the project.

Additional components for the proposed reservoir enlargement under Alternative 6 include:

- replacement of the concrete dam and spillway, powerhouse, and saddle dams;
- modifications to the intake tower and Pardee Tunnel;
- a new pressure reduction facility;
- relocation of roads and bridges, including the SR 49 bridge, Pardee Dam Road, and Stony Creek Road;
- removal of the Middle Bar Bridge and construction of fishing piers;
- relocation of utilities; and
- replacement of the existing Pardee Reservoir recreation areas.

Pardee Replacement Dam

Location

Pardee Dam, constructed in 1927–1929, is a 350-ft-high curved concrete gravity dam with a crest length of approximately 1,330 ft (Figure 2-3). The top of the dam is at 575 ft msl. The dam includes two 5-ft parapet walls constructed on each side of the roadway across the crest of the dam for a total height of 580 ft. The parapet walls prevent overtopping during conditions of maximum flooding. The thickness of the dam varies from 16 ft at the crest to 234.5 ft at the base of the maximum section. The dam has 6 low-level river outlets with a combined maximum discharge of 5,230 cfs when the reservoir is full. This includes a maximum release from the power plant of 1,260 cfs.

The Pardee replacement dam would be located 4,200 ft downstream of the existing Pardee Dam, just upstream of the confluence of Rag Gulch with the Mokelumne River. The replacement dam would be approximately 42 ft higher than the existing dam.

The South Spillway is a concrete structure located approximately 1,200 ft to the south of the main dam (Figure 2-3). The spillway has an 800-ft-long ungated ogee crest at 568 ft msl. The spillway discharges to the Mokelumne River through Mexican Gulch. The spillway was modified in 2002 to safely pass the estimated PMF.

The Jackson Creek Dam, constructed in 1925, consists of a 37-ft-high concrete structure originally constructed as a spillway with earth embankments abutting the northeast and southwest ends of the structure (Figure 2-3). The crest of Jackson Creek Dam is approximately 585 ft msl (including a 3-ft parapet wall), and the crest length is about 1,360 ft. The dam contains sixteen 5-ft-by-12-ft spillway barrels originally fitted with slide gates. The spillway barrels were plugged with concrete in 1952 to improve stability and the structure no longer functions as a spillway. The earth embankment dikes have a crest width of 20 ft; reinforced concrete slabs cover the upstream slopes.

The JVID is entitled to divert up to 3,850 af per year from Pardee Reservoir into Lake Amador, as stated in the May 1962 agreement with EBMUD. A 24-inch outlet pipe with gate control passing through the concrete structure provides a maximum diversion rate of 50 cfs. The quantity of water available in Pardee Reservoir for delivery to JVID at any time is determined by the inflow to Pardee Reservoir. This flow is regulated by the existing upstream reservoirs of PG&E and is diminished by the demands of other diverters with senior rights. If the water level of Pardee Reservoir drops below 550 ft msl or if no water is available under the permit's 1926 priority date, no Mokelumne River water is diverted to JVID.

Design

The replacement dam would be constructed of roller-compacted concrete (RCC). The replacement dam would have a conventional trapezoidal cross section. The dam crest would be approximately 1,970 ft long at an elevation of 617 ft msl. The structural height of the dam at its maximum sections would be about 402 ft, depending on the depth of foundation excavation needed. The crest width of the dam would be 30 ft to accommodate two 12-ft-wide traffic lanes and a 1-ft-wide parapet wall (3.5 ft high) and 2-ft-wide walkway on each side. Construction would require approximately 1.5 million cubic yards of RCC.

The replacement dam spillway, located in the middle of the dam crest, would consist of two spillways: a gated service spillway that would be used routinely for frequent small-scale spills and a gated auxiliary spillway to accommodate larger spills. The combined release capacity of the spillways, in addition to the release capacity of the replacement dam, would safely convey the PMF. The general capacity and operational criteria for the proposed spillways are described below.

Operation and Maintenance

The discharge capacity of the service spillway varies according to reservoir storage levels and increases as reservoir storage increases. Gate information for the service spillway is shown in Table 2-3.

Table 2-3. Pardee Dam Service Spillway Gate Design Data

Category	Data
Number and type of gate	One flap gate
Width of gate opening	60 ft
Spillway crest	596 ft msl
Top of gate	614 ft msl
Discharge at reservoir level:	
601 ft msl—normal maximum storage	2,500 cfs
614 ft msl—maximum flood control storage	16,400 cfs
617 ft msl—PMF surcharge	20,400 cfs

The auxiliary spillway would be used only to carry the remainder of the spills that exceed the capacity of the service spillway with the gate fully open (i.e., spills above an elevation of 614 ft msl) and would allow the safe discharge of the PMF.

Construction Considerations

Constructing a new replacement dam downstream of the existing dam would allow Pardee Reservoir to continue normal operations during construction. As a result, the replacement dam and associated structures could be constructed without requiring any unusual scheduled drawdown of the reservoir. Releases from the existing dam would be stopped for a period of about 1 month when the river is first diverted and again 2 years later when the diversion is closed and plugged.

Existing flood protection procedures would not be affected except that increased flood storage may be provided in Pardee Reservoir to minimize the risk of flooding the replacement dam construction site. Floods in excess of the capacity of the diversion scheme may overtop the cofferdam and the partially completed main dam, requiring rebuilding of the cofferdams and cleanup of deposited sediment.

From time to time during construction, downstream flow releases from Pardee Reservoir would be interrupted to accommodate construction activities. When the river is first diverted in the second year of construction, and again when the diversion is shut down and plugged at the end of construction, all releases from the existing dam would be temporarily shut off. For the duration of construction, releases from the existing dam would be regulated to even out fluctuations in streamflow through the construction site. Other contingencies may also require occasional reductions or shutdown of releases. While the new reservoir between the existing and replacement dam is being filled, downstream releases would be adjusted to control the rate of filling.

New Powerhouse

Location

The existing powerhouse was constructed in 1929 as part of the original Pardee Reservoir project. The powerhouse is a concrete structure located at the toe of Pardee Dam and equipped with two 9.4-MW Francis hydroelectric turbine generator units. A third Francis unit of 10.4 MW capacity was added in 1983 in an annex on the downstream side of the original powerhouse. A 60-kV substation located on the roof of the powerhouse interconnects with a 60-kV PG&E overhead transmission line. The powerhouse provides an average annual energy generation of 83 GWh/yr. The maximum release from the powerhouse is 1,260 cfs.

The existing Pardee powerhouse would be decommissioned and replaced by a new 30-MW powerhouse facility constructed at the downstream toe of the replacement dam.

Design

The new powerhouse would be 60 ft long by 55 ft wide containing two 15-MW Francis turbines and generators. The generating units would draw water from a multilevel power intake facility on the upstream face of the dam. On the downstream face of the dam, the generator units would be connected to outlets that release up to 600 cfs each. Provisions may be made for later installation of a third unit.

A new switchyard for the powerhouse would be located approximately 600 ft south of the south abutment of the new dam. Transmission lines would be extended from the switchyard to PG&E's transmission system, in a manner similar to the existing transmission lines (see Utilities below).

Maintenance and Operations

Average annual energy generation would increase from 83 GWh/yr to an estimated 102 GWh/yr.

Construction Considerations

During construction, power production from Pardee would be interrupted for a period of about 2 years. When the temporary river diversion for the replacement dam is placed in operation, existing power production facilities would be decommissioned and dismantled to avoid the possibility of inundation during flood events. The new powerhouse would not be commissioned until about 2 years later.

New Saddle Dams

Location

To contain the enlarged reservoir, two saddle dams (Pardee Saddle Dams Nos. 1 and 2) would be constructed on the reservoir perimeter to the north of the replacement dam (Figure 2-3). Two additional saddle dams (Jackson Creek Saddle Dams Nos. 1 and 2) would be constructed on the divide between the Mokelumne River Valley and Jackson Creek Valley to contain the north arm of the enlarged reservoir.

Design

Pardee Saddle Dam No. 1 would be required to close a low draw located approximately 1,000 ft to the north of the right abutment of the new replacement dam. The dam would be an earth-core/rockfill embankment dam approximately 120 ft high, requiring approximately 430,000 cubic yards of fill material. The dam crest would be 1,500 ft long at a crest elevation of 622 ft msl.

A smaller saddle dam, Pardee Saddle Dam No. 2, would be located approximately 1,500 ft north of Saddle Dam No. 1. Saddle Dam No. 2 would be 12 ft high by 200 ft long with a crest elevation of 622 ft msl. The earth embankment dam would require approximately 10,000 cubic yards of fill materials. The crest width would be 30 ft to accommodate the relocation of Pardee Dam Road.

Jackson Creek Saddle Dam No. 1, would be an earthfill/rockfill embankment dam constructed just to the north of the present Jackson Creek Spillway. The dam would be aligned to take advantage of an existing knoll at the westerly end of the dam with an overall length of approximately 1,700 ft. The saddle dam would have a crest elevation of 622 ft msl and a width of 30 ft to accommodate the relocated Stony Creek Road. The dam height, from crest to toe, would be approximately 97 ft. A new 24-inch-diameter outlet pipe would be connected to the existing 24-inch-diameter pipe to allow water releases from Pardee Reservoir to the JVID, as provided by the existing Jackson Creek Spillway. The existing Jackson Creek Spillway would be abandoned in place and inundated by the new reservoir.

Jackson Creek Saddle Dam No. 2, would be a conventional zoned earthfill dam approximately 670 ft long. The dam crest would be at an elevation of 622 ft msl and would be 30 ft wide to accommodate the relocated Stony Creek Road. The dam height, from crest to toe, would be approximately 67 ft.

Operations and Maintenance

The Pardee and Jackson Creek saddle dams would not have spillways. All reservoir spillway requirements would be met by the spillway design of the Pardee replacement dam.

Construction Considerations

Construction of the new saddle dams would not require cofferdams or drawdown of the water level of Pardee Reservoir.

Intake Tower Modifications

Location

Water in Pardee Reservoir is conveyed to the beginning of the Mokelumne Aqueducts via an intake tower that feeds water to Pardee Tunnel and on to the beginning of the aqueduct at Campo Seco. The intake to the aqueduct system is located in the south arm of Pardee Reservoir about 1 mile southeast of the main dam. The maximum delivery capacity of the system (with pumping) is 325 MGD. Currently EBMUD delivers an average supply of 220 MGD in non-drought years. During winter when the demand is low, flows can be as low as 100 MGD.

Design

The existing intake facility consists of a vertical cylindrical concrete tower 187 ft tall. The upper 100 ft of this tower is freestanding in the reservoir, and the lower 87 ft is a shaft excavated in rock. The tower has inlets at elevations 460, 490, 520, and 550 ft msl and an operating deck at 576 ft msl. The inlet openings or gates are located at various elevations to allow EBMUD to draw water from any desirable elevation band within the reservoir. Water is drawn into the intake tower through the gates at two selected elevations that are determined by sampling water from the west portal of the tunnel. Because of water quality concerns in Pardee Reservoir (i.e., temperature and turbidity), the water samples are taken from different elevation bands and analyzed for water quality. Water is drawn from the inlet that provides the best water quality. When the reservoir water level falls below 460 ft msl, water is drawn through the extended tunnel in the reservoir.

To accommodate high reservoir water surface elevations, the height of the existing intake tower would be increased by 35 ft. The intake facility would be 375 ft high and constructed of reinforced concrete with several sets of gates at different water levels to regulate temperature and turbidity of outflow from the reservoir. Openings for 8-ft-by-12-ft slide gates would be constructed at elevations 585, 515, 445, and 300 ft msl in the structure's sidewalls. These openings would be provided with trash racks.

Maintenance and Operations

Modifying the intake tower would include removing the upper part of the tower above 565 ft msl; strengthening the remaining existing tower; constructing a reinforced concrete extension of the tower extending from 565 ft msl to a new operating deck at 620 ft msl; raising the access bridge to serve the new operating deck; installing the new gates and operating equipment; constructing a gatehouse on the intake tower; and constructing a central power unit to operate all hydraulic equipment.

Construction Considerations

Reservoir drawdown would not be necessary during construction. The intake tower could be shut down during construction for up to 3 to 4 months at a time because EBMUD's water supply needs would be met by the terminal storage reservoirs in the East Bay or by pumping water from Camanche Reservoir to the Mokelumne Aqueducts.

Pardee Tunnel Modifications

Location

Pardee Tunnel, which has been in operation since its completion in 1930, conveys water from the intake tower to the Campo Seco valve facility. The concrete-lined tunnel is about 10,000 ft long and with a nominal diameter of 8 ft. The tunnel extends upstream approximately 800 ft from the intake into the reservoir.

Design

When the water surface elevation of Pardee Reservoir falls below 460 ft msl, water is drawn directly into the tunnel. The tunnel has a slight slope from 392 ft msl at the intake to 388 ft msl at Campo Seco. A chemical feed plant is located directly over the tunnel about 1,200 ft downstream of the intake and is connected to the tunnel by a 230-ft vertical shaft. The chemical feed plant adds lime to the Mokelumne River water being conveyed by the aqueducts to increase the pH of the water. The higher the pH (or the more basic the water), the less likely the water will adversely react with the mortar lining of the aqueducts.

Pardee Tunnel would be modified to accommodate higher water pressure associated with higher water levels in the enlarged reservoir. Most of the tunnel, where rock cover is adequate, would not be modified.

Operations and Maintenance

Improved access to the tunnel would be added to allow the tunnel to be inspected and repaired.

Construction Considerations

Modifications to Pardee Tunnel should not affect water supply for EBMUD's service area. The tunnel could be shut down during construction for up to 3 to 4 months at a time because EBMUD's water supply needs would be met by the terminal storage reservoirs in the East Bay or by pumping water from Camanche Reservoir to the Mokelumne Aqueducts.

Pressure Reduction Facility

Location

The downstream segment of Pardee Tunnel, the Campo Seco valve facility, and the Mokelumne aqueduct are not designed to sustain the higher internal hydraulic pressures that would result from the higher water levels in the enlarged reservoir.

Design

Rather than upgrade the above-mentioned facilities to accommodate the higher pressure, a pressure reduction facility would be added. The pressure reduction facility would consist of three rotovalve energy dissipaters and a new surge shaft and basin. The facility would be constructed approximately 3,000 ft upstream of the Campo Seco portal. Each of the three valves would have a capacity of 300 cfs.

Operations and Maintenance

The underground pressure-regulating facility would be connected to the existing Pardee Tunnel during construction-related outages of the intake tower and tunnel.

Relocation or Removal of Roads, Bridges, and Utilities

Roads and Bridges

Location

Pardee Dam Road begins at Stony Creek Road, extends south across Pardee Dam and its spillway, and intersects Campo Seco Road. It provides access to the Pardee Recreation Area and to Pardee Center. EBMUD owns the road, but public access is allowed.

Stony Creek Road is an Amador County road that provides access around the north side of Pardee Reservoir. Stony Creek Road intersects Pardee Dam Road about 1.75 miles north of Pardee Dam, passes the recreation area, crosses Jackson Creek Dam and Spillway, and continues northeast to Jackson.

SR 49 connects Amador and Calaveras Counties via a 2-lane concrete box girder bridge, designed in 1951, that crosses the Mokelumne River at Big Bar.

Middle Bar Bridge is a 1-lane steel girder bridge that spans the upper reaches of the existing Pardee Reservoir. The Middle Bar Bridge, built in 1912 by Clinton Bridge and Iron Works, is listed on the National Register of Historic Places.

Design

Pardee Dam Road would be relocated to cross the crest of the new dam and Pardee Saddle Dam No. 2. The road would follow a new alignment route west of the reservoir and connect to the existing road at points approximately 1.2 miles north and 1.2 miles south of the existing Pardee Reservoir (Figure 2-3). The length of the new alignment would be approximately 2.6 miles.

Stony Creek Road would be relocated to cross the crests of the new Jackson Creek Dam and Jackson Creek Saddle Dams. The length of the new alignment would be approximately 1.5 miles.

At the upstream end of the reservoir, the SR 49 bridge crossing would be replaced with a new higher bridge structure and approaches that would clear high water, including reservoir backwater effects during high flows. Figure 2-3 shows the proposed realignment of SR 49 and the location of the replacement bridge over the Mokelumne River. The new bridge would be located 50–80 ft east of the existing bridge. Realigning to the east would avoid encroaching on the wetlands and floodway of Butte Canyon, which enters the Mokelumne River from the north, downstream (west) of the existing bridge. The proposed 2-lane bridge and road approaches would meet current Caltrans standards for bridges and rural highways in mountainous terrain.

The increased reservoir levels would inundate the Middle Bar Bridge. The bridge would be removed because it would become a hazard to navigation if left in place. A new fishing pier would be constructed near the head of the reservoir to replace the bridge. Turnaround areas would be constructed at the ends of

Gwin Mine and Middle Bar Roads above the high water level on both sides of the reservoir. Figure 2-3 shows the location of the existing Middle Bar Bridge and the proposed locations for the turnaround areas and new fishing pier.

In addition to the above modifications, a new access road would be built for construction of the powerhouse and replacement dam. The new access road would extend from the intersection with the relocated Pardee Dam Road, approximately 1,000 ft southeast of the left abutment of the new replacement dam, and descend down a steep gradient following Rag Gulch to near its confluence with the Mokelumne River. The new access road would begin to flatten as the roadway turns sharply to the northeast to the top deck of the new powerhouse. The last portion of the access road would create a 40-ft-high cut on the uphill side.

Operations and Maintenance

The existing SR 49 bridge would remain in service during construction. If it is determined that the existing bridge would be a hazard to navigation, it would be demolished after the new bridge has been constructed and placed in service. The height of the new bridge would satisfy the criteria requiring a minimum 4-ft clearance above the 100-year flood level.

Construction Considerations

Public access across the existing dam would be available throughout the construction program; however, traffic would be discouraged by signs advising of construction activities and directing public traffic to alternate routes. Stony Creek Road would be closed during reconstruction of the Jackson Creek Dam; a detour around the site would be constructed for public use. Equipment working on the replacement dam would use dedicated haul roads separated from public roads by grade separation structures.

Utilities

Location

Several power transmission lines cross the upper part of the reservoir and the new inundation area between the existing and replacement dams.

Design

The power lines would be either raised or relocated. The powerlines are:

- A 60-kV transmission line crossing the Mokelumne River just upstream of the SR 49 bridge.
- A 60-kV transmission line crossing the upper part of the reservoir about 4,000 ft downstream of the Middle Bar Bridge.
- A 60-kV transmission line extending to the south from the substation located on the roof of the existing powerhouse. This line would be relocated to tie into the new switchyard near the left abutment of the replacement dam.

- A distribution line extending from the existing powerhouse substation to Pardee Center. A new line from the new switchyard would replace this line.
- A distribution line near the right abutment of the existing Jackson Creek Dam.

Replacement of Existing Recreational Areas

Location

The Pardee Recreation Area is located on the north arm of the reservoir near Jackson Creek Dam (Figure 2-3). The lakeshore recreation area offers a boat ramp and marina, short and long-term recreational vehicle (RV) areas, coffee shop/store, swimming pools, fishing, and hiking. The season for the Pardee Recreation Area begins the first Friday in February and closes the last Sunday in October. The Mokelumne Coast to Crest Trail extends along the south side of Pardee Reservoir from the south arm to the end of the east arm, approximately 8 miles up the Mokelumne River Canyon. The trail is approximately 11 miles long.

Middle Bar Bridge provides a river crossing for vehicles and is used by anglers to access the upper reservoir when the reservoir is near capacity. The bridge is also used as a take-out point by whitewater rafters that have continued downstream from SR 49.

Design

The Pardee Recreation Area would be inundated by the enlarged reservoir. The existing facilities would be relocated above the new shoreline of the reservoir. The proposed recreation facilities would be located on approximately 116 acres along the western shore of the reservoir's southern arm (shown in small scale in Figure 2-3, and in large scale in Figure 2-14). An entry gate, administration building, and restrooms would be located along a new road leading from Pardee Road into the recreation area. The recreation area would feature a children's playground, two swimming pools, coffee shop with a store and game room, equestrian staging area, day use area with 30 picnic sites, two campgrounds, group camping facilities, and a walk-in campground. The campgrounds would feature 100 tent-camping sites and 112 short- and long-term RV areas. There would also be an area for employee housing. Water-related amenities would include a marina providing boat rentals and a bait and tackle shop, a 10-boat capacity boat launch ramp, and boat launch parking. The new recreation area also would include a service station, car wash, dump station, showers, storage area, and laundry facilities.

The Middle Bar Bridge would be inundated by the enlarged reservoir. Fishing piers would be constructed on the north and south sides of the reservoir, near the ends of Gwin Mine Road and Middle Bar Road. Turnaround and parking areas would be constructed at the end of each road.

The Middle Bar Take-Out Facility is a 2-acre boating take-out. The facility was established to provide for easier egress from the river for whitewater kayakers and rafters, thereby limiting body contact with reservoir waters and protecting reservoir water quality. Construction of this recreation facility began in fall 2002 and was completed in May 2003. This facility would be replaced with a similar facility at a higher elevation not susceptible to frequent inundation.

Operations and Maintenance

So as not to disrupt recreation provided by these facilities, relocation of the Pardee Recreation Area would be completed before beginning construction on the new Pardee Dam and saddle dams. The new boat ramp and marina would be constructed and developed in such a fashion as to extend from below the existing water level (568 ft msl) to allow boating recreation to continue before the reservoir is filled to its new water level (601 ft msl).

Construction Considerations

Recreation and boating facilities would be relocated before construction starts to avoid interference with construction activities.

Construction Schedule

Construction of the project components would occur on the following schedule, assuming the components were constructed concurrently.

Freeport Intake Facility to Mokelumne Aqueducts

- Intake facility: construction would require between 2 and 3 years, depending on river flow, weather conditions, and time of year the project is initiated.
- Pipeline: construction would proceed at an average rate of 100 ft per day along major roadways, 150 ft per day within other city and county streets, and up to 400 ft per day in construction areas outside roadways. Construction would require approximately 2 years to complete.
- SCWA Zone 40 Surface WTP: construction would require 3 to 4 years to complete the initial phase.

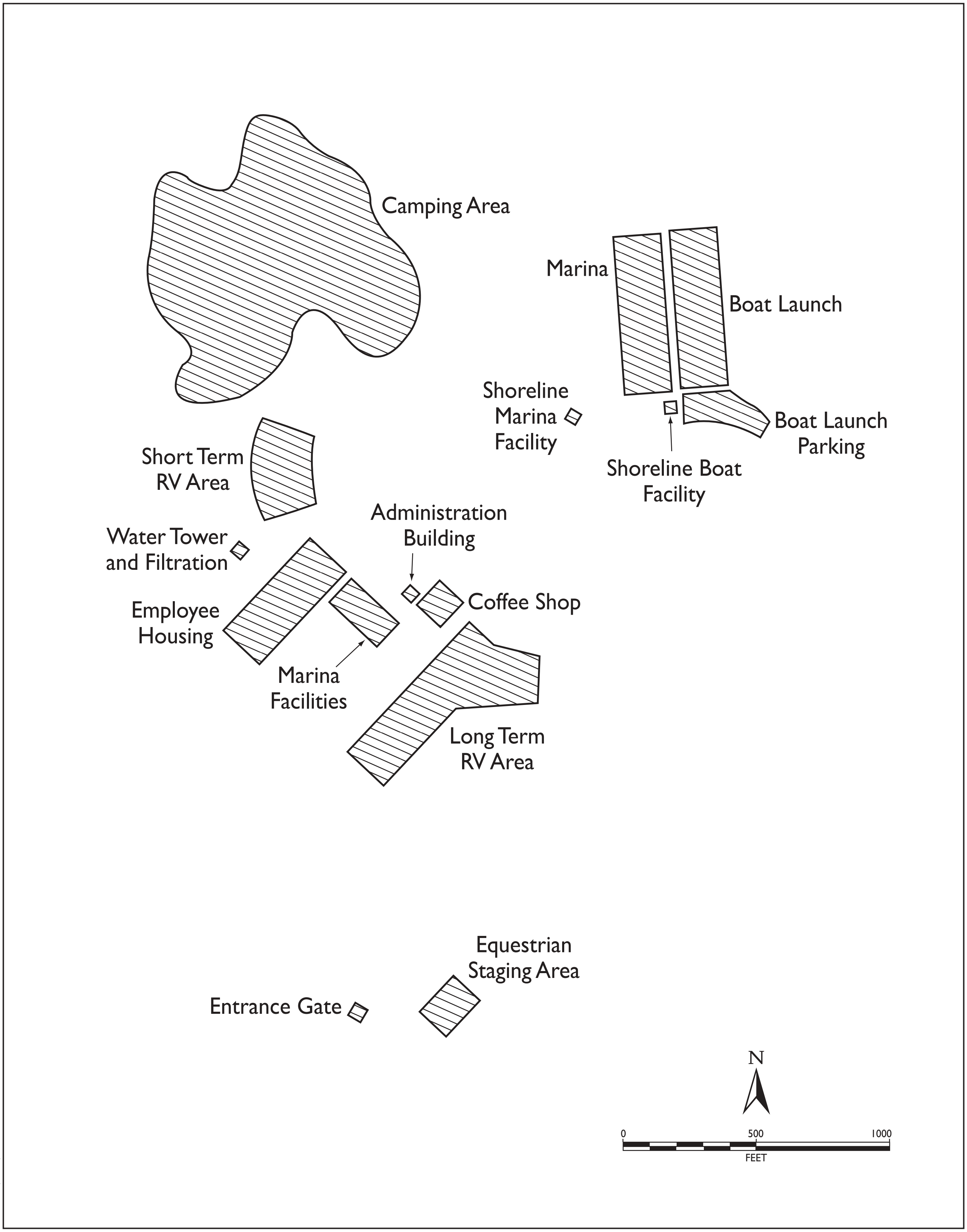

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Figure 2-14
Proposed Recreation Area Detail

- Canal pumping plant: construction would require 2 full construction seasons to complete.
- Aqueduct pretreatment facility and pumping plant: construction would require 2 full construction seasons to complete.

Enlarge Pardee Reservoir

- Predesign, design, and construction activities for the replacement dam are anticipated to require 7 years, with construction occurring nonstop year-round for 3 to 4 years.
- The existing Pardee Dam would be breached after the replacement dam is completed. The breaching process would be executed in two phases, separated by a few months as the reservoir is equalized.
- Powerhouse: construction of the new powerhouse would occur during the final 2 years of the project.
- Saddle dams: construction of Pardee and Jackson Creek Saddle Dams would require 3 years of construction and would be completed by the end of the third year.
- SR 49 bridge: A new bridge upstream of the existing bridge and approaches would be constructed and opened in the fourth construction year. The existing roadway would remain open until the replacement is built.

Operations

Sacramento County Water Agency

Alternatives 2–6

SCWA's primary sources of water for Zone 40 are its existing P.L. 101-514 CVP water supply contract, commonly known as the "Fazio contract," an anticipated assignment of a portion of SMUD's existing CVP water supply contract, potential appropriative water rights on the American and Sacramento Rivers, potential transfers of water from areas within the Sacramento Valley, and groundwater in the central county basin. Table 2-4 summarizes the total surface water supplies from these sources assumed for facility planning. Each of these sources is described below, following a brief summary of the Sacramento Area Water Forum Agreement, which sets the stage for some of the information presented later.

Table 2-4. Total SCWA Existing and Anticipated Surface Water Supplies[1]

Surface Water Entitlement	Estimated Long-Term Average Use[2]
P.L.101-514 CVP water supply contract	12,500 [3]
SMUD CVP contract assignments	25,500
Appropriated or transferred water	16,000
Other water supplies[4]	14,500
Total long-term average use	68,500

[1] Long-term average use of each individual supply is subject to minor change resulting from refinement of CALSIM modeling runs for Freeport Regional Water Project EIS/EIR. Total Long-Term Average Use will remain fixed at 68,500 AFA.

[2] Based on 73-year historical hydrology.

[3] 8,500 AFA to be diverted at SRWWTP.

[4] Further described under "Other Water Supplies" below.

Sacramento Area Water Forum Agreement

Public agencies in the Sacramento area have been involved in a cooperative effort, known as the Water Forum, designed to explore acceptable project alternatives that could bring additional high-quality water to Sacramento County, the City of Sacramento, and entities in Placer and El Dorado Counties. The common goal is to provide a safe, reliable water supply for the entire region while preserving fishery, wildlife, recreational, and aesthetic values along the lower American River.

The Water Forum is a diverse group of business and agricultural leaders, citizen groups, environmentalists, water managers, and local governments in the Sacramento area. In 1995, water managers in Placer and El Dorado Counties joined these groups. The members of the Water Forum developed a Water Forum Proposal for the effective long-term management of the region's water resources. The Water Forum Proposal was analyzed and reviewed in an EIR prepared and certified by the City and County of Sacramento. To signify approval of the Proposal, 40 Water Forum members signed the Water Forum Agreement in April 2000.

To achieve the Water Forum goals, all signatories of the Water Forum Agreement are committed to support and, where appropriate, participate in seven elements of the agreement:

- increased surface water diversions,

- actions to meet customers' needs while reducing diversion impacts on the lower American River in drier years,
- support for an improved pattern of fishery flow releases from Folsom Reservoir,
- lower American River habitat management,
- water conservation,
- groundwater management, and
- participation in Water Forum successor effort.

SCWA participated in the Water Forum process and is a signatory to the Water Forum Agreement. The Water Forum Agreement supports SCWA's pursuit of additional water supplies and includes SCWA's need for increased surface water diversions. SCWA's "Purveyor Specific Agreement" also commits it to certain limitations on its use of water supplies. SCWA agreed to divert surface water at or near the mouth of the American River or from the Sacramento River. It agreed to limit its maximum surface water diversions to 78,000 AFA within the "South County M&I Users Group" area within Zone 40. An additional area within Zone 40 that overlaps the City of Sacramento's American River water rights settlement contract place of use is considered in the Water Forum Agreement. This area will need a long-term average of 9,300 AFA of surface water to meet its projected demand and up to 12,000 AFA in any single year. SCWA anticipates diverting up to 90,000 AFA (in any single year) to serve all of Zone 40. It also agreed to meet strict water conservation requirements specified in the Water Forum Agreement that are to be applied throughout the Sacramento region. In addition, the Water Forum Agreement sets the sustainable yield of the central county groundwater basin, from which SCWA pumps, at 273,000 AFA. Of that yield, SCWA expects to be able to produce a long-term average of approximately 41,000 AFA.

CVP Water Supply Contracts

In 1999, SCWA contracted with Reclamation for a CVP water supply under Public Law 101–514. This contract provides for the delivery of up to 22,000 AFA to meet the needs of Sacramento County, with up to 7,000 AFA of this amount delivered to the City of Folsom through a subcontract. This subcontract is intended to provide a long-term supply to the City of Folsom. Under this contract SCWA is authorized to receive up to 15,000 AFA depending on actual water needs and provided that it fully uses existing water entitlements within Sacramento County, implements water conservation and metering programs within the contract service area, and implements programs to maximize the conjunctive use of surface water and groundwater. This contract provides for Reclamation to reduce deliveries by up to 25% from the contract maximum during years when low runoff limits CVP supplies.

SMUD CVP Contract Assignments

The Sacramento Area Water Forum supports the development of water transfers and water contracts with existing entitlement holders. Consistent with the Water Forum Agreement, an agreement-in-principle has been signed by SMUD, the City of Sacramento, and SCWA. SMUD has an existing Reclamation contract. Under that contract, two assignments totaling 30,000 AFA of water would be made to SCWA. As part of the Water Forum Agreement, SCWA's Zone 40 would provide groundwater supply and delivery facilities to meet SMUD's dry-year water shortages.

The agreement to effectuate both assignments is currently being negotiated. The potential environmental effects of both assignments are undergoing CEQA environmental review and are addressed further under the EIR/EIS for the proposed FRWP. The quantity of water to be obtained under the SMUD assignment could be offset completely or in part by some or all of the other water supplies described below.

Appropriative Water Rights

On May 30, 1995, the Sacramento County Board of Supervisors approved the submittal of an application to the (SWRCB) for the appropriation of water from the American and Sacramento Rivers. The amount of water available would be determined after an evidentiary hearing before the SWRCB, wherein environmental and public interests will be balanced with SCWA's need for water. This water, estimated to be diverted at an average rate of 16,000 AFA, could be used in conjunction with existing groundwater supplies to increase long-term groundwater yields. This quantity of water could be offset completely or in part by some or all of the other water supplies described below. The potential environmental effects of using this supply are assessed in this EIR/EIS.

Other Water Supplies

As Zone 40 approaches buildout conditions in the future, more reliance on other sources of water or methods of supplementing groundwater yields will be necessary to comply with long-term average operational groundwater yield limitations while meeting buildout demand. Possible options for meeting this demand could involve the following actions:

- acquiring water through transfers from other water users upstream of SCWA diversion points,
- using the City of Sacramento's American River entitlements in that area of Zone 40 that is within the City's authorized American River Place of Use,
- supplementing natural recharge during wet years with existing supplies,

- using reclaimed water from the SRWWTP on an exchange basis, or
- acquiring additional appropriated water.

The potential environmental effects of using a water rights transfer are addressed in this EIR/EIS.

East Bay Municipal Utility District

Alternatives 2–5

Water supply forecasts are used in the preparation of operation projections. The water supply forecast is a March 1 forecast of EBMUD's October 1 total system storage, as revised monthly through May 1 as more reliable information becomes available. The main parameters considered in the operation projection are the water supply forecast of projected runoff, water demand of other users on the river, water demand of EBMUD customers, and flood control requirements. According to the terms of its CVP Contract with Reclamation, these forecasts determine when EBMUD would be able to take delivery of Sacramento River water through the new intake facility to supplement its water supplies and retain storage in its Mokelumne River and terminal reservoir systems.

Under the terms if its amendatory contract with Reclamation, EBMUD is able to take delivery of Sacramento River water in any year in which EBMUD's March 1 forecast of its October 1 total system storage is less than 500,000 af. When this condition is met, the amendatory contract entitles EBMUD to take up to 133,000 af annually. However, deliveries to EBMUD are subject to curtailment pursuant to CVP shortage conditions and are further limited to no more than 165,000 af in any three-consecutive-year period that EBMUD's October 1 storage forecast remains below 500,000 af.

EBMUD would take delivery of its entitlement at a maximum rate of 100 MGD. Deliveries would start at the beginning of the CVP contract year (March 1) or any time afterward. Deliveries would cease when EBMUD's CVP allocation for that year is reached, when the 165,000 af limitation is reached, or when EBMUD no longer needs the water, whichever comes first. Alternatives 2–5 assume that delivery limitations mandated in the Hodge Decision would not apply to the Sacramento River diversion point because it is not located on the lower American River.

Use of Available Capacity

At times when EBMUD is not using the full capacity available from Alternatives 2–5, some capacity may potentially be available to others; however, implementation of these alternatives is not dependent on use of this potentially available capacity by others, including the joint project participants. Such use will be subject to additional environmental documentation and compliance.

Alternative 6

Proposed operations of the enlarged reservoir (Alternative 6) would not fundamentally change from existing operations. However, the new facilities would increase operational flexibility. This section describes EBMUD's water rights, as well as water rights upstream and downstream of Pardee Reservoir for other parties. These water rights affect how water is managed at Pardee Reservoir. This section also describes reservoir operations, the capacity of the enlarged Pardee Reservoir, yield of the enlarged reservoir, and flood control operations for both Camanche and Pardee Reservoirs.

Water Rights

When the original EBMUD water system, including construction of Pardee Reservoir, was planned in the 1920s, EBMUD acquired water rights to divert up to 200 MGD from the Mokelumne River for water supply. When EBMUD completed Camanche Reservoir in 1964, EBMUD increased its entitlement from the Mokelumne River to 325 MGD.

Although EBMUD is entitled to use up to 325 MGD from the Mokelumne River, the ability to use the full entitlement is limited by system demand, river hydrology, upstream storage and diversions, seasonal flood control requirements, and reservoir releases to the lower Mokelumne River. These releases are required to meet obligations to protect environmental resources and the needs of senior water rights holders.

Upstream storage and diversions that require minimum instream flow requirements include:

- PG&E's Mokelumne Hydroelectric Project,
- Amador County Water Agency,
- Calaveras County (including Calaveras County Water District and Calaveras Public Utility District), and
- JVID.

Inflow to Pardee Reservoir is regulated by the upstream PG&E reservoirs and is diminished by the demands of other diverters with priorities earlier than EBMUD's water rights. EBMUD's original water rights permit was issued on April 17, 1926. Diversions from the lower Mokelumne River that are senior to EBMUD's rights include:

- North San Joaquin Water Conservation District,
- Woodbridge Irrigation District, and
- City of Lodi.

EBMUD also must accommodate reservoir releases to the lower Mokelumne River as agreed upon under the November 27, 1998, FERC Order approving the Joint Settlement Agreement (JSA) and Amending License, EBMUD.

EBMUD also releases additional carriage water from Camanche Reservoir, which is located just below Pardee Reservoir, to ensure that sufficient water actually reaches downstream users because water is lost from the stream to evaporation, evapotranspiration, and seepage from the streambed into the groundwater basin.

Before enlarging Pardee Reservoir, EBMUD would have to obtain any appropriate modifications to its water rights from the SWRCB. Except as discussed below, this project assumes that the water rights would not constrain operation of an enlarged Pardee Reservoir.

Reservoir Operations

EBMUD operates both Pardee Reservoir and Camanche Reservoir to provide a reliable water supply, manage water quality and temperature, provide downstream flood protection, generate hydroelectric power, accommodate water recreation, and sustain flows in the Lower Mokelumne River. Joint operation of Pardee Reservoir and Camanche Reservoir would be consistent with existing operations to meet water supply, flood control, and downstream flow requirements. Main operating objectives of Pardee Reservoir are as follows:

- Storage and diversion of water for transfer through the Mokelumne Aqueducts to the East Bay to meet filter plant demands, and to meet East Bay Terminal Reservoir storage objectives. Currently EBMUD delivers to its service area an average water supply of 220 MGD in nondrought years. During winter when the demand is low, flows can be as low as 100 MGD.
- Transfer of water by gravity flow. Aqueduct pumping costs are minimized by keeping the reservoir near full.
- Winter and spring flood control storage in conjunction with Camanche Reservoir and PG&E's Salt Springs and Lower Bear Reservoirs.
- Providing suitable water levels for boating recreation.
- Hydropower generation at the Pardee powerhouse.
- During fall, special releases of cold water from Pardee Reservoir are made through Camanche Reservoir to the lower Mokelumne River for protection of aquatic resources.

- In very dry years, when Camanche Reservoir is depleted, water is released from Pardee Reservoir to meet the needs of senior water rights holders downstream of Camanche Dam.

Pardee Reservoir Capacity

The maximum controlled water surface elevation of the enlarged Pardee Reservoir would be increased from 568 ft msl to 614 ft msl. Maximum controlled reservoir storage would be 370,000 af, an increase of 172,000 af from current conditions. Table 2-5 summarizes the existing and enlarged reservoir capacity and water surface elevations.

Table 2-5. Reservoir Capacity and Water Surface Elevations

Parameter	Units	Existing Reservoir	Enlarged Reservoir	Difference
Gross maximum controlled storage	TAF	198	370	172
Maximum controlled storage elevation	ft msl	568	614	46
Surface area at maximum controlled storage elevation	ac	2,250	3,480	1,230
Normal operation maximum storage elevation	ft msl	568	601	33
Major flood events maximum storage elevation	ft msl	575	614	39
Probable maximum flood water surface elevation	ft msl	581	617	36

To minimize effects on whitewater boating in the Electra Run, upstream of the SR 49 bridge, the water surface at Pardee Reservoir would be held at or below 601 ft msl during normal operating conditions. Empty storage space in Pardee Reservoir above 601 ft will allow some Camanche flood control storage to be reallocated to water supply.

The 13-ft increment between the maximum water supply surface elevation of 601 ft msl and the maximum controlled storage elevation of 614 ft msl would be used for flood control purposes. Under extreme conditions, defined as the design PMF, the water surface elevation would increase to 617 ft msl. Monthly minimum elevations are strongly influenced by infrequent, but dramatic, climate-driven lowering during dry periods, such as water years 1931–32, 1935, 1961–62, 1976–79, and 1988–92.

Yield

Studies conducted by EBMUD indicated that increasing the storage capacity of Pardee Reservoir by 172,000 af would substantially meet EBMUD's need for additional water.

Flood Control

Enlarging Pardee Reservoir would not change flood control parameters at Pardee and Camanche Reservoirs. Storage and releases for flood control purposes are based on the *Corps of Engineers Reservoir Regulation Manual for Flood Control* for Pardee and Camanche Reservoirs. The manual requires that a combined flood storage reservation of 200,000 af be maintained in Pardee and Camanche Reservoirs between September 15 and July 31 of each year. The manual also provides that Camanche releases be restricted as possible to less than 5,000 cfs.

When space available for flood control is less than required, as determined using the manual's flood control design, water is released from Camanche Reservoir according to a specified schedule without causing the maximum flow rate to be exceeded. Once the flood control space equals the required volume, Camanche releases can be reduced.

The surface elevation of the enlarged Pardee Reservoir could reach as high as 617 ft msl during the PMF. The PMF is the largest flood that can be reasonably expected to occur. The combined service and auxiliary spillway would be designed to safely pass the PMF.

Mitigation Responsibilities

This EIR/EIS consistently specifies FRWA as the responsible agency for implementing the mitigation measures identified throughout this EIR/EIS. It is possible that FRWA, through its CEQA findings, will identify other agencies as the appropriate entity to implement specific mitigation measures. Specifically, SCWA and/or EBMUD may be identified in FRWA's findings as the appropriate agency to implement mitigation measures associated with specific elements of the FRWP that are intended solely for the benefit of that individual agency (e.g., SCWA's Zone 40 Surface WTP, canal pumping plant, enlarged Pardee Reservoir). However, until the exact long-term roles of FRWA, SCWA, and EBMUD, as they relate to the FRWP, are determined, FRWA is the appropriate agency to be identified as the responsible agency for all mitigation measures.

Environmental Commitments

As part of the project planning process, FRWA has incorporated certain environmental commitments into the FRWP alternatives to avoid or minimize potential impacts. Because these environmental commitments have been incorporated into the project by FRWA they will not be restated in the impact analysis sections but instead will be incorporated by reference.

General Construction Measures

To reduce or eliminate construction-related effects, FRWA determined the following commitments to be feasible and implementable measures to reduce or mitigate short-term, construction-related effects. These measures would be implemented as appropriate, depending on the location of construction and surrounding land uses. The identified measures are as follows:

- temporary striping, signing, traffic lighting, and signals for residential and business areas affected by construction;
- access and parking provisions for residences and business areas;
- replacement of existing landscaping;
- coordination with planned improvements (e.g., raised medians, turn lanes, street alignments) to minimize disruptions associated with two or more projects and other projects (e.g., light rail).
- restricted work area in residential areas, expressed as a maximum length of open trench for a given segment at any given time;
- restricted work hours;
- dust suppression and cleanup provisions (e.g., street sweeping, sidewalk cleaning, and debris removal) as needed;
- restoration of roadway surfaces damaged by construction activities, including hauling operations, to preexisting conditions;
- establishment of a community ombudsman to handle ongoing public outreach and address construction concerns;
- fact sheets and public updates to inform the community about progress of the project; and
- restoration of community facilities affected by construction.

A site-specific construction mitigation plan will be finalized after additional community outreach and design and once a project is approved.

Erosion and Sediment Control Plan

FRWA will prepare and implement an erosion control and restoration plan to control short-term and long-term erosion and sedimentation effects and to restore soils and vegetation in areas affected by construction activities. The plan will include all the necessary local jurisdiction requirements regarding erosion control and will implement Best Management Practices (BMPs) for erosion and sediment control as required (may be incorporated into the Storm Water Pollution Prevention Plan [SWPPP] described below).

Storm Water Pollution Prevention Plan

FRWA will submit to the Regional Water Quality Control Board (RWQCB) a notice of intent to discharge stormwater before construction and/or operation activities begin and will develop and implement a SWPPP as required by the conditions of a National Pollutant Discharge Elimination System (NPDES) permit. FRWA will prepare a SWPPP that identifies BMPs for discharges and groundwater disposal from dewatering operations associated with intake construction, trench construction, tunneling, and pipeline testing procedures and/or operations. The SWPPP will identify how and where these discharges would be disposed of during construction and operations. The SWPPP will include an erosion control and restoration plan, a water quality monitoring plan, a hazardous materials management plan, and postconstruction/operations BMPs.

Traffic Control Plan

FRWA, in coordination with affected jurisdictions, will develop and implement a traffic control plan for construction activities to reduce construction-related effects on the roadway system and traffic and circulation patterns throughout the affected pipeline alignment area during the construction period. All construction activities will follow the standard construction specifications and procedures of these jurisdictions. The traffic control plan should include, but not be limited to, the following actions:

- Coordinate with the affected jurisdictions on construction hours of operation and lane closures.
- Follow guidelines of the local jurisdiction for road closures caused by construction activities.
- Limit lane closures during peak commuting hours to the extent possible.
- Install traffic control devices as specified in the California Department of Transportation's *Manual of Traffic Controls for Construction and Maintenance Works Zones*.

- Provide notification of road closures in the immediate vicinity of the open trenches in the construction zone.
- Provide access to driveways and private roads outside the immediate construction zone.
- Develop a business notification plan for access to local businesses in and adjacent to the construction zone.
- Provide alternate routes for bicyclists and pedestrians during sidewalk, bike lane, and recreation trail closures.
- Provide notification to the public of temporary closures of sidewalks, bike lanes, and recreation trails.
- Consult with emergency service providers and develop an emergency access plan for emergency vehicles access in and adjacent to the construction zone.

Dust Suppression Plan

FRWA will develop and implement a dust suppression plan to reduce fugitive emissions during construction activities. This plan will be based on guidance from the Sacramento Metropolitan Air Quality Management District (SMAQMD), the San Joaquin Valley Unified Air Pollution Control District (SJVUAPCD), and other air pollution control agencies. The following practices will be implemented on a site-by-site basis during pipeline construction activities to reduce particulate matter 10 microns or less in diameter (PM10):

- Water all activity construction sites at least twice daily, more often if wind speeds exceed 15 miles per hour.
- Prohibit all grading activities during periods of high wind (i.e., winds greater than 30 miles per hour).
- Stabilize all disturbed areas, including storage piles, that are not being actively used for construction purposes using water, chemical stabilizer/suppressant, or vegetative groundcover.
- Apply nontoxic binders to exposed areas after cut-and-fill operations and hydroseed area.
- Stabilize all on-site unpaved roads and off-site unpaved access roads using water or chemical stabilizer/suppressant.
- Install wheel washers for exiting trucks.
- Control all land clearing, grubbing, scraping, excavation, land leveling, grading, cut and fill, and demolition activities using water or by presoaking to control dust emissions.
- Cover or wet down all material being transported off site to limit visible dust emission.

- Limit or expeditiously remove the accumulation of mud or dirt from adjacent public streets at least once every 24 hours when operations are occurring.
- Following the addition or removal of materials from the surface of outdoor storage piles, effectively stabilize these piles from creating fugitive dust emissions using water or chemical stabilizers/suppressants.
- Control and limit traffic speeds on unpaved roads for non-landowners based on site conditions.
- Replant vegetation in disturbed areas as quickly as possible. In determining the timing of replanting, vegetation type and season will be taken into consideration.

Fire Control Plan

FRWA will develop and implement a fire management plan in consultation with the appropriate city, county, and state fire suppression agencies to verify that the necessary fire prevention and response methods are included in the plan. The plan will include fire precaution, presuppression, and suppression measures consistent with the policies and standards in the affected jurisdictions.

Phase I and Phase II Hazardous Materials Studies

FRWA will complete Phase I hazardous materials studies for soil and groundwater contamination in areas where project facilities would be constructed before beginning construction. Additionally, the recommendations set forth in the Phase I hazardous materials site assessment will be implemented to the satisfaction of the appropriate hazardous materials agencies before construction begins. If Phase I assessments indicate the potential for contamination within or adjacent to the pipeline alignment, Phase II studies will be completed before construction begins. Phase II studies will include soil and groundwater sampling and analysis for anticipated contaminating substances. If soil or groundwater contaminated by potentially hazardous materials is exposed or encountered during construction, the appropriate hazardous materials agencies will be notified. A work plan to characterize and possibly remove contaminants may be required by the appropriate hazardous materials agencies.

Hazardous Materials Management Plan

FRWA will develop and implement a hazardous materials management plan before beginning construction. The plan will include appropriate practices to reduce the likelihood of a spill of toxic chemicals and other hazardous materials during construction. A specific protocol for the proper handling and disposal of materials will be established before construction activities begin and will be enforced by FRWA.

Channel and Levee Restoration Plan

FRWA, in coordination with the California State Reclamation Board, affected local jurisdictions, and the construction contractor, will develop and implement a channel and levee restoration plan to ensure levee flood protection and all water channels and levees affected by project construction activities are restored to preconstruction conditions. This plan also will include erosion protection methods that are consistent with the Erosion Control and Sedimentation Plan mentioned above and revegetation to restore habitat values and aesthetics to the extent permissible by the California State Reclamation Board.

Hydrologic Simulation Modeling and Scour Analysis

FRWA will complete an analysis to determine the potential for adverse effects related to scour of levees or the natural channel as a result of in-channel construction or placement of the intake facility. The analysis will identify measures for minimizing or avoiding adverse effects related to scour, erosion, and sedimentation.

Agricultural Land Restoration

FRWA will prepare and implement an agricultural land restoration plan to ensure agricultural lands that have been disturbed during the construction of the pipeline are returned to preproject levels of production, where practicable. These lands include agricultural lands used for temporary pipeline construction access or as construction staging areas. During construction, use of these lands as storage areas for pipeline trenching spoils will be avoided. If these areas are used for storage of spoils, FRWA will ensure that spoils are removed after pipeline construction is completed. If necessary, FRWA will also ensure that lands are recontoured, topsoil is replaced, irrigation systems are reestablished, and fences are replaced, where practicable. Where implementation is not practicable, FRWA will follow the Private Property Acquisition and Access environmental commitment described below.

Spoils Disposal Plan

FRWA, in coordination with the construction contractor, will ensure that spoils materials from excavation activities during construction will be hauled to an appropriate off-site disposal location or used within the construction right-of-way, where feasible. The disturbed pipeline right-of-way will be reseeded with the appropriate seed mixture. Spoils materials will not be placed in sensitive habitat areas, such as wetlands, or in floodplains identified by FEMA.

Environmental Training

FRWA will inform field management and construction personnel of the need to avoid and protect resources. Communication efforts will occur at preconstruction meetings so that construction personnel are aware of their responsibilities and the importance of compliance.

Construction personnel will be educated on the types of sensitive resources located in the project area and the measures required to avoid impacts on these resources. They will attend an environmental training program before groundbreaking activities associated with the proposed project are initiated. Materials covered in the training program will include environmental rules and regulations for the proposed project and requirements for limiting activities to the construction right-of-way and avoiding demarcated sensitive resources areas.

Training seminars will be held to educate construction supervisors and managers on:

- the need for resource avoidance and protection,
- construction drawing format and interpretation,
- staking methods to protect resources,
- the construction process,
- roles and responsibilities,
- project management structure and contacts,
- environmental commitments, and
- emergency procedures.

Access Point/Staging Area Plan

FRWA will establish staging areas for equipment storage and maintenance, construction materials, fuels, lubricants, solvents, and other possible contaminants in coordination with the construction contractor. Practices and procedures for construction activities along city and county streets will be consistent with the policies of the affected local jurisdiction.

Staging areas will have a stabilized entrance and exit and will be located at least 100 ft from bodies of water, where feasible. If such an area cannot be located, an appropriate alternative site (or sites) will be selected by FRWA in coordination with the construction contractor. If an off-road site is chosen, the selected site will be surveyed by qualified biological and cultural resources personnel to verify that no sensitive resources are located on the site that would be disturbed by staging activities. If sensitive resources are found, an appropriate buffer zone will be staked and flagged to avoid impacts. If impacts on sensitive resources cannot be avoided, the site will not be used. No equipment refueling or fuel storage will take place within 100 ft of a body of water.

For areas where construction activities do not exist in the road right-of-way, the biological and cultural resources personnel will determine whether the selected staging area meets the criteria identified above and whether additional environmental clearance is required for the site. If sensitive resources are identified on the site that cannot be protected by environmental commitments described in the environmental document for similar resources, an alternate site will be selected.

Trench Safety Plan

FRWA will require that trench safety precautionary measures be implemented during construction activities. These measures will be consistent with the city and county standard practices and requirements for roadway construction. These measures shall include, but not be limited to, the following:

- Preparation of a trench safety plan.
- Road and/or lane closures shall be limited to the immediate vicinity of open trenches and the length of open trenches shall be kept as short as possible.
- No unprotected trenches shall be open overnight.
- Any pit or hole required to be left open overnight shall be labeled and fenced according to the affected local jurisdiction or the U.S. Occupational Safety and Health Administration (OSHA).

Private Property Acquisition and Access

FRWA will implement the following measures in order to construct and operated facilities within private property:

- Acquire temporary or permanent easements from the landowners or acquire the land in fee simple; landowners would be appropriately compensated for all easements or acquired lands;
- Maintain reasonable access to all private property during construction and maintenance activities;
- Notify all affected residents and property owners at least 1 week before construction or nonemergency maintenance activities.

Noise Compliance

FRWA will design noise-generating facilities to be as quiet as is feasible. At a minimum, all noise-generating facilities will be designed to meet the applicable local noise ordinance.

Coordinated Operations between Freeport Regional Water Authority and Sacramento Regional County Sanitation District

FRWA and the SRCSD, operator of the SRWWTP, would coordinate their operations with automated streamflow monitoring equipment. The FRWP diversion facility generally would not be operated during low-flow events if the project diversions would cause SRWWTP discharges to not comply with NPDES permit conditions. FRWP diversions would also be coordinated with the SRWWTP to not cause the utilization of effluent storage when it would otherwise not be necessary, or cause SRWWTP to exceed effluent storage capacity if it would otherwise have sufficient storage capacity. The FRWP diversion facility also generally would not be operated during the few hours of the peak higher high tide during extreme low-flow/high-tide events if there is potential to exacerbate reverse flow conditions. Similarly, FRWA and the City of Sacramento would coordinate their operations to avoid potential conflicts between FRWA diversions and City of Sacramento combined sewer system discharges and urban runoff/stormwater discharges.

Project Planning, Coordination, and Communication Plan

FRWA and the appropriate city and county agencies will coordinate planning, engineering, and design phases of the project. FRWA will identify a liaison to carry out this coordination and will ensure that the above measures are implemented consistent with local agency policies and that any potential conflicts with other activities are limited.

Uses of the Environmental Impact Report/ Environmental Impact Statement

Intended Uses

The FRWP EIR/EIS is intended for use by the NEPA and CEQA lead and responsible agencies with project approval or permit authority for the project alternatives. The specific uses and agencies are indicated below.

Reclamation

- Approval of assignment of CVP water service contract from SMUD to SCWA.
- Any necessary approvals for modifications to Reclamation facilities required to implement the FRWP.

Freeport Regional Water Authority

- Approval of the FRWP.

Sacramento County Water Agency

- Approval of renewal of long-term CVP contract.
- Approval of the FRWP.

East Bay Municipal Utility District

- Approval of the FRWP.
- Approval of renewal of long-term CVP contract.

Potential Uses of the Environmental Impact Report/ Environmental Impact Statement

Sacramento County Water Agency

- Approval of CVP assignment of water service contract from SMUD.
- Environmental documentation in support of water rights application.

- Environmental documentation in support of future water transfers.

City of Sacramento

- As a responsible agency, this environmental documentation may be used to support a real estate transaction for the intake site.

Permits Required

Several regulatory permits and approvals have been identified as potentially applicable to implementation of the project alternatives (Table 2-6).

Table 2-6. Summary of Anticipated Regulations, Regulatory Agencies, and Approvals for Freeport Regional Water Project

Regulation	Regulatory Agency	Required Permits/ Agreements/Authorizations
Federal Regulations		
NEPA	Reclamation (lead agency)	Joint EIR/EIS
Clean Water Act Section 404 (33 USC 1344)	U.S. Army Corps of Engineers, Sacramento District	Section 404 permit for discharges of dredged or fill material into waters of the United States, including wetlands
Rivers and Harbors Act, Section 10 (33 CFR 329.4)	U.S. Army Corps of Engineers, Sacramento District	Section 10 permit for construction of structures in, over, or under; excavation of material from; or deposition of material into navigable waters of the United States
Clean Water Act Section 402 (33 USC 1311,1342)	Central Valley Regional Water Quality Control Board	National Pollutant Discharge Elimination System permit (General Construction Activity Storm Water permit)
Clean Water Act Section 401	California State Water Resources Control Board Central Valley Regional Water Quality Control Board	Water Quality Certification or Waiver for discharge of dredged or fill material into waters of the United States
Fish and Wildlife Coordination Act (16 USC 661 et seq.)	U.S. Fish and Wildlife Service National Marine Fisheries Service California Department of Fish and Game	Consultation and Fish and Wildlife Coordination Act report

Regulation	Regulatory Agency	Required Permits/ Agreements/Authorizations
U.S. Coast Guard Private Aids to Navigation Program	U.S. Coast Guard-11th District, Aids to Navigation Branch	Requires a permit for private aids on navigable waters regulated by the federal government.
Federal Executive Order 11990: Protection of Wetlands	U.S. Army Corps of Engineers Reclamation (lead agency)	Requires federal agencies to follow avoidance/ mitigation/preservation procedures before proposing new construction in wetlands
Endangered Species Act (16 USC 1531 et seq.)	U.S. Fish and Wildlife Service National Marine Fisheries Service	Section 7 consultation and take authorization with Biological Opinion
Migratory Bird Treaty Act	U.S. Fish and Wildlife Service	Avoidance of take for unlisted migratory bird species, and take authorization for federally listed species via ESA
National Historic Preservation Act Section 106 (16 USC 470 et seq.)	State Historic Preservation Officer Native American Heritage Commission	Consultation
Clean Air Act - Authority to Construct and Operating Permit	Sacramento Metropolitan Air Quality Management District San Joaquin Valley Unified Air Pollution Control District	Authority to Construct permit to construct or modify a facility that may emit air pollutants from a stationary source into the atmosphere. Operating Permit to operate such facility.
U.S. Council on Environmental Quality Memoranda on Farmland Preservation and Farmland Protection Act (7 USC 4201, 7 CFR 658)	Natural Resources Conservation Service, Reclamation (lead agency)	Requires federal agencies to identify adverse effects of programs on preservation of farmland; consider alternative actions to lessen effects; and ensure compatibility with state, local, and private farmland protection programs
Reclamation Water Service Contract Amendment	Reclamation	Amendment to original water service contract required if water delivery point (or turnout point) is changed
Reclamation Encroachment Permit	Reclamation	Required for encroachment of Reclamation lands (incorporated into Water Service Contract Amendment)

Regulation	Regulatory Agency	Required Permits/ Agreements/Authorizations
Federal Executive Order 12898: Environmental Justice	Reclamation (lead agency)	Requires federal agencies to identify and address disproportionately high and adverse human health and environmental effects of federal programs on minority and low-income populations
Federal Executive Order 11988: Floodplain Management	Reclamation (lead agency)	Requires federal agencies to take action to reduce the risk of flood loss and restore and preserve the values of floodplains
State Regulations		
California Fish and Game Code Section 1601	California Department of Fish and Game- Sacramento Valley-Central Sierra Region (Region 2)	Streambed alteration agreement
California Code of Regulations, Title 2, Division 3, Section 1900 et seq. and Public Resources Code Section 6000 et seq.	California State Lands Commission	Land use lease and dredging permit
California Water Code Section 8590 et seq.	State Reclamation Board	Encroachment permit
California Endangered Species Act (California Fish and Game Code Section 2080 et seq.)	California Department of Fish and Game- Sacramento Valley-Central Sierra Region (Region 2)	Consultation, take authorization pursuant to Section 2081 and/or Section 2080.1 (with USFWS consultation), avoidance of “fully protected” species
California Water Code Sections 1700-1746	California State Water Resources Control Board - Division of Water Rights	Water Rights Amendment or Change Petition (to originally permitted appropriative right), if necessary
California Streets and Highways Code Sections 660-734	California Department of Transportation	Encroachment permit
California Health and Safety Code Sections 116275-116750	California Department of Health Services	Public Water System permit
Key Regional And Local Agency Regulations		
County and City Permits and Ordinances	Amador County, Calaveras County, Sacramento County, San Joaquin County, City of Sacramento Departments of Planning and Public Works	Conditional or special use permits, grading permits (including erosion and sediment control plans), building permits, encroachment permits, natural resources permits (tree removal and protection)

Regulation	Regulatory Agency	Required Permits/ Agreements/Authorizations
California Land Conservation Act (Williamson Act) (California Government Code 51200-51295)	California Department of Conservation	Acquisition of contracted land by purchasing or by eminent domain
Utility Line Coordination	California Public Utilities Commission (CPUC) Public Utilities	Compliance with CPUC General Orders that guide utilities in development, construction, maintenance, and operation of utility facilities
Railroad Crossing Coordination	Union Pacific/Southern Pacific Central California Traction	Encroachment permit

Alternatives Considered but Not Included in Detailed Analysis

As described in greater detail in the Alternatives Screening Report for the FRWP (Appendix B, Volume 2), FRWA is undertaking an extensive three-stage process to screen alternatives potentially capable of meeting the project objectives described earlier in this chapter. An extensive range of potential alternatives was examined during this process.

In conducting this screening process, FRWA developed specific criteria against which potential alternatives were evaluated. Failure of a potential alternative to substantially achieve one or more of the specific criteria resulted in elimination of the alternative from detailed consideration in this EIR/EIS. The specific criteria used in the screening evaluation were:

- An alternative, either individually or in combination with other possible alternatives, must not result in unacceptable environmental impacts.
- An alternative must not have any significant geotechnical or engineering problems, involve questionable or untested technology, or depend on a site or resource that is unreliably available.
- An alternative must not require FRWA to obtain permits and approvals that reasonably cannot be obtained, and must be consistent with local policies.
- An alternative must not require approvals, agreements, or coordination activities (between FRWA member agencies and other agencies or jurisdictions) that are infeasible.
- An alternative must be of reasonable cost while meeting most of the basic project objectives.
- An alternative must minimize costs to ratepayers.

- An alternative must meet drinking water standards after treatment (Title 22, California Code of Regulations).
- An alternative, to the extent feasible, should take into account the policy of providing drinking water supplies from the best available source.
- An alternative must maintain current finished water quality.
- An alternative must be capable of being implemented in a reasonable timeframe.
- An alternative must increase system reliability by providing a reliable supplemental water source.

Screening Criteria and Procedure

The screening criteria listed above representing specific project assumptions and objectives were developed to determine which alternatives are practicable and potentially feasible for meeting most of the basic project objectives and the project purpose and need. The screening criteria were used to determine whether each potential alternative could satisfy most of the basic project objectives and the project purpose and need, and whether the alternative was practicable and feasible. Planning assumptions and project objectives were held constant throughout the screening process to fairly evaluate the alternatives using each specific criterion.

Practicable alternatives were identified consistent with Section 404(b)(1) guidelines. To date, two stages of alternatives analysis were conducted. Each stage was more rigorous than the previous and focused with greater resolution on identifying practicable alternatives. The results of these three stages are presented in Chapters 6 and 7 of the Alternatives Screening Report. In each chapter, explanations are provided for each potential alternative found not to be practicable or not to meet most of the basic project objectives and the purpose and need of the project.

First-Stage Screening

The first stage of screening analyzed SCWA and EBMUD alternatives independently. This screening determined which alternatives under consideration were practicable and capable of meeting the project purpose, objectives, and need by comparing each alternative to the screening criteria. The criteria were not strictly applied in the first-stage evaluation to ensure that alternatives for which insufficient specific information was available to clearly eliminate them during the first-stage screening were carried forward to the second stage.

Second-Stage Screening

The second stage of screening evaluated the remaining alternatives using the same criteria, but with more strict application than during the first stage and therefore a greater focus on the relative ability of each alternative to meet the criteria. Engineering aspects of each alternative were analyzed in detail, and environmental components were reviewed in more detail than in the first-stage evaluation. Alternatives carried forward to the third stage of screening were considered practicable for meeting the water needs of SCWA and/or EBMUD.

Third-Stage Screening

Third stage screening is being conducted through this EIR/EIS. In addition to further evaluating the practicability and feasibility of the remaining alternatives, this screening step identifies the least environmentally damaging alternative, subject to 40 CFR, Part 230, Sections 230.10(b), (c), and (d).

Screening Results

A summary of the results through the second-stage of the alternatives screening process is provided in Tables 2-7 through 2-10. Table 2-7 lists alternatives that have been considered in previous analyses but that were found to be clearly infeasible for meeting the project purposes and objectives. Table 2-8 lists those alternatives that were evaluated in first-stage screening. Alternatives evaluated in second stage screening are listed in Table 2-9. Finally, Table 2-10 lists those alternatives that passed through the second-stage screening process and are evaluated in detail in this EIR/EIS.

A Delta diversion was determined to be infeasible based on environmental, biological, and water quality criteria. In particular, a Delta diversion would not provide EBMUD with adequate water quality.

While a groundwater banking/exchange alternative was identified as infeasible at this time, Chapter 18 of this document conducts a programmatic evaluation of a groundwater banking/exchange component to the FRWP.

A full description of each alternative considered for screening, supporting information for each criterion, and details of the alternatives evaluation process are provided in Appendix B, Volume 2.

Table 2-7. Previously Analyzed Alternatives Excluded from Evaluation

Alternative	Primary Reasons for Elimination before First Stage Screening
Alamo Creek Reservoir (46.5 TAF)	This alternative was eliminated because the watershed has existing and proposed housing and commercial development, which would be inundated under this alternative. In addition, the reservoir rim may be unstable, and siltation has been identified as a potential issue because the site is entirely within the Orinda Formation, which consists of loosely consolidated sand, stone, and shale.
Bailey Road Reservoir (4.5 TAF)	This alternative was eliminated because of its small size, which does not meet the needs of the project. Also, a large landslide is located in the southern part of the proposed reservoir area, and a portion of Bailey Road would have to be relocated on steep terrain.
Bolinas Reservoir (57 TAF)	This alternative was eliminated because of its small size, which does not meet the project purpose and need. An agreement with the East Bay Regional Park District to allow for the acquisition or trade of parkland would also be required, and potential habitat for federally listed species and habitat for rainbow trout would be affected.
Enlarge Briones Reservoir	This alternative was eliminated because it is not logistically feasible. It would require draining the reservoir for a 3-year period. Also, the raised reservoir would inundate Briones Regional Park.
Upper Buckhorn Reservoir (14 TAF)	This alternative was eliminated because of its small size, which does not meet the project purpose and need.
Canada del Cierbo Reservoir (14.2 TAF)	This alternative was eliminated because of its small size, which does not meet the project purpose and need, and because of the potential for the oil tanks to seep mineral oil contamination into the reservoir, compromising water quality.
Enlarge Chabot Reservoir (+43 TAF)	This alternative was eliminated because highly developed recreational facilities would be inundated by the larger reservoir. In addition, the dam axis would be closer to the Hayward fault than the existing dam, which is only 1,600 feet away from the fault.
Clay Station Reservoir (170 TAF)	This alternative was eliminated because of significant wetland impacts and water quality issues. Approximately 238 acres of wetlands would be altered. There are also historic mine tailings in the inundation area, and an average water depth of 27 feet would lead to severe water quality problems.
Conservation	Water conservation reduces demand on potable water; sole reliance on these programs would not meet the basic project objectives and needs.
Recycled water	Recycled water projects reduce demand for potable water. Sole reliance on these programs would not meet the basic project objectives and purpose and need.
Kaiser Reservoir (11.3 TAF)	This alternative was eliminated because of its small size, which does not meet the project purpose and need.
Upper Kaiser Reservoir (38 TAF)	This alternative was eliminated because of its small size, which does not meet the project purpose and need. In addition, the site has issues regarding wetlands, a trout population, and water seepage concerns because the dam axis was planned to be at a high angle in relation to the strike of bedding.

Alternative	Primary Reasons for Elimination before First Stage Screening
Kirker Reservoir (21-, 40-, and 126-TAF Options)	Options 1 and 2 for this alternative were eliminated because of their small sizes at 21 and 40 TAF, which do not meet the needs of the project. Option 3 (126 TAF of storage) was eliminated because it would inundate Kirker Pass Road, a four-lane expressway linking State Route 4 at Pittsburg to the Concord/Walnut Creek area. Relocation or replacement of this expressway would be extremely difficult because of topography.
Enlarge Lafayette Reservoir (+47 TAF)	This alternative was eliminated because of its small size, which does not meet the project purpose and need. In addition, the downstream toe of the new dam would encroach on an existing community and the existing reservoir has excessive algae growth, which would require the removal and disposal of nutrient-rich sediments on the reservoir bottom in order to improve the water quality.
Mitchell Canyon Reservoir (49 TAF)	This alternative was eliminated because of its small size, which does not meet the project purpose and need. Further, this alternative would inundate lands permanently dedicated to public use as part of Mount Diablo State Park.
Montezuma Hills Reservoir (14- and 62-TAF Options)	Both size options were eliminated because of their small sizes, which do not meet the project purpose and need. The 62 TAF option was also eliminated because of possible future saltwater intrusion that could result from the location of the proposed dam. In addition, the sediments present create a rim and foundation stability problem as well as possible siltation problems.
Morningside Reservoir (17 TAF)	This alternative was eliminated because of its small size, which does not meet the project purpose and need. This alternative also has geologic issues because an unnamed fault of unknown activity passes through the dam axis, and two similar faults pass through the reservoir.
Nichols Reservoir (5 TAF)	This alternative was eliminated because of its small size, which does not meet the project purpose and need. In addition, there is potential for water quality constraints because of the small size; the size could promote high algae growth. The site is close to the U.S. Naval Station's industrial area, which may contain hazardous materials.
Pinole Reservoir (25-, 40-, 45-, and 68-TAF Options)	All four reservoir size options were eliminated because of their small sizes, which do not meet the project purpose and need. There may also be an anadromous rainbow trout run in Pinole Creek, which would be partially inundated. In addition, the 40-TAF option would require the acquisition of several privately owned houses, farms, and a horse association arena; the 45-TAF reservoir basin site contains large landslides and it is likely that a large landslide complex at the left abutment of the reservoir and approximately 10 miles of Pinole Creek would be inundated; finally, the 68-TAF option would require the relocation of electrical transmission lines as well as the acquisition of several privately owned houses, farms, and a horse association arena.
Railroad Flat Reservoir (100 TAF)	This alternative was eliminated because of water quality, community, and biological concerns. Septic systems in the towns of Independence, Railroad Flat, and Wilseyville, and at residences lining the river would make it difficult to control water quality hazards. Inundating Railroad Flat Road would adversely affect the provision of services between the towns of Railroad Flat and Wilseyville. Also, this section of the Mokelumne River provides suitable habitat for cold-water salmonid fish species that move upriver from Pardee Reservoir, including wild and hatchery rainbow trout, kokanee salmon, and brown trout.
Rodeo Reservoir (31 TAF)	This alternative was eliminated because of its small size, which does not meet the project purpose, need, or objectives.

Alternative	Primary Reasons for Elimination before First Stage Screening
San Leandro Reservoir (51 TAF)	This alternative was eliminated because of its small size, which does not meet the project purpose and need. Also, San Leandro Creek may support a remnant wild trout population. Approximately 6 miles of stream and high-quality habitat would be inundated.
Sidney Flat Reservoir (76 TAF)	This alternative was eliminated because of its small size, which does not meet the project purpose and need. In addition, this alternative would inundate East Bay Regional Park District's Black Diamond Mines Regional Preserve lands, including valuable historic and cultural resources, mines, and park facilities. Large landslides are also present in the reservoir basin.
Tassajara Reservoir (25- and 40-TAF Options)	Both size options were eliminated because of their small sizes, which do not meet the project purpose and need. Also, the 40-TAF option would inundate state parklands and extensive private land holdings.
Tice Valley Reservoir (50 TAF)	This alternative was eliminated because it would inundate the majority of Rossmoor, an existing residential community. Also, the reservoir size does not meet the project purpose and need.
Enlarge Upper San Leandro Reservoir	This alternative was eliminated because it would inundate the existing community of Canyon as well as urban development along San Pablo Creek (Moraga).
Enlarge San Pablo Reservoir	This alternative was eliminated because it would inundate residences along Camino Pablo Road, key elements of the road circulation system in the village of Orinda, and the EBMUD Orinda water treatment plant.
Bixler Groundwater Storage	This alternative was eliminated because it small yield (10 MGD) would not meet the basic project purposes and objectives and because its feasibility is highly uncertain.
Mokelumne River Salt Springs	This alternative was eliminated because it would inundate portions of a wilderness area.
Watershed Cloud Seeding	This alternative was eliminated because it could not provide a reliable water supply. PG&E and EBMUD already seed clouds in the Mokelumne watershed. No further yield is anticipated by increasing seeding efforts.
Raise Lower Bear River Reservoir (+26 TAF)	This alternative was eliminated because of its small size, which does not meet the project purpose, need, or objectives.
Lower Mokelumne Supply	This alternative was eliminated because of the length of the pipeline that would be required to convey water, and because of a lack of water supply available.
Mokelumne River Devil's Nose Supply	This alternative was eliminated because it does not meet the project purpose and need. No water supply is available for purchase.
Tanker Transport of Canadian Water Supplies	This alternative was eliminated because of significant legal, technical, and operational uncertainties.
North Fork Stanislaus River Supply	This alternative was eliminated because it would result in severe biological impacts.
Stanislaus River, New Melones Reservoir Supply	This alternative was eliminated because it does not meet the project purpose and need. Reclamation does not have water available for purchase from this facility.

Alternative	Primary Reasons for Elimination before First Stage Screening
Intertie Group, Zone 7, Dublin-San Ramon Services District, and Martinez	This alternative was eliminated because it does not meet the project purpose and need. Water would not be available. This alternative is dependent on State Water Project supplies, with limitations on yield and availability to the agencies currently supplied.
South Bay Aqueduct Intertie	This alternative was eliminated because it does not meet the project purpose and need. Water would not be available. This alternative is dependent on State Water Project supplies with limitations on yield and availability to the agencies currently supplied.
CCWD Bollman Plant Intertie	This alternative was eliminated because it does not meet the project purpose and need. It would not provide a reliable source to meet dry-year needs.
Tuolumne Hetch Hetchy Intertie	This alternative was eliminated because it does not meet the purpose and need. No reliable dry-year water supplies would be made available to FRWA under this alternative. In addition, there are substantial biological resource issues in the upper reaches of the Tuolumne watershed, as well as operational and institutional issues.
Tuolumne Hayward Intertie	This alternative was eliminated because it does not meet the project purpose and need. No reliable dry-year water supplies would be made available under this alternative.
Yuba River Water by Barge	This alternative was eliminated because of significant legal, technical, and operational uncertainties.
Cosumnes River Source	This alternative was eliminated because it does not meet the project purpose and need. There is no firm yield on the Cosumnes River and water is not available.
Iceberg Source	This alternative was eliminated because of significant legal, technical, and operational uncertainties.
Auburn Dam	This alternative was eliminated because of substantial uncertainty regarding its implementation.
CALFED Combined Delivery	This alternative was eliminated because of water quality concerns and technical, operational, and timing uncertainties. This alternative has not been developed beyond a very conceptual stage, and would require significant agreements among many water interests. It would not be available within a reasonable timeframe.

TAF = thousand acre-feet.

Table 2-8. Alternatives Considered during First Stage Screening

SCWA	EBMUD
American River Diversion	American River Diversion
Sacramento River Diversion:	Sacramento River Diversion
Option 1: Sacramento River Water Treatment Plant	Groundwater Banking/Exchange (Sacramento Basin)
	Delta Diversion
Option 2: Freeport	Enlarged Camanche Reservoir
Groundwater Banking/Exchange (Sacramento Basin)	Expanded Los Vaqueros Reservoir
Full Surface Water Reliance	Enlarged Pardee Reservoir
Full Groundwater Reliance	Bollinger Canyon Reservoir
	Buckhorn Canyon Reservoir
	Cull Canyon Reservoir
	Curry Canyon Reservoir
	Delta Wetlands Project
	Kellogg Reservoir
	Duck Creek Reservoir
	Middle Bar Reservoir
	PG&E Mokelumne River System Acquisition
	Groundwater Banking/Exchange (San Joaquin Basin)
	Bayside Groundwater Project
	Desalination
	Bay Area Water Quality and Supply Reliability Improvement Project

Table 2-9. Alternatives Considered during Second Stage Screening

SCWA Alternatives	EBMUD Alternatives
# American River—Diversion at I-5 location	# Diversion at Freeport
# Sacramento River Diversion:	# Enlarged Pardee Reservoir
– Option 1: Sacramento River Water Treatment Plant	# Surface water diversion with groundwater banking/exchange
– Option 2: Freeport	# American River—Diversion at Folsom South Canal
– Option 3: Freeport	# American River—Diversion at Site 5
# Surface water diversion with groundwater banking/exchange	# Diversion at Sacramento River Water Treatment Plant
# American River—Diversion at Fairbairn Water Treatment Plant	# Delta Diversion
	# Desalination
	# Expanded Los Vaqueros Reservoir

Table 2-10. Alternatives Not Eliminated during Second Stage Screening

SCWA Alternatives	EBMUD Alternatives
▪ Diversion at Freeport: Sacramento River Diversion—Option 3	# Diversion at Freeport
▪ Surface water diversion with groundwater banking/exchange	# Enlarged Pardee Reservoir
	# Surface water diversion with groundwater banking/exchange

Chapter 3
Hydrology, Water Supply, and Power

Chapter 3

Hydrology, Water Supply, and Power

Affected Environment

California's flood control, water supply, and hydropower generation systems are intricately linked together through physical and institutional arrangements. Water supply diversions, as proposed for this project, have effects throughout the system of river, reservoir, groundwater, and water quality management operations. The State Water Project (SWP) and CVP provide a majority of the water storage and conveyance capacity of the system in combination with a numerous smaller systems that are operated by water supply and agricultural entities. Therefore, forecasting and planning for annual water supply, demand, and delivery functions are influenced with each additional project that serves to use water from the system. Consequently, the following section provides an overview of the major northern California water storage and conveyance facilities.

The "Affected Environment" section describes the hydrologic and water supply conditions in the Sacramento and Mokelumne River basins and Sacramento–San Joaquin Delta (Delta). Each of the project alternatives (i.e., Alternatives 2, 3, 4, 5, and 6) under consideration has the potential to change the timing, location, and volume of water diverted from the CVP system. To determine the probable magnitude and effect of these changes and to evaluate the ability of the alternatives to meet FRWA's project objectives, FRWA and Reclamation have used available technology to extensively model hydrologic conditions. This section also includes a description of the hydrologic modeling and related assumptions used for the analysis.

This chapter provides information on the evaluation of river and reservoir hydrology conducted for this EIR/EIS. It includes a summary of existing hydrologic conditions and changes in these conditions that are expected to occur under Alternative 1 (no-action conditions at the 2001 level of system development), project alternatives at the 2001 level of development with the FRWA agencies' demands set at the projected 2020 level of development, and project alternatives under cumulative conditions at the 2020 level of development and FRWA demands. This chapter also includes a discussion of the changes to water supply and power production that would occur under each of the conditions discussed above.

Hydrology and Water Supply

Sacramento River Basin

Hydrologic Conditions and Water Supply

The Sacramento River drainage basin upstream of the American River confluence encompasses approximately 23,500 square miles and produces an average annual runoff of about 17,000,000 af at the Freeport gaging station (below the confluence with the American River). Principal reservoirs controlling flows in the lower Sacramento River include Lake Shasta (4,550,000 af) on the Sacramento River upstream of Redding and Trinity Lake (2,480,000 af), which regulates deliveries made to the Sacramento River from the Trinity River basin. Diversions from the Trinity River basin into the Sacramento River basin averaged 1,030,000 af annually from 1967 to 1991. The Feather River is a major tributary to the Sacramento River, and Lake Oroville is a component of the SWP system that provides 3,540,000 af of storage. Average runoff from the Feather River basin (including the Yuba River) is approximately 5,850,000 af at the Nicholas gaging station (downstream of the confluence with the Yuba River).

The proposed intake facility is located on the Sacramento River about 10 miles downstream of the confluence with the American River. The Sacramento River at the intake facility is confined within project levees that are maintained by the Corps. Based on the 30-year record of data for the period 1968 through 1998, which spans a variety of water year types, individual monthly average flows have ranged from a low of 4,500 cfs in October 1978 to a maximum of 87,000 cfs in January 1997. Overall, the average monthly flows of all 30 years range between 13,000 and 40,600 cfs, with the low occurring in October and peak flow in February. The 30-year average monthly flow during the wetter months of December through May is approximately 30,000 cfs; during the typically drier months of June through November, it is 16,500 cfs.

Project Area Flood Conditions

The 100-year flood event flow in the Sacramento River at Freeport is about 130,000 cfs and is fully contained by the levees. The surrounding urban and rural areas of the pipeline alignments encompass the watersheds of a series of small streams collectively joining near I-5 to form Morrison Creek. The upper watershed streams from north to south include Morrison Creek, Florin Creek, Elder Creek, Union House Creek, Strawberry Creek, and the Laguna Creek system of tributaries. Morrison Creek flows through the Beach Lake and Stone Lake wildlife refuge area near I-5 and continues to a pump station that conveys the flow into the Sacramento River. The volume of water combined with the limited channel capacities of these small streams results in extensive flooding of low-lying areas during the 100-year flood.

American River Basin

The American River drainage basin encompasses approximately 1,900 square miles. Folsom Reservoir is the principal reservoir in the basin with a capacity of 975,000 af; several smaller reservoirs upstream contribute another 820,000 af of storage capacity. Nimbus Dam impounds Lake Natoma downstream of Folsom Dam and regulates releases from Folsom Reservoir to the lower American River. The entrance facilities to the FSC are located along the south shore of Lake Natoma immediately upstream of Nimbus Dam. Annual average unimpaired runoff at the Fair Oaks gage is approximately 2,645,000 af but varies from less than 900,000 af (lowest 10% of years) to more than 5,000,000 af (wettest 10% of years). Mean annual flow in the lower American River is 3,300 cfs; the design capacity of the channel for floodflows is 115,000 cfs. Diversions to the FSC are about 20,000 af annually, with the large majority being conveyed for use by SMUD at their Rancho Seco nuclear power plant site. The power plant is in the process of being dismantled and the water is used for maintenance of the spent fuel rod bath facility and for dilution water.

Mokelumne River Basin

The Mokelumne River basin has a watershed area of about 660 square miles (at the Woodbridge stream gage) on the western slope of the Sierra Nevada in Alpine, Amador, and Calaveras counties. The Cosumnes River basin lies between the American and Mokelumne River basins. The Mokelumne River basin upstream of Pardee Reservoir (watershed area of 570 square miles) is the principal water supply for EBMUD's service area. Rainfall averages 15 inches in the valley and 60 inches at the higher elevations. The average annual unimpaired flow at Pardee is about 700,000 af, with a range from less than 250,000 af (driest 10% of the years) to about 1,200,000 af (wettest 10% of the years).

The unimpaired flows indicate an average inflow to Pardee Reservoir of about 965 cfs. Snowmelt dominates the seasonal runoff pattern, with the highest flows in April–June of wet years. Unimpaired flows typically are very low (less than 100 cfs) in July through November.

PG&E operates seven reservoirs in the upper watershed upstream of Pardee Reservoir. Because these reservoirs store some of the winter snowmelt for hydropower production later in the year, they decrease springtime inflows to Pardee Reservoir while increasing inflows in the late summer in most years compared to what would normally occur without upstream storage capacity. Total PG&E reservoir storage upstream of Pardee Reservoir is about 220,000 af. Salt Springs Reservoir is the largest of the PG&E reservoirs with a capacity of 142,000 af.

Pardee Reservoir and Camanche Reservoir Operations and Flood Control

Flood control operations for Pardee and Camanche Reservoirs are regulated by USACE. Flood control storage space can be coordinated between these reservoirs. A combined 200,000 af of flood storage space is required in Pardee Reservoir and Camanche Reservoir from November 15 until March 15. However, if PG&E's Salt Springs and Lower Bear Reservoirs are sufficiently drawn down, EBMUD can reduce the amount of space it must provide to a minimum of 130,000 af. For the period after March 15, flood storage space requirements are based on rainfall and snowpack estimates, and the reservoirs can be completely filled at the end of May in dry years and the end of July in wet years. No flood control storage is required from July 15 to November 15. When inflow is adequate, Camanche Reservoir is operated to reach full capacity by July 15. Camanche Reservoir is not allowed to store inflows after July 15; therefore, releases are made to meet instream flow requirements for the lower Mokelumne River and storage is gradually reduced to the flood control requirement by November 5.

The peak discharge into Pardee Reservoir from the upper watershed for the projected 1-in-100-year return frequency flood event is about 57,135 cfs; the 500-year event is about 95,250 cfs; and the probable maximum flood is estimated to produce a peak inflow to Pardee Reservoir of 203,000 cfs (HCG 1998).

Demands for Reservoir Water Supply and Lower Mokelumne River Flows

Diversions of Mokelumne River basin water supplies upstream from Pardee Reservoir include about 25,000 af annually that is allocated to several purveyors, including Amador Water Agency, Calaveras Public Utility District, Calaveras County Water District, and JVID. The existing EBMUD demand from Pardee is about 250,000 af (220 MGD) under existing conditions (2001 demand) and is assumed to be about 260,000 af (228 MGD) under 2020 level of development. Downstream of Camanche Dam, the lower Mokelumne River flows west to the Delta. Existing water rights along the lower Mokelumne River include numerous riparian diversions and the North San Joaquin Water Conservation District (NSJWCD) and Woodbridge Irrigation District (WID). In 1997, EBMUD, DFG, and USFWS approved the Mokelumne Settlement Agreement (Partnership Agreement) for management of the lower Mokelumne River, which was later approved by FERC and the SWRCB. The agreement requires releases from Camanche Reservoir that depend on fish life-stage protection throughout the year and the water year type. The agreement also includes a provision called "gainsharing" requiring EBMUD to provide up to 20,000 af for use during a dry period should a new water supply be developed. Releases range from 100 to 325 cfs during normal and above-normal runoff water year types, 100 to 250 cfs in below-normal years, 100 to 220 cfs in dry years, and 100 to 130 cfs in critically dry years.

The lower Mokelumne River flows through Lodi Lake which is a seasonal impoundment created by the WID dam near Lodi. WID demands are between 39,000 af in dry years and 60,000 af in normal and wet years. The maximum summer deliveries are approximately 350 cfs. The NSJWCD has entitlements to about 20,000 AFA and historically has used about 8,000 to 10,000 AFA. Additional downstream deliveries are about 20,000 af for riparian and senior appropriative use. EBMUD must also release additional water termed “carriage” water from Camanche Reservoir to ensure that sufficient flow actually reaches downstream users. Flow can be lost from evaporation, evapotranspiration, and channel seepage into the groundwater basin. Loss rates have ranged from 57,000 to 130,000 af annually, with most of the loss occurring in the 21-mile reach between Camanche Dam and Lake Lodi near the town of Lodi (HCG 1998). Resulting minimum required releases from Camanche Reservoir range from 135,000 af in critical years to 315,000 af in wet years.

Downstream of the Lodi area and the City of Thornton, the lower Mokelumne River splits into the North and South Fork channels. The Delta Cross Channel (DCC) delivers water from the Sacramento River into the North Fork channel.

Other Rivers and Reservoirs

The San Joaquin River basin encompasses approximately 13,500 square miles (at the Vernalis gage) and is controlled by several reservoirs on the Stanislaus, Tuolumne, Merced, and upper San Joaquin Rivers. The upper San Joaquin River is controlled by the Friant Dam (Millerton Reservoir) with most water diverted to the Kern and Madera Canals. The average annual unimpaired flow at Vernalis is about 6,200,000 af for 1972–1992. Average annual historical runoff for 1972–1992 at Vernalis is 3,200,000 af, but runoff varies from 700,000 af (lowest 10% of years) to more than 6,000,000 af (wettest 10% of years). Because San Joaquin River tributary reservoir projects and water deliveries are operated independently of the Sacramento River basin projects, there is no substantial connection between FRWA Sacramento River basin deliveries and San Joaquin River flows.

Sacramento River–San Joaquin River Delta

All of the northern California drainage basins described above combine in the region that is officially designated as the Sacramento River–San Joaquin River Delta defined by the approximate extent of tidal action within the river channels. The Sacramento River at Freeport is within the Delta. CVP and SWP water deliveries are conveyed through Delta channels to the respective federal and state pumping plants that provide water for water exports to the San Joaquin Valley and southern California areas. The federal CVP pumping plant is located on Old River at Tracy and conveys water to the Delta Mendota Canal (DMC). The SWP Harvey O. Banks pumping plant lifts water into the California Aqueduct from Clifton Court Forebay. San Luis Reservoir is an important component for both canal systems and serves to provide storage for water that is pumped from the

Delta. The Contra Costa Water District (CCWD) diversion points at Old River and Rock Slough are also major diversions in the western Delta.

Hydropower Resources and Energy Production

CVP's hydropower system in northern California consists of 11 facilities with a combined total power-generating capacity of 2,045 megawatts (MW). Most of this capacity is derived from the Trinity, Carr, Spring Creek, Shasta, Keswick, Folsom, and Nimbus powerplants, which are identified as the CVP North facilities. Two facilities, New Melones and San Luis, are located south of the Delta. CVP powerplants are located downstream from the storage reservoirs and operate in conjunction with releases of stored water that are made to meet demands. The major power supplier in the region is PG&E with a capacity of 20,000 MW.

CVP power-generation capacity is a function of reservoir elevation and the rate at which water is passed through the turbines. The pattern of generation is directly related to reservoir releases made for irrigation, municipal and industrial uses, instream flow requirements, and other CVP water demands. Maximum releases generally occur in the summer irrigation season, which often corresponds to the peak power load period within the CVP service area. Recent water quality requirements in the rivers and Delta have increased the need for water releases in spring and winter, reducing the amount of water available for release during peak power loads.

In northern California, the CVP generates power in coordination with PG&E operations. The Western Area Power Administration (Western), operates, maintains, and upgrades the transmission grid for the western United States. Power generated at CVP facilities is dedicated first to meeting CVP power requirements ("Project Use Load"), primarily for pumping facilities. CVP generating capacity is generally not sufficient to meet peak project-use demand; therefore, CVP coordinates power production with PG&E under a contract that expires in 2004 to ensure that peak power loads are satisfied. Western is responsible for ensuring that CVP Project Use Loads are met at all times. In addition, Western markets surplus power that is generated by CVP, with preference given to "Preference Power Customers," which include irrigation districts, cooperatives, public utility districts, municipalities, California educational and penal institutions, federal defense agencies, and other institutions.

Three generators at EBMUD's Pardee Dam powerhouse have a combined capacity of 29.2 MW and produce 83 GWh of electricity in average-to-above-normal years. Camanche Dam has a 10.6-MW-capacity powerhouse and generates about 40 GWh in average-to-above-normal years.

Environmental Consequences

Methods and Assumptions

Use of Hydrologic Data for the Environmental Impact Assessment

Hydrologic data served as the primary assessment tool for the evaluation of effects on water supply, power production, water quality, fish, and recreation. A detailed discussion of how the hydrologic data were used to support the evaluations is included in the "Methods and Assumptions" section of Chapter 4, "Water Quality," Chapter 5, "Fish," and Chapter 6, "Recreation." The evaluation of changes to water supply and power production is presented later in this chapter.

Modeling Procedures and Assumptions

The potential effects of the alternatives on the hydrologic characteristics of upstream reservoir storage levels and river flows, Delta flows and export water operations, and other rivers and reservoirs in northern California were evaluated primarily with the DWR/Reclamation hydrologic simulation model CALSIM II. EBMUD's comparable hydrologic simulation model EBMUDSIM also was used to simulate the Mokelumne River basin water supply operations at a monthly time step over the historical hydrologic record (1922–1993). Water demands for SCWA and EBMUD were modeled at full buildout. Although buildout demands for each agency will not occur for several years, it is appropriate to include the full demands in the simulations so that the complete effects of the alternatives can be adequately assessed.

The CALSIM and EBMUDSIM models each rely on a variety of user-defined inputs and modeling assumptions. The available planning models, although appropriate for comparative assessment of likely changes with these project alternatives, do not forecast actual operations of EBMUD, SCWA, CVP, or SWP facilities. The actual day-to-day operations of these water management facilities are more complex than can be simulated with available models. For purposes of this project evaluation, the water supply demands, instream flow requirements, and applicable Delta water quality objectives are assumed to remain unchanged. These models represent the state of the art in CVP, SWP, and EBMUD system hydrologic modeling, and the model results are appropriate for impact assessment purposes. The Modeling Technical Appendix (Volume 3) describes the criteria used for the CALSIM and EBMUDSIM modeling and a comprehensive set of tabular presentations of the modeling output for each alternative.

CALSIM Modeling

CALSIM is a planning model designed to simulate the operations of the CVP and SWP reservoir and water delivery system for current and future facilities, flood control operating criteria, water delivery policies, instream flow and Delta outflow requirements, and hydroelectric power generation operations.

CALSIM is the best available tool for modeling the CVP and SWP and is the only systemwide hydrologic model being used by Reclamation and DWR to conduct planning and impact analyses of potential projects.

CALSIM simulations for this project were performed with model assumptions that incorporate CVPIA–prescribed (b)(2) actions and the Environmental Water Account (EWA) program. In December 2000, the ROD on the Trinity River Mainstem Fishery Restoration EIS/EIR was signed. The EIS/EIR was challenged in Federal District Court and litigation is ongoing. The District Court has limited the flows available to the Trinity River until preparation of a supplemental environmental document is completed. As a result of ongoing litigation, the flows described in the ROD may not be implemented at this time.

Therefore, the FRWP existing conditions run includes variable flows (between 369 TAF/year and 452 TAF/year depending on hydrologic conditions) up to the limit established by the court. This is consistent with the assumptions and modeling conducted for the CVP Operations Criteria and Plan (OCAP) biological assessment.

The future 2020 cumulative runs use the full Trinity ROD flows of 369,000 AFA to 815 TAF/year depending on hydrologic conditions, also consistent with the OCAP biological assessment modeling.

The modeling conducted for the FRWP is consistent with the modeling being conducted by Reclamation for its CVP OCAP. Specific and detailed information on the modeling conducted for the FRWP is included in the Modeling Technical Appendix (Volume 3).

In addition to the modeling described above, FRWA conducted a CALSIM analysis assuming that deliveries to EBMUD were treated as “Delta exports” for purposes of the Coordinated Operations Agreement. A summary of these modeling results can be found in Section 3.4.10 of the Modeling Technical Appendix (Volume 3).

EBMUDSIM Modeling

Effects of the project alternatives on the Mokelumne River system were evaluated with results from EBMUD’s hydrologic simulation model EBMUDSIM, which simulates river hydrology, reservoir operations, demands on the Mokelumne River and within the EBMUD service area, Mokelumne River instream flow requirements, and the water delivery system constraints.

EBMUDSIM has been used by several other agencies including SWRCB and FERC to assess hydrologic conditions in the Mokelumne River and has been reviewed and accepted in numerous previous applications. Water supply forecasts are used in the preparation of operation projections. The operations projection is updated throughout February, March, and April as more reliable information becomes available. The main parameters considered in the operation projection are the water supply forecast of projected runoff, water demands of other users on the river, water demand of EBMUD customers, and flood control requirements. EBMUDSIM was used to determine when end-of-September total EBMUD storage is forecast to be less than 500,000 af, enabling EBMUD to take delivery of Sacramento River water under its CVP contract. Deliveries from the Sacramento River were then input to a second EBMUDSIM simulation to determine the effects on the Mokelumne River reservoirs, downstream Mokelumne River flows, and EBMUD deliveries.

CALSIM and EBMUDSIM Modeling Procedures

Under the no-action condition (Alternative 1), CALSIM and EBMUDSIM data reflect current conditions at the 2001 level of system development and 2001 level of demands of the SWP and CVP contractors and the year 2000 demand schedule for EBMUD totaling 220 MGD annually. For Alternatives 2–5, the data reflect the same system level of development conditions as for the No-Action Alternative; however, SCWA annual surface water needs to serve buildout of development in its Zone 40 area and EBMUD's 2020 surface water needs to supplement its other water supplies to during droughts are imposed through the FRWP diversion facilities. This approach is appropriate because it provides for analysis of the full project against existing conditions, thereby fully analyzing the environmental effects of the entire project without including major (and likely speculative) assumptions about what other projects and water uses may be developed in the future. The FRWP alternatives are also analyzed against a future no project condition, which assumes that additional projects and water uses are implemented by others (see below). This analysis is part of the cumulative impact analysis considered in this EIR/EIS. For Alternatives 2–5, the 100-MGD EBMUD demand is allotted to the Freeport intake facility. Under Alternative 6, the additional EBMUD need is allotted to the enlarged Pardee Reservoir, while SCWA needs are modeled as described for Alternatives 2–5. Alternative 1 was used as the baseline for assessing effects of these project alternatives.

The cumulative scenarios of the alternative project facilities were modeled assuming the 2020 level of system development and 2020 demands. The cumulative scenarios reflect only changes to the systemwide level of development. The cumulative impacts are assessed as the difference between the cumulative project alternative scenarios and the 2001 no-action conditions (Alternative 1). However, a 2020 no-action scenario was used to determine the incremental effects of the project alternatives under cumulative conditions.

Simulated EBMUD and SCWA Deliveries for Alternatives 2–5

Figure 3-1 shows simulated annual average water year deliveries by EBMUD and SCWA from the Freeport intake facility. Annual SCWA deliveries would be relatively uniform from year to year and range from 42,000 af to 90,000 af with an average of 71,000 af. This amount is slightly greater than the projected long-term SCWA demand of 68,500 AFA because of the specific hydrologic sequence portrayed in CALSIM II. EBMUD deliveries are simulated to occur in 32 of the 72 water years simulated, and about 20% of the total months. The annual average delivery to EBMUD would be 23,000 af; the maximum water delivery to EBMUD would be 99,000 af. The combined EBMUD and SCWA operations would result in a maximum annual delivery of 155,000 af. The maximum and average annual deliveries on a Reclamation contract year basis (March through February) would be similar at 196,000 af and 94,000 af, respectively.

Cumulative Conditions for Alternatives 2–5

Figure 3-2 shows the deliveries to SCWA and EBMUD under future systemwide demands at a 2020 level of development. EBMUD or SCWA demands served from the Freeport intake facility are the same as those assumed for the 2001 model scenario. Therefore, there are only slight changes compared to the Alternatives 2–5 delivery patterns shown in Figure 3-1. The range of annual water year deliveries to SCWA (41,000 to 90,000 af) would be nearly identical to the 2001 scenario. Average and maximum annual EBMUD deliveries under 2020 conditions are the same as the 2001 scenario with only small differences in some months. Total combined average water year and Reclamation contract year deliveries to SCWA and EBMUD are nearly identical to the 2001 scenario.

Simulated EBMUD and SCWA Deliveries for Alternative 6

EBMUDSIM was used to simulate delivery from an enlarged Pardee Reservoir under the projected 2001 level of development conditions with EBMUD demand elevated to 2020 levels. This is consistent with assumptions in Alternatives 2–5. Deliveries to SCWA from the Freeport intake facility are modeled in CALSIM. SCWA demands from the intake facility are assumed to be the same as for Alternatives 2–5. Figure 3-3 shows the annual EBMUD deliveries (i.e., that would be in addition to existing deliveries) to terminal reservoirs via the Mokelumne Aqueduct. Additional annual average EBMUD deliveries would range from –4,000 af to 71,000 af and average 14,000 af. The monthly delivery pattern in years that they occur would be fairly uniform. The project provides relatively uniform yield in most years of about 10,000 af, reflecting the additional 8 MGD of demand simulated at the 2020 level. SCWA deliveries from the Freeport intake facility location are nearly the same as described for Alternatives 2–5, with only negligible differences in a few months. The annual average, minimum, and maximum water year and Reclamation contract year delivery quantities are identical to Alternatives 2–5.

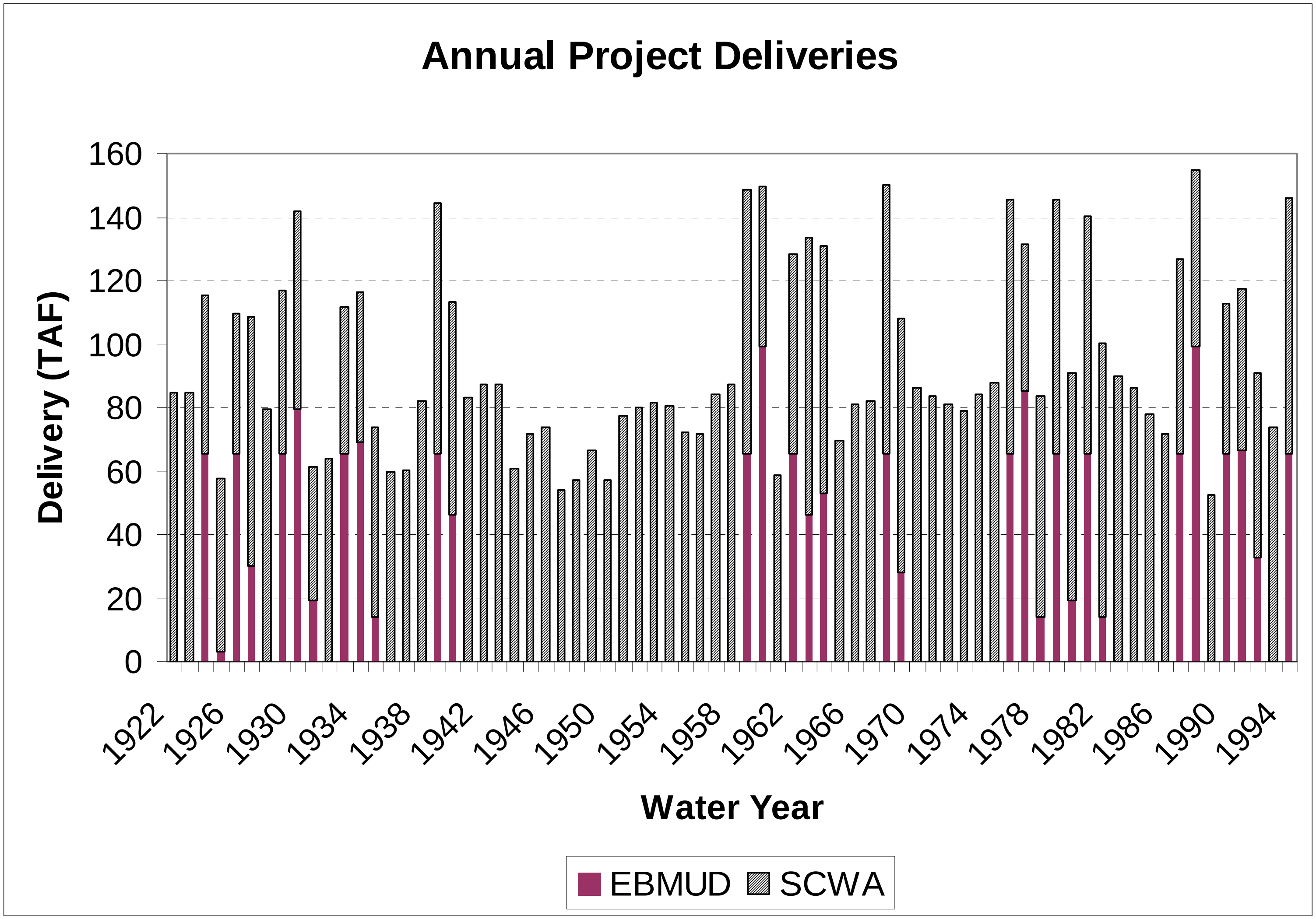


Figure 3-1.
Deliveries to EBMUD and SCWA for Alternatives 2–5 at the 2001 Level of Development

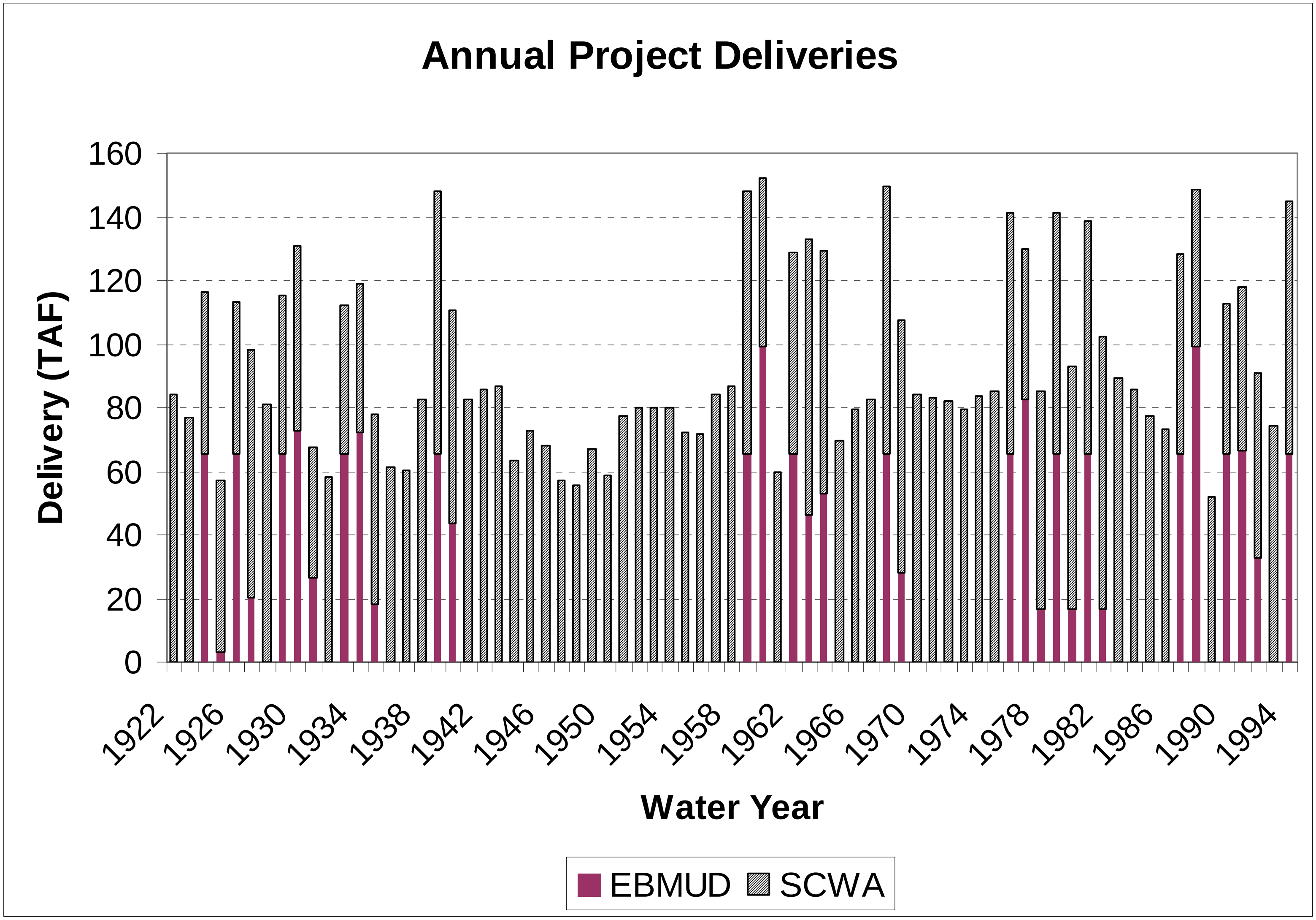


Figure 3-2.
Deliveries to EBMUD and SCWA for Alternatives 2–5 at the 2020 Level of Development

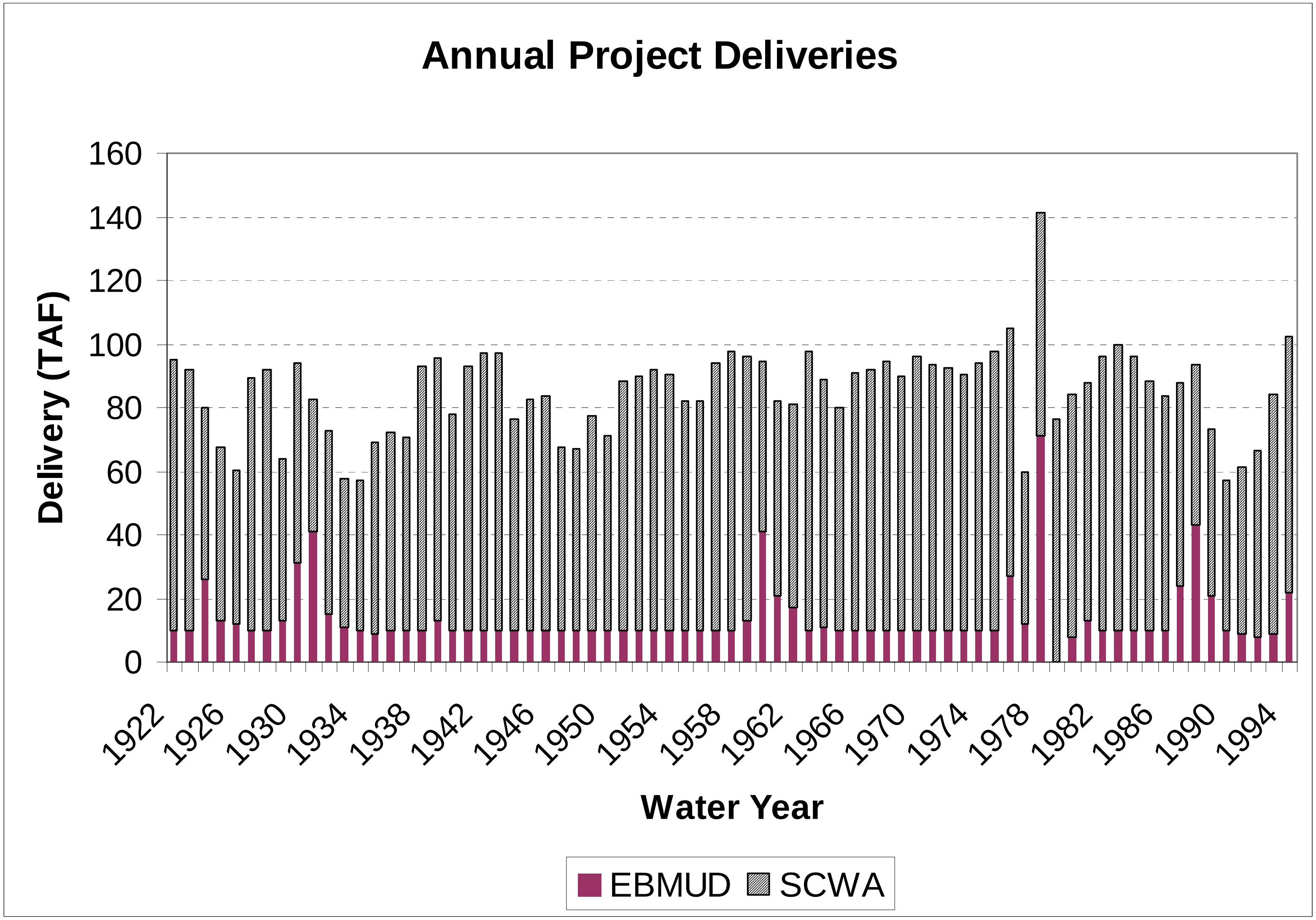


Figure 3-3.
Deliveries to EBMUD and SCWA for Alternative 6 at the 2001 Level of Development

Cumulative Conditions for Alternative 6

Cumulative water demand conditions for Alternative 6 included projections of systemwide demand at the 2020 level of development in the Mokelumne River basin and other CVP and SWP service areas. EBMUD or SCWA demands from the Freeport intake facility are the same as those assumed for the 2001 model scenario. Therefore, the deliveries shown in Figure 3-4 reflect only slight changes compared to the Alternative 6 delivery pattern shown in Figure 3-3. The incremental changes to EBMUD deliveries from Pardee Reservoir for individual months compared to the no-action condition would be very small. The annual average delivery quantity to EBMUD would increase by 6,000 af. Average annual water year and Reclamation contract year deliveries to SCWA would be similar to the 2001 scenario.

Interpretation of Graphs

This chapter contains a series of graphs that are used to help explain the modeling results. While most of the graphs are self-explanatory, some graphs (frequency distributions) are not commonly used in other contexts and require an explanation. This section explains how to interpret these specific types of graphs. In these graphs (e.g., Figure 3-5), the vertical axis is the measure of a variable such as reservoir storage (expressed as thousand acre-feet [TAF]) or river flows (expressed as cubic feet per second [cfs]). The horizontal axis represents the percentage of time that a certain level of storage or flow is exceeded. Starting at the left end of the horizontal axis, the "0%" mark represents the level that is exceeded "0% of the time," or in other words represents the highest level of storage or flow. At the right end of the horizontal axis, the "100%" mark represents the level that is exceeded "100% of the time," or that which is always exceeded and therefore represents the lowest level of storage or flow.

In each graph, all alternatives are compared to one another in terms of a ranked distribution. To accomplish this, each data point (typically an end-of-month or monthly average) for each alternative is sorted and ranked from highest to lowest. Those data are then used to create a line between the 0% and 100% exceedance points on the graph. By overlaying each alternative's frequency distribution, a comparison between alternatives can be made to the base condition. Generally, alternatives that substantially overlie each other can be interpreted as having a minimal effect on the feature of interest. Points that fall off of the base condition line identify where specific differences between the alternative and the base case exist.

Significance Criteria

Numerous environmental documents have been published over the past 10 years that have addressed hydrologic, water supply, and hydropower production changes to the CVP and SWP potentially resulting from implementation of a project or program. A review of significance criteria used in those documents was undertaken to determine appropriate significance thresholds for this EIR/EIS. Examples of the documents reviewed include, among others:

- Programmatic EIS for the Central Valley Project Improvement Act,
- Programmatic EIS for the CALFED Bay-Delta Program,
- Trinity River Mainstem Fishery Restoration Program EIS,
- Contra Costa Water District's Los Vaqueros Reservoir Project EIR/EIS,
- State Water Resources Control Board–U.S. Army Corps of Engineers Delta Wetlands Project EIR/EIS, and
- Central Valley Project Water Supply Contracts Under Public Law 101-514 (Section 206) EIS/EIR.

Many of the documents reviewed do not consider changes in hydrological conditions resulting from project operations, in and of themselves, to be environmental effects. Rather, such changes are often considered to be the causative agents that may result in impacts on water quality, fish, recreation, groundwater, and agricultural resources. However, in response to comments received during the scoping process, these hydrologic changes were evaluated as potential environmental effects for purposes of this analysis.

Based on a review of these documents as well as review of the potential impacts of the FRWP alternatives analyzed in this EIR/EIS, the significance criteria below were determined to be appropriate thresholds for this analysis. An alternative may result in a significant impact if it would result in the following:

- substantial changes in reservoir storage or river flows,
- substantial changes in amount of water available to other water users, or
- substantial changes in the production of hydroelectric power.

The information contained in this chapter is also used in the analysis of secondary environmental effects associated with changes in river flows, reservoir levels, and water supply conditions. Specifically, potential secondary environmental effects associated with river flows, reservoir levels, and water supply conditions are described in the following chapters of this EIR/EIS:

- Chapter 4, "Water Quality;"
- Chapter 5, "Fish;"
- Chapter 6, "Recreation;"
- Chapter 9, "Soils, Seismicity, and Groundwater;" and
- Chapter 11, "Agricultural Resources."

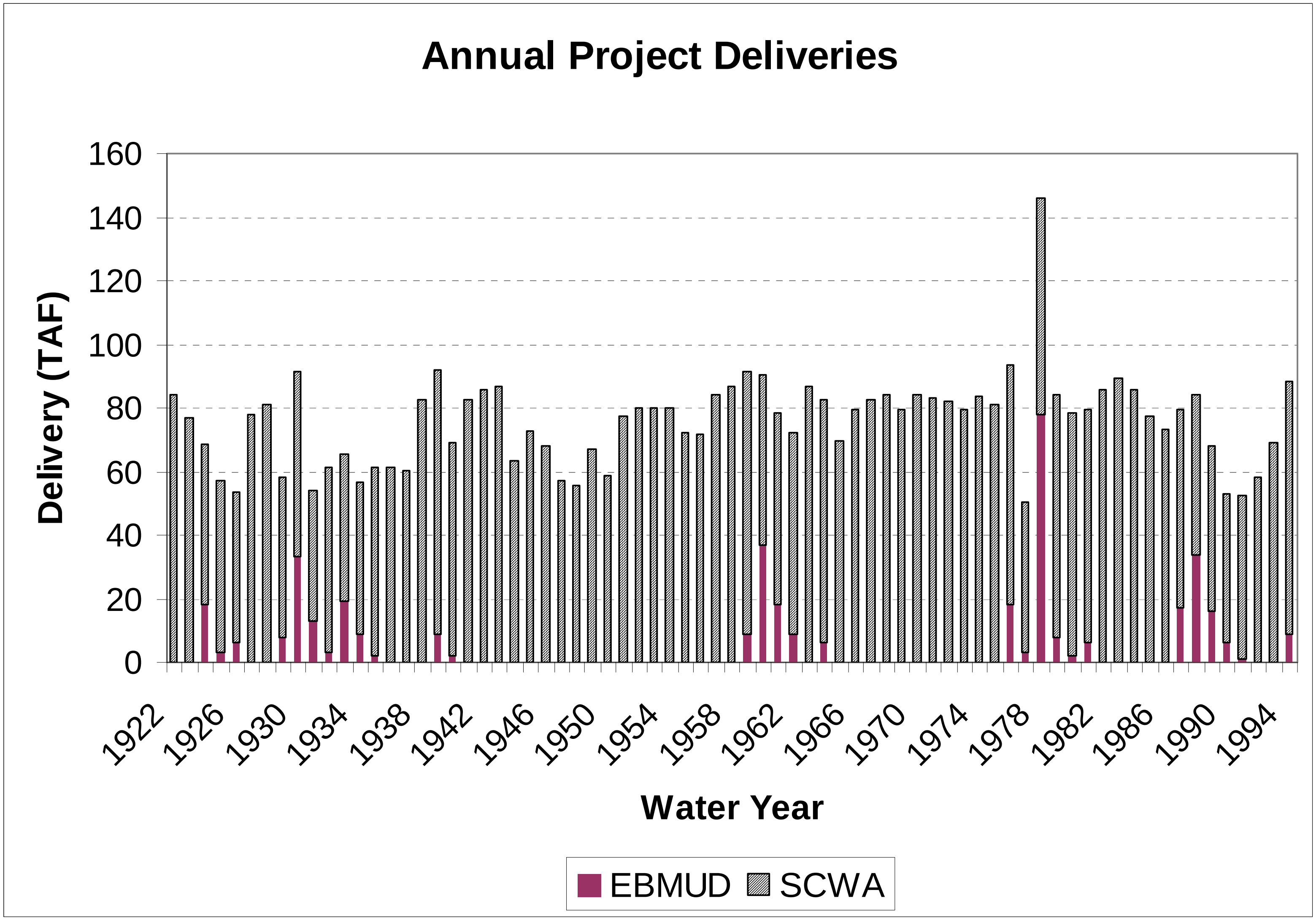


Figure 3-4.
Deliveries to EBMUD and SCWA for Alternative 6 at the 2020 Level of Development

Hydrologic Modeling Results

The modeling results from CALSIM and EBMUDSIM were evaluated to identify the magnitude and pattern of changes in water supply operational characteristics for some of the major river and reservoir variables that might be affected by project deliveries. Data that were evaluated include reservoir storage and elevation at the Shasta, Trinity, Oroville, Folsom, Pardee, and Camanche systems; flows in the Feather River, lower American River, Sacramento River, and lower Mokelumne River; total Delta inflow and outflow; and effects on Delta export operations reflected in Banks and Tracy pumping, CVP and SWP south-of-Delta deliveries, and San Luis Reservoir storage. Because CALSIM simulates monthly operations for the entire CVP and SWP water supply operations, CALSIM responds to project-related diversions by altering reservoir releases or river flows to meet system flow and water quality objectives. Conditions in a specific model year will not necessarily match those observed in the historical record. CALSIM uses unimpaired runoff as initial conditions and then applies existing or future land development and consumptive use conditions on the unimpaired runoff. Exports and reservoir operations are then calculated for a specific level of demand given the entire period of record. The model optimizes operations over the period to meet system operations and regulatory requirements. In addition, these responses in CALSIM can be numerically greater than the original project-related operation because operations may change at multiple locations, and/or the resolution of model parameters cannot accurately reflect the small changes caused by relatively small project-related diversions. Generally, agency personnel operating the water supply systems have flexibility in controlling these interactions between the criteria than the monthly model results would suggest.

Alternatives 2–5

Impact 3-1: Changes in Upper Sacramento River Basin Hydrologic Conditions

Figures 3-5 and 3-6 show the frequency distribution of the ranked end-of-September storage (also known as carryover storage) in the major northern California SWP and CVP reservoirs (Shasta, Trinity, Oroville, and Folsom) for Alternative 1 (no-action scenario) and Alternatives 2–6. Carryover storage is important for protecting against unanticipated drought conditions that may occur during the following year. The frequency plots indicate the percentage of months with storage of a particular value. Table 3-1 shows summary statistics of carryover storage values for all water years, and for the historical dry water year period (1928–1934) (see section 3.4.1 of the Modeling Technical Appendix, Volume 3 of this EIR/EIS, for additional information on simulated project effects during other drought periods). The CALSIM simulation results indicate that reservoir storage responses to project deliveries are distributed throughout the SWP and CVP system. Average annual changes would be slightly greater during dry periods. Very infrequent, larger increases and reductions in storage are observed in some individual months even though project diversions are small or not occurring. These changes in storage are typically associated with equivalent changes in storage or deliveries at other locations. Therefore, these changes are not substantial, are infrequent, and represent less-than-significant impacts. See Sections 3.4.3 and 3.4.9 of the Modeling Technical Appendix, Volume 3 of this EIR/EIS, for detailed information.

Impact 3-2: Changes in Lower Sacramento River, Delta Inflow, and Delta Outflow Hydrologic Conditions

Changes to SWP and CVP operations simulated by CALSIM for upper basin reservoir storage and flows in response to project-related diversions at the Freeport Intake facility are ultimately reflected in Sacramento River flows and total Delta inflow. Figure 3-7 shows the frequency distribution plots for monthly average Sacramento River flow below the Freeport intake facility and monthly average total Delta inflow for all alternatives. The plots include data that are truncated to include only the relatively lower flow values where project-related differences would have the largest proportional effects to background flow conditions. As a result of the relatively small size of maximum project-related diversion rates compared to the background flows, there are no discernible differences in the overall distribution of flows with and without project operations.

Figure 3-8 shows time series of Sacramento River flows downstream of the project diversions at Freeport for the historical dry water year period (1928–1934) and historical wet water year period (1967–1971) for all alternatives. The project-related changes resulting from Freeport intake facility diversion rates of up to 286 cfs are negligible (less than 3%) relative to the background Sacramento River flows that are rarely less than 10,000 cfs. Consequently, the differences cannot be detected in the plots. Data for the San Joaquin River at Vernalis, which is a component of total Delta inflow, reflects similar negligible differences between conditions with and without the project diversions.

Figure 3-9 shows the frequency distributions of data for monthly Delta outflow volume (truncated to volumes less than 2,000 af per month) and the X2 position for all alternatives. Both variables have similar data distributions for with- and without-project conditions. Table 3-1 shows that average annual Delta outflow would be reduced by 33,000 af compared to the no-action conditions, equivalent to 0.2% of the total existing outflow volume. The pattern of incremental monthly outflow reductions indicates a similar average volume reduction through each month of the water year. The X2 position is directly related to Delta outflow, and both the frequency plot and tabulated results (Table 3-1) indicate that there would be no appreciable changes between with- and without-project conditions. These changes are not substantial and represent less-than-significant impacts. See Sections 3.4.4 and 3.4.5 of the Modeling Technical Appendix, Volume 3 of this EIR/EIS, for detailed information.

Table 3-1. Summary Statistics of CALSIM and EBMUDSIM Hydrologic Modeling Parameters for 2001 Level of Development

			Alternatives 2–5		Alternative 6	
Location/Resource	Year Type [a]	No Action [b]	Change	Change (%)	Change	Change (%)
Trinity Reservoir Storage (TAF) [c]	Dry	584	10	1.6	-2	-0.3
	Average	1318	-4	-0.3	-2	-0.1
Shasta Reservoir Storage (TAF) [c]	Dry	1512	-60	-4.0	-8	-0.5
	Average	2672	-15	-0.6	-1	-0.1
Oroville Reservoir Storage (TAF) [c]	Dry	1528	14	0.9	-8	-0.6
	Average	2113	-8	-0.4	-13	-0.6
Folsom Reservoir Storage (TAF) [c]	Dry	400	-20	-4.9	-3	-0.7
	Average	503	-4	-0.9	-2	-0.4
San Luis Reservoir Storage (TAF) [c]	Dry	603	-25	-4.2	-1	-0.2
	Average	573	-5	-0.9	-3	-0.6
Pardee Reservoir Storage (TAF) [c]	Dry	179	3	1.7	90	50.3
	Average	176	6	3.4	117	66.5
Camanche Reservoir Storage (TAF) [c]	Dry	174	53	30.4	-5	-2.9
	Average	221	17	7.7	25	11.3
Mokelumne Inflow to Delta (TAF)	Dry	86	4	4.7	0	0.0
	Average	284	8	2.8	-14	-4.8
Delta Outflow (TAF)	Dry	6611	-19	-0.3	-15	-0.2
	Average	14473	-33	-0.2	-35	-0.2
Exports, Banks Pumping Plant (TAF)	Dry	1947	6	0.3	-4	-0.2
	Average	3170	-6	-0.2	-3	-0.1
Exports, Tracy Pumping Plant (TAF)	Dry	1636	-10	-0.6	-4	-0.3
	Average	2300	-4	-0.2	0	0.0

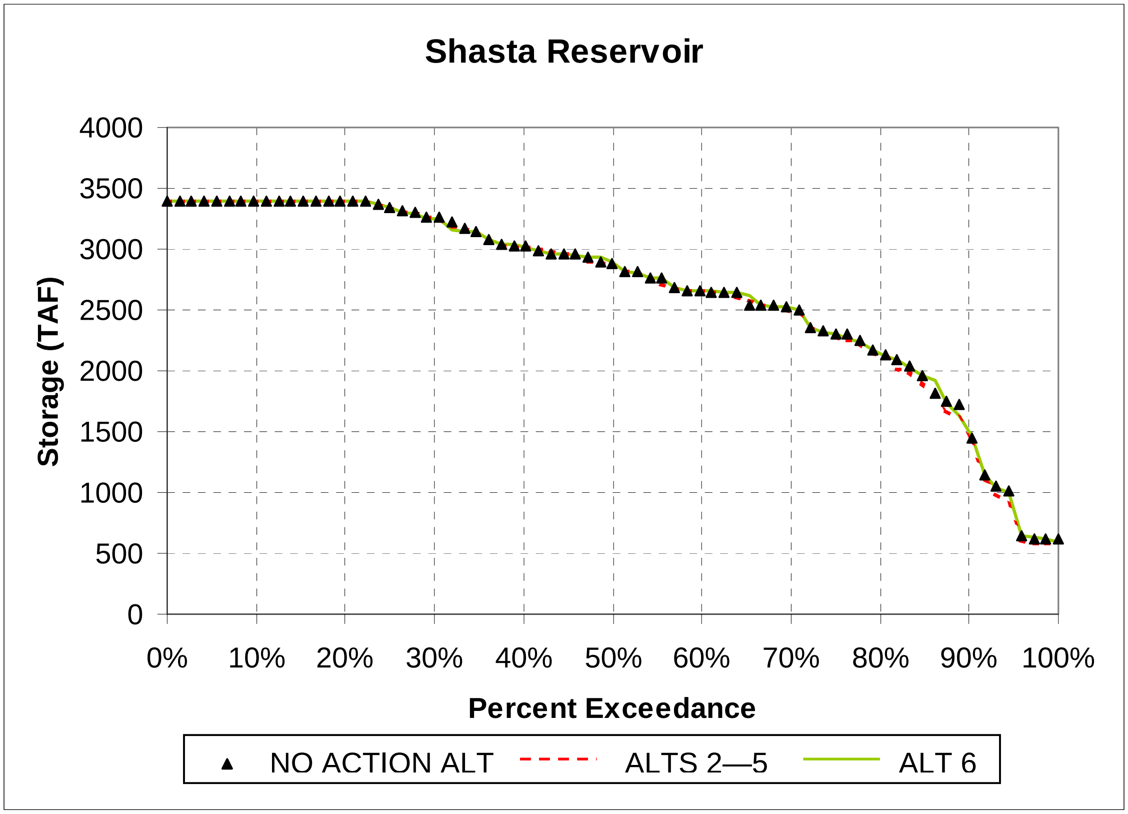
			Alternatives 2–5		Alternative 6	
Location/Resource	Year Type [a]	No Action [b]	Change	Change (%)	Change	Change (%)
X2 Position (km)	Dry	81	0.0	0.0	0.0	0.0
	Average	76	0.0	0.0	0.0	0.0
CVP Deliveries North of Delta (TAF) [d]	Dry	1959	0	0.0	1	0.0
	Average	2210	0	0.0	1	0.1
CVP Deliveries South of Delta (TAF)	Dry	1668	-6	-0.3	-2	-0.1
	Average	2595	-4	-0.2	1	0.0
SWP Deliveries South of Delta (TAF)	Dry	2132	6	0.3	-8	-0.4
	Average	3213	-6	-0.2	-7	-0.2

[a] "Average" is the average value of 72-year simulation period (1922–1993). "Dry" is the average value of 1928–1934 dry period.

[b] Annual values are based on water years (October–September).

[c] End of September carry-over storage.

[d] Does not include American River Division and FRWP deliveries.



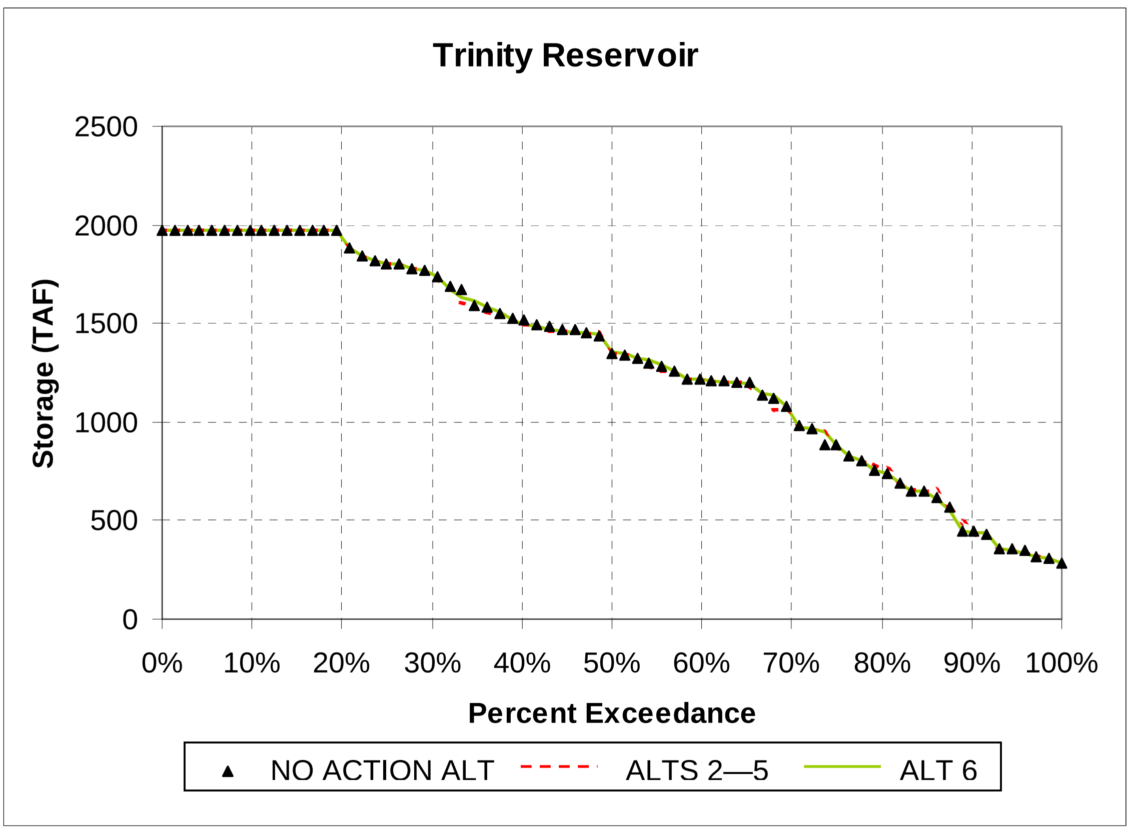
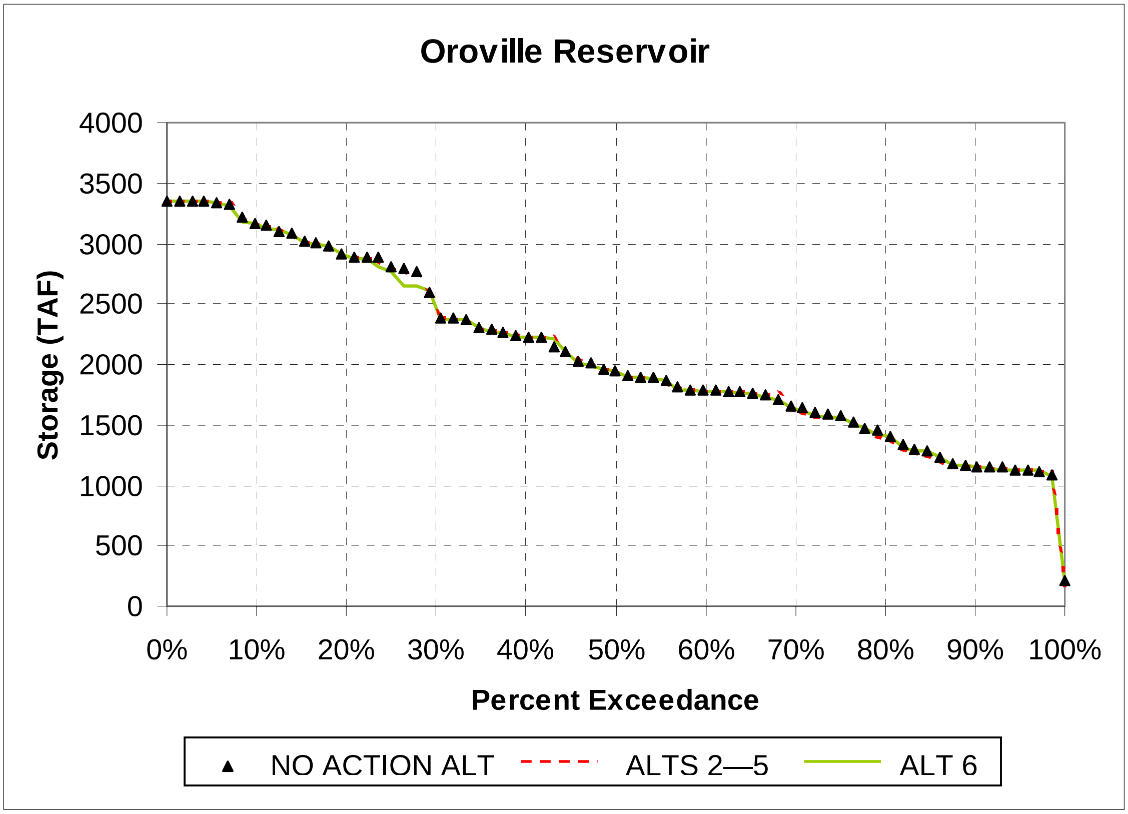


Figure 3-5.
Frequency Distribution of End-of-September Storage in Shasta and Trinity Reservoirs



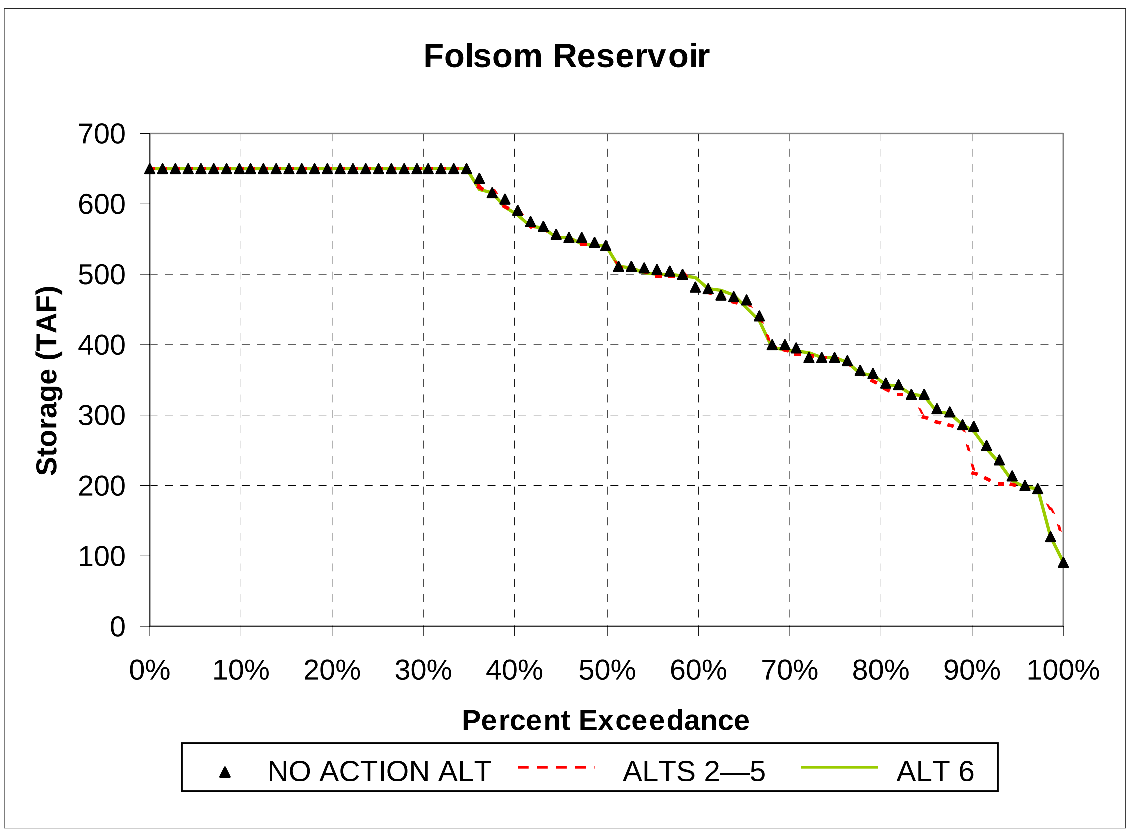
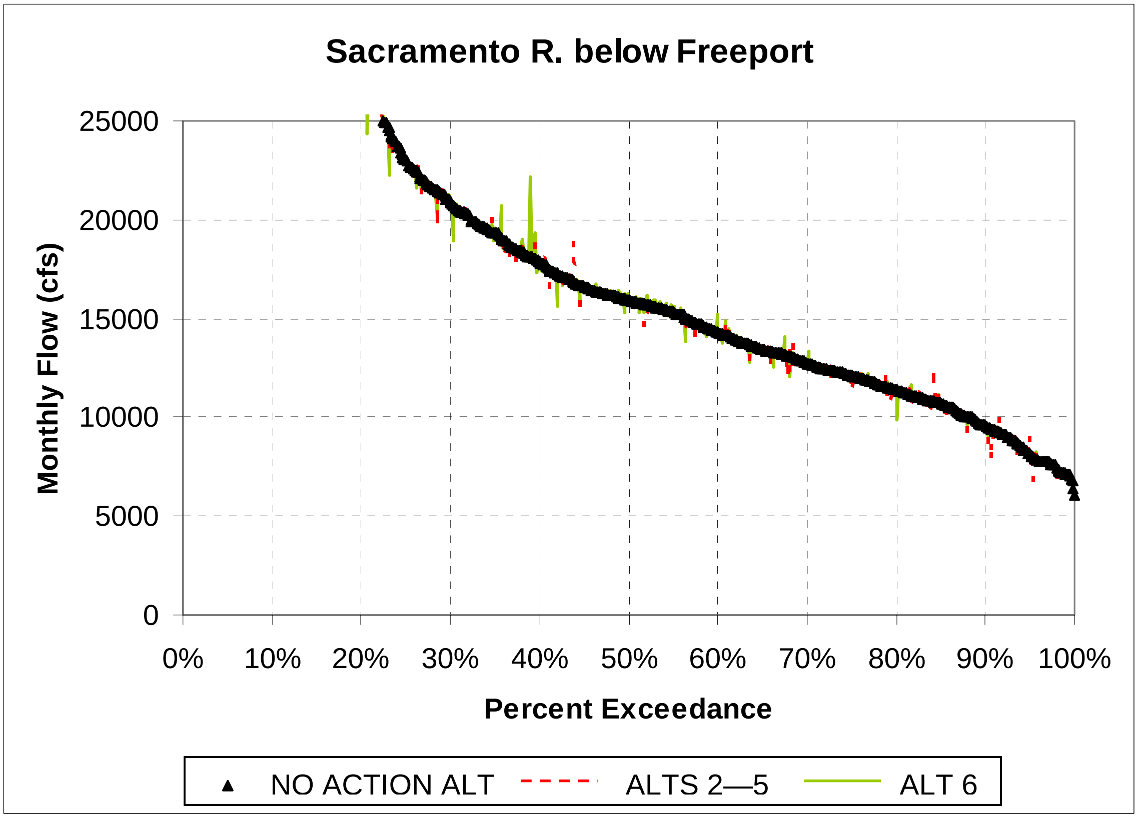


Figure 3-6.
Frequency Distribution of End-of-September Storage in Oroville and Folsom Reservoirs



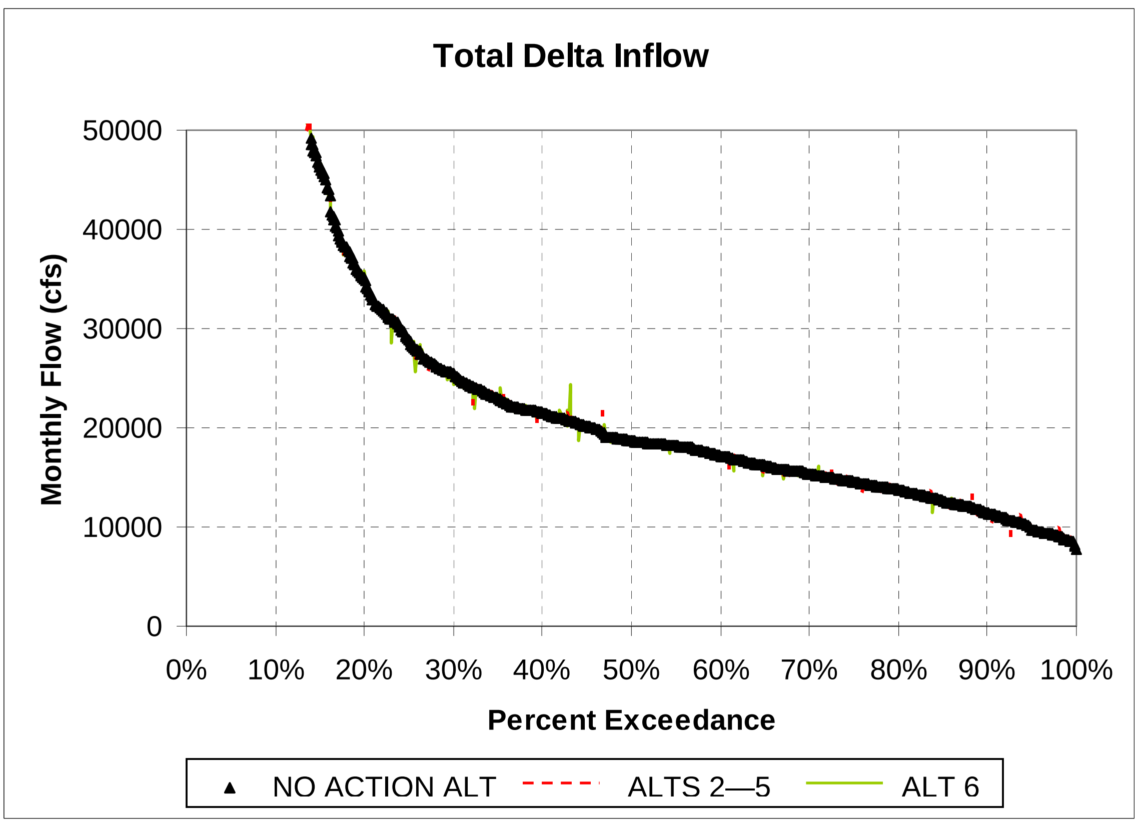
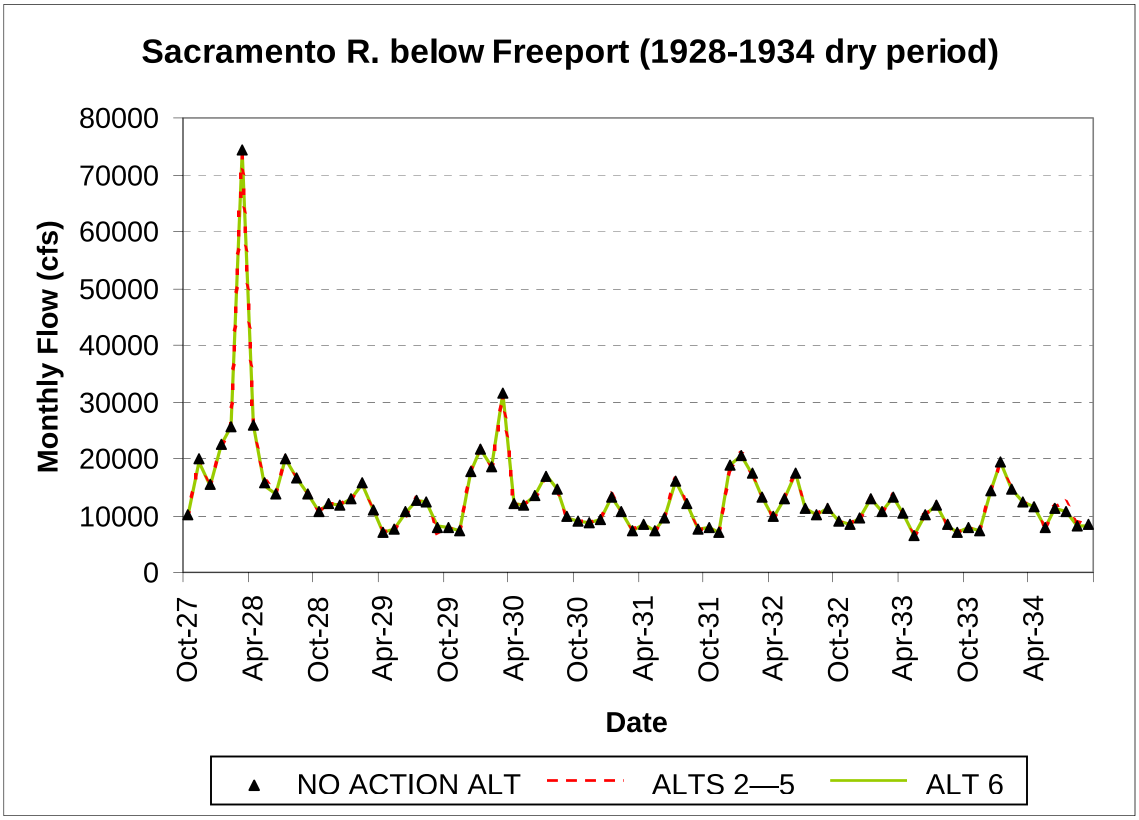


Figure 3-7.
Frequency Distribution of Sacramento River Flow and Delta Inflow



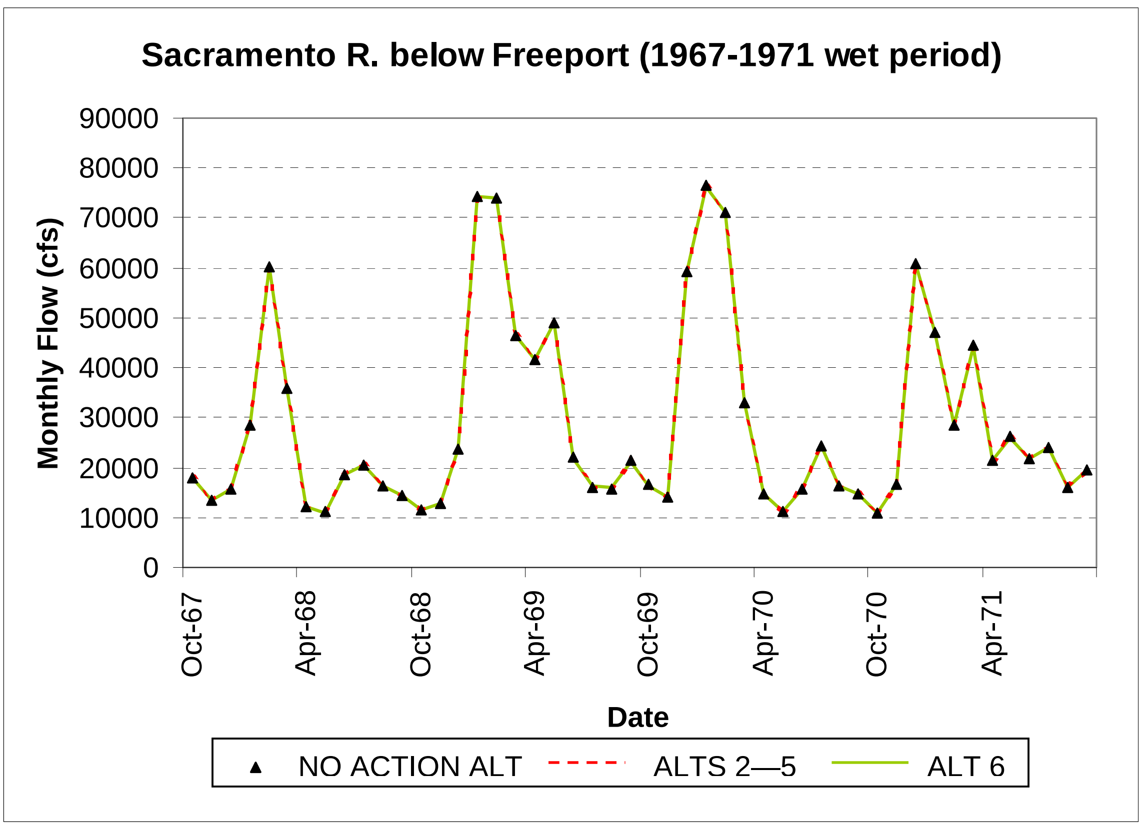
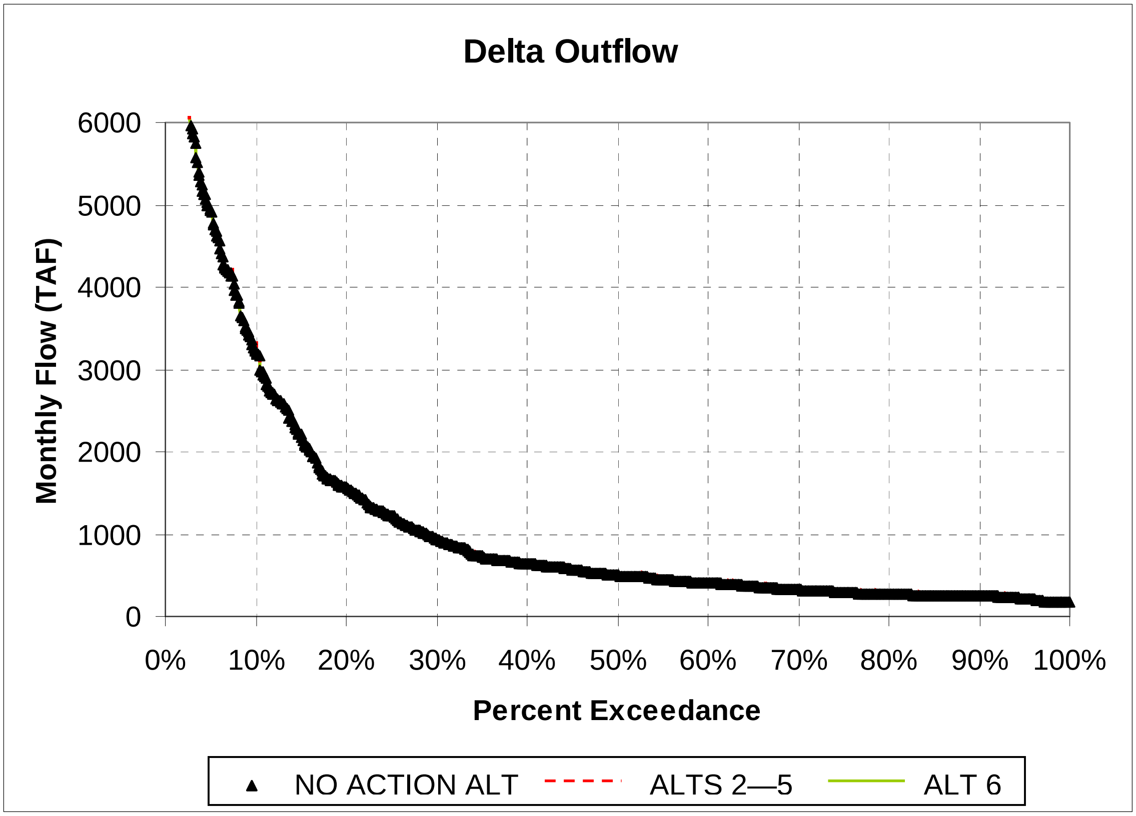


Figure 3-8.
Time Series of Sacramento River Flow



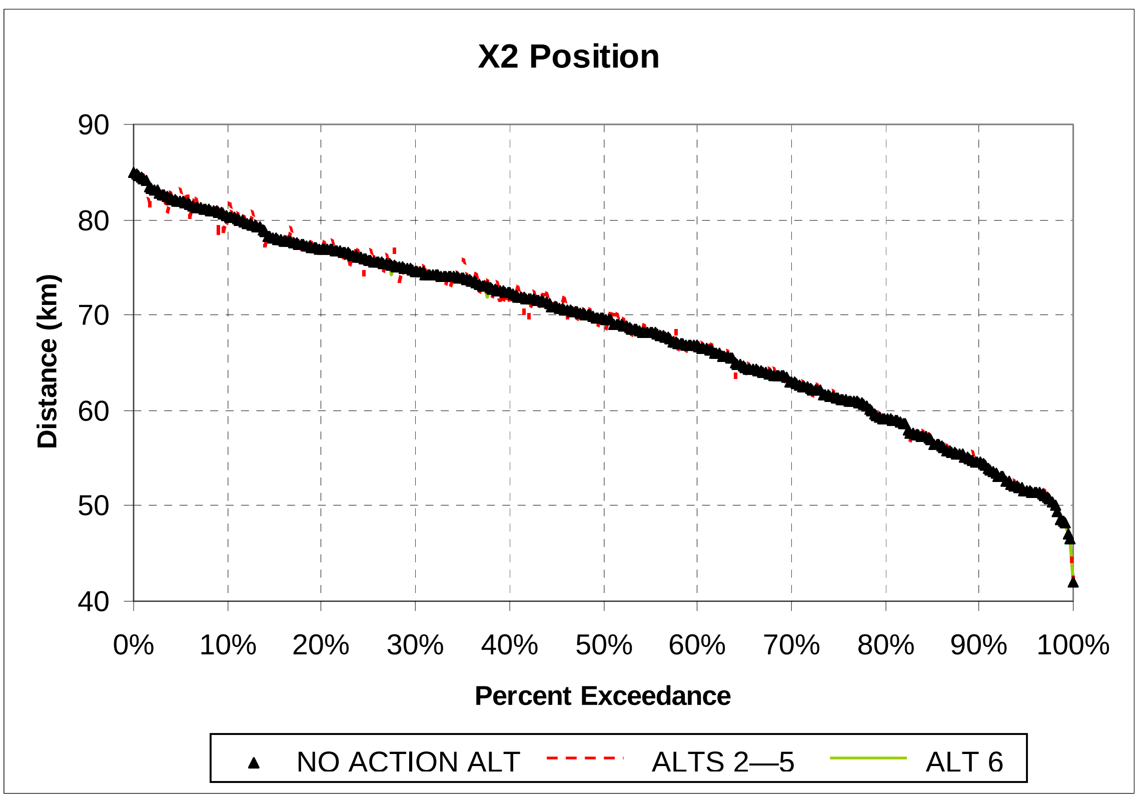


Figure 3-9.
Frequency Distribution of Delta Outflow and X2 Position

Impact 3-3: Changes in Mokelumne River Basin Hydrologic Conditions

Pardee and Camanche Reservoirs

Figure 3-10 shows the frequency distributions of EBMUDSIM simulated Pardee Reservoir and Camanche Reservoir end-of-September carryover storage volume. For Alternatives 2–5, the magnitude of discernible differences in the overall distribution of storage levels with and without project operations are small. Summary data in Table 3-1 indicate that for Alternatives 2–5, the average carryover storage in Pardee Reservoir would be about 6,000 af greater than the no-action conditions; average carryover storage in Camanche Reservoir would increase by 17,000 af. Storage gains help to meet water supply demands and instream flow requirements. The reservoir storage savings are a direct result of project-related deliveries to the Mokelumne Aqueduct that serve to supplement EBMUD demands in their service area. During the 1928–1934 dry period, Pardee Reservoir carryover storage would be about 3,000 af higher than under no-action conditions, while Camanche reservoir storage would be approximately 53,000 af higher. These changes are not substantial and represent less-than-significant impacts. See Sections 3.4.4 and 3.4.5 of the Modeling Technical Appendix, Volume 3 of this EIR/EIS, for detailed information.

Lower Mokelumne River

Figure 3-11 shows the frequency distribution of monthly flow volumes released from Camanche Reservoir and net inflow to the Delta from the lower Mokelumne River for all alternatives. For Alternatives 2–5, the observed changes are attributable to increased carryover storage levels in both Pardee Reservoir and Camanche Reservoir that result in an increased frequency of higher fishery releases under the 1998 Joint Settlement Agreement and a slightly greater probability of winter releases to maintain flood control storage requirements. The simulated annual average Mokelumne River inflow to the Delta under Alternatives 2–5 (Table 3-1) would be increased by 8,000 af; the value would be similar for the dry (increase of 4,000 af) and average annual conditions. These changes are not substantial and represent less-than-significant impacts. See Sections 3.4.4 and 3.4.5 of the Modeling Technical Appendix, Volume 3 of this EIR/EIS, for detailed information.

Impact 3-4: Changes in South-of-Delta Water Supply Delivery Operations

Figure 3-12 shows the frequency distribution of CVP and SWP south-of-Delta deliveries for all alternatives. Table 3-1 shows summary statistics for changes in Banks and Tracy pumping plants and CVP and SWP deliveries. Similar to other variables, the relatively small project-related diversions under Alternatives 2–5 compared to Delta export operations would not be expected to cause substantial changes in deliveries and no discernible difference can be observed with the frequency distribution. Model simulations indicate that implementation of Alternatives 2–5 would result in reductions of annual average SWP and CVP south-of-Delta deliveries by approximately 6,000 af and 4,000 af, respectively, compared to no project conditions. Relative to the total south-of-Delta deliveries, the changes are small and represent about a 0.2% reduction to each. The values for the total Delta exports from Banks and Tracy pumping plants are similar.

Figure 3-13 shows frequency distributions for the CVP and SWP portions of end-of-September storage volume in San Luis Reservoir for all alternatives. In response to the small changes in Delta export pumping, there are no discernible differences in the overall distribution of storage volumes between with- and without-project operations. The average annual total CVP and SWP end-of-September storage in San Luis Reservoir (Table 3-1) would decrease by approximately 5,000 af, representing approximately a 0.9% reduction. These changes are not substantial and represent less-than-significant impacts. See Sections 3.4.6, 3.4.7, and 3.4.8 of the Modeling Technical Appendix, Volume 3 of this EIR/EIS, for detailed information.

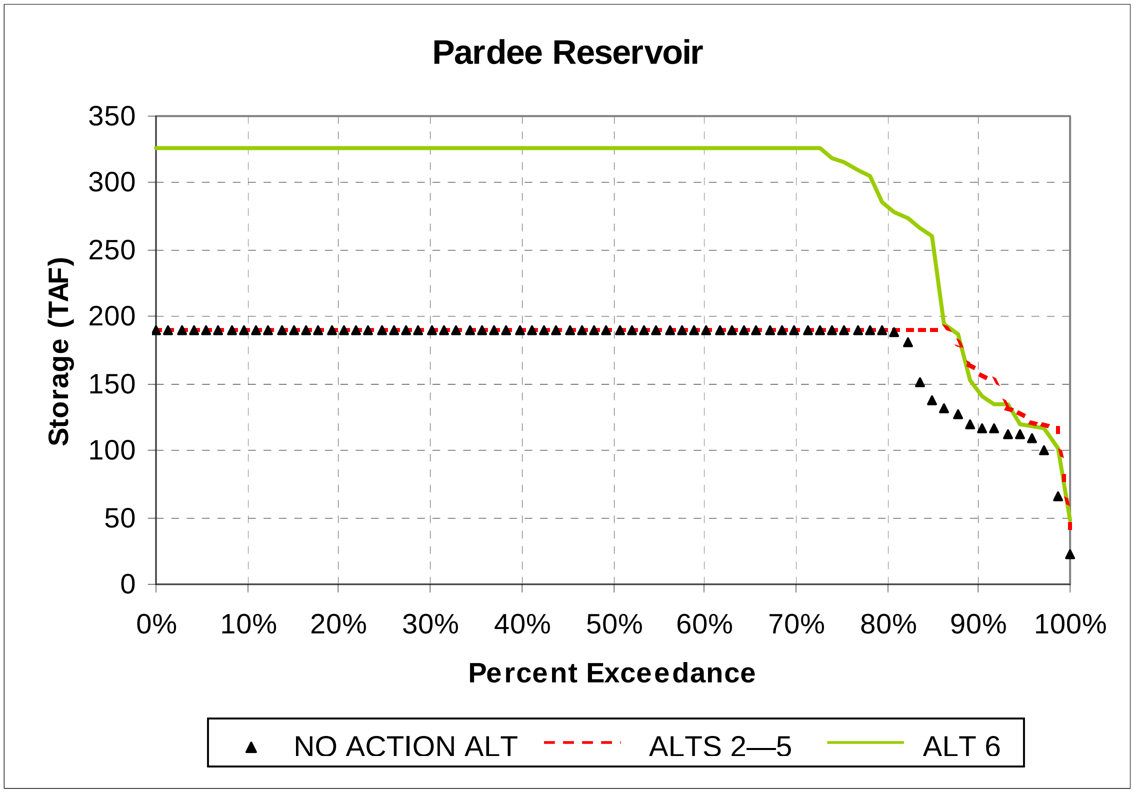
Alternative 6

Impact3-5: Changes in Upper Sacramento River Basin Hydrologic Conditions

Figures 3-5 and 3-6 also provide the frequency distributions end-of-September carryover storage for the four northern California reservoirs (Trinity, Shasta, Oroville, Folsom) for all alternatives. Table 3-1 provides summary statistics for average carryover storage for the full 72-year data set, and the historical dry period (1928–1934). The construction of a new Pardee Dam and enlarging the reservoir would result in the capture of additional spring and summer runoff from the upper Mokelumne River basin watershed and thereby increase EBMUD’s water supply storage capacity. SCWA would divert water from a smaller Freeport intake facility at Freeport at a rate up to 85 MGD. Consequently, CALSIM-simulated responses would be controlled by additional SCWA demands for Sacramento River water and reduced overall Delta inflow. The resulting carryover storage in the Shasta, Oroville, and Folsom Reservoirs would be slightly less than under no-action conditions. Average storage in Trinity Reservoir would not change. However, these differences are not discernible in the frequency distributions. These changes are not substantial and represent less-than-significant impacts. See Section 3.4.3 of the Modeling Technical Appendix, Volume 3 of this EIR/EIS, for detailed information.

Impact 3-6: Changes in Lower Sacramento River, Delta Inflow, and Delta Outflow Hydrologic Conditions

Figures 3-7 and 3-8 show that there is very little difference in Sacramento River flow below Freeport and Delta inflow between the alternatives and the no-action conditions. Figure 3-9 shows that there is a similar negligible difference in



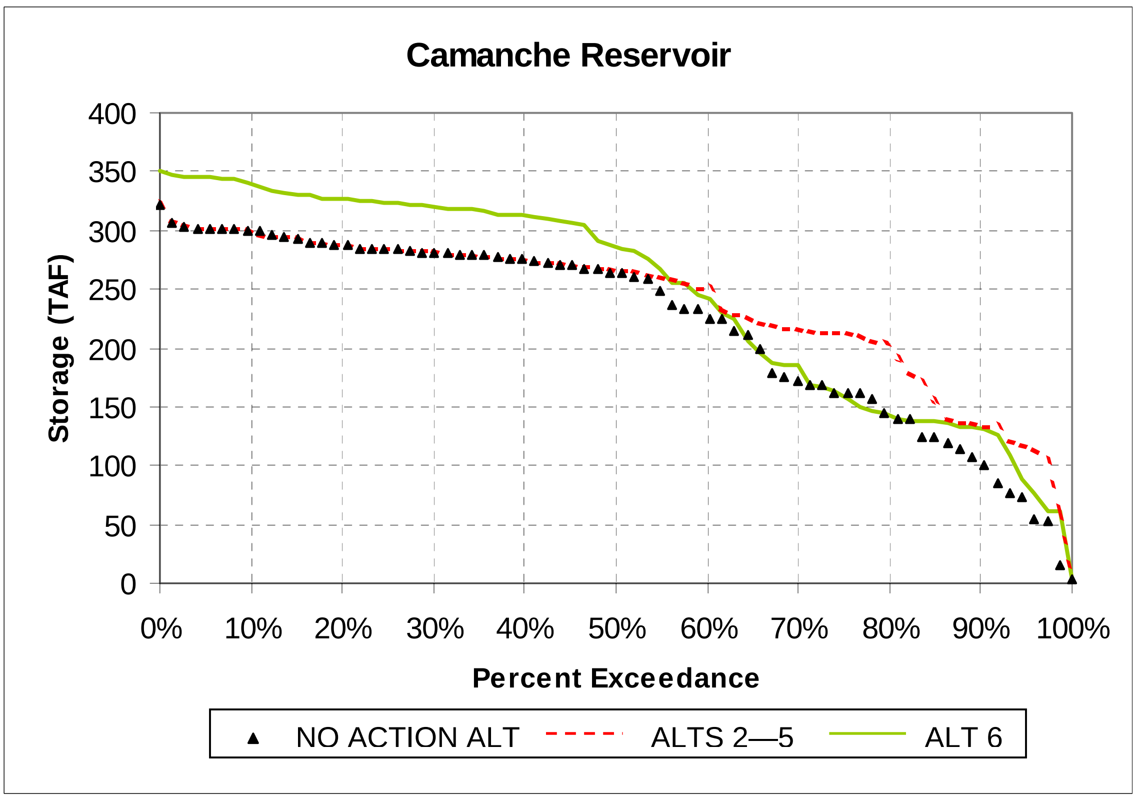
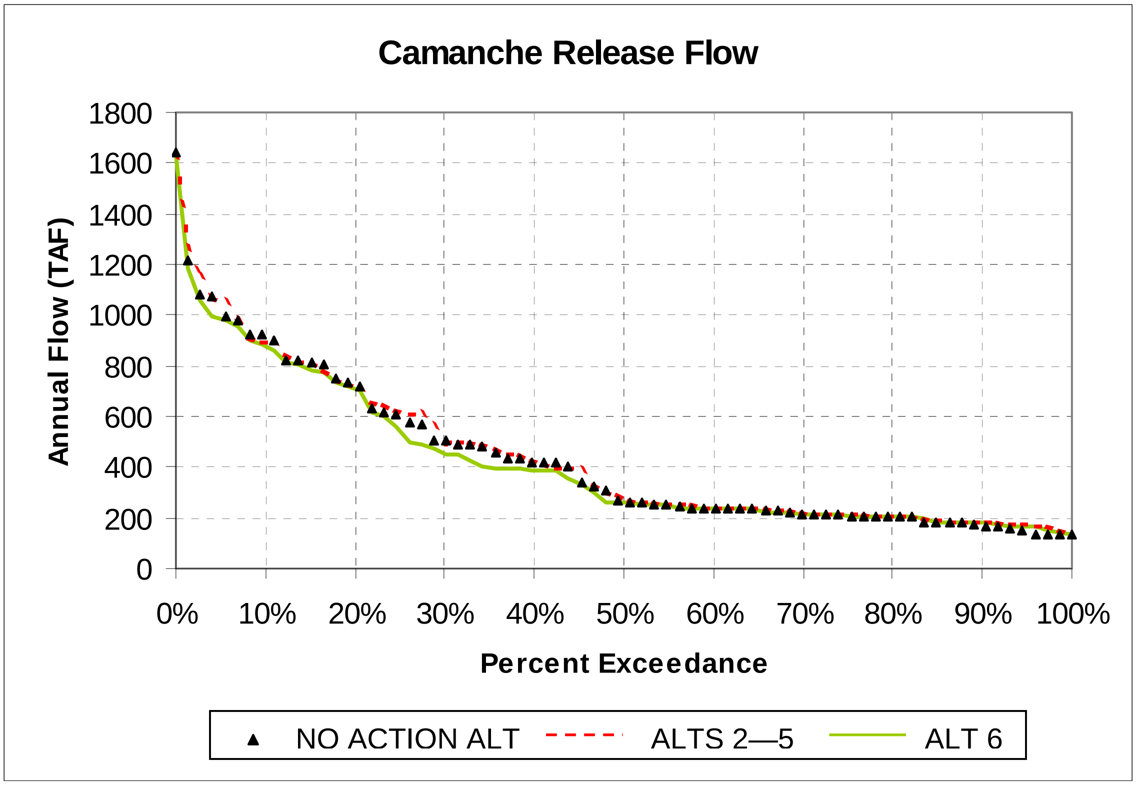


Figure 3-10.
Frequency Distribution of End-of-September Storage in Pardee and Camanche Reservoirs



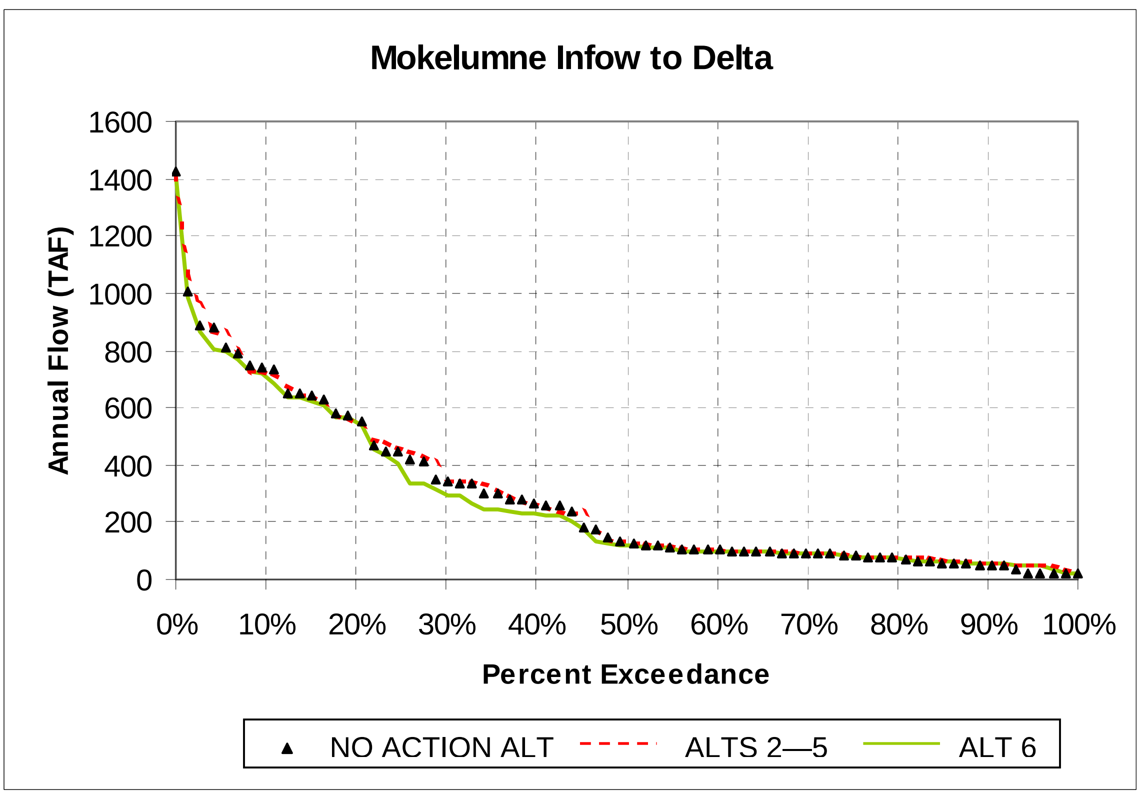
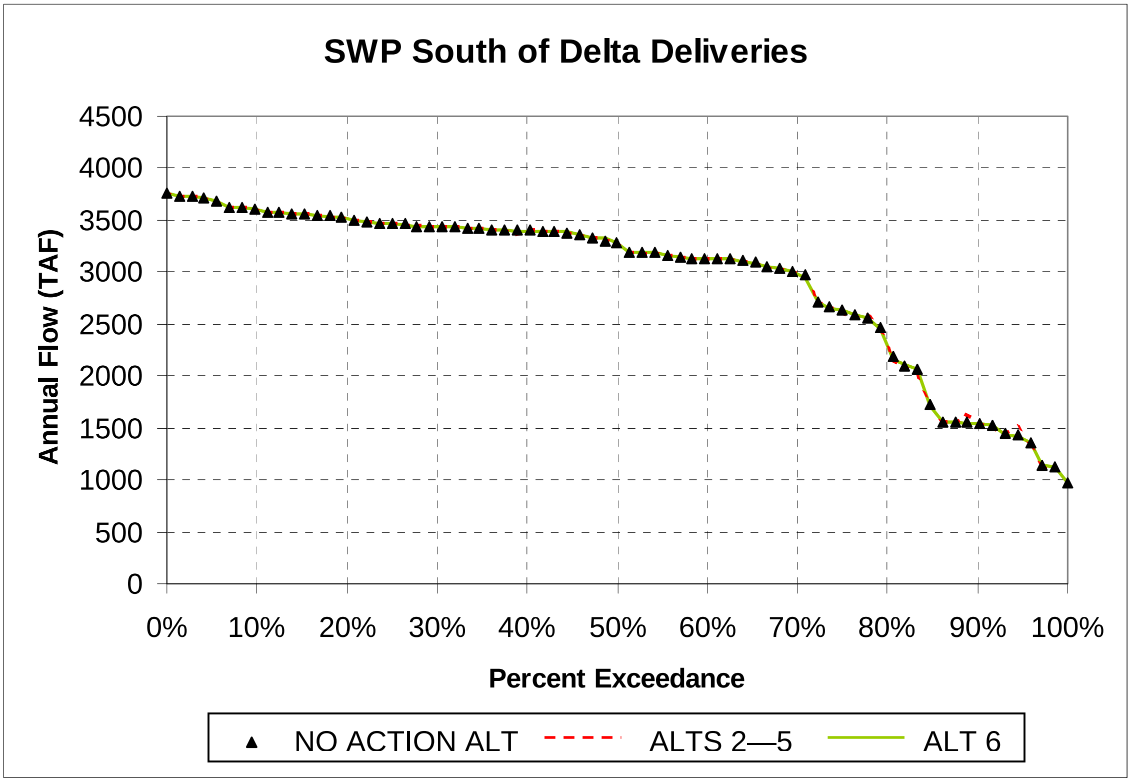


Figure 3-11.
Frequency Distribution of Camanche Releases and Mokelumne Inflow to Delta



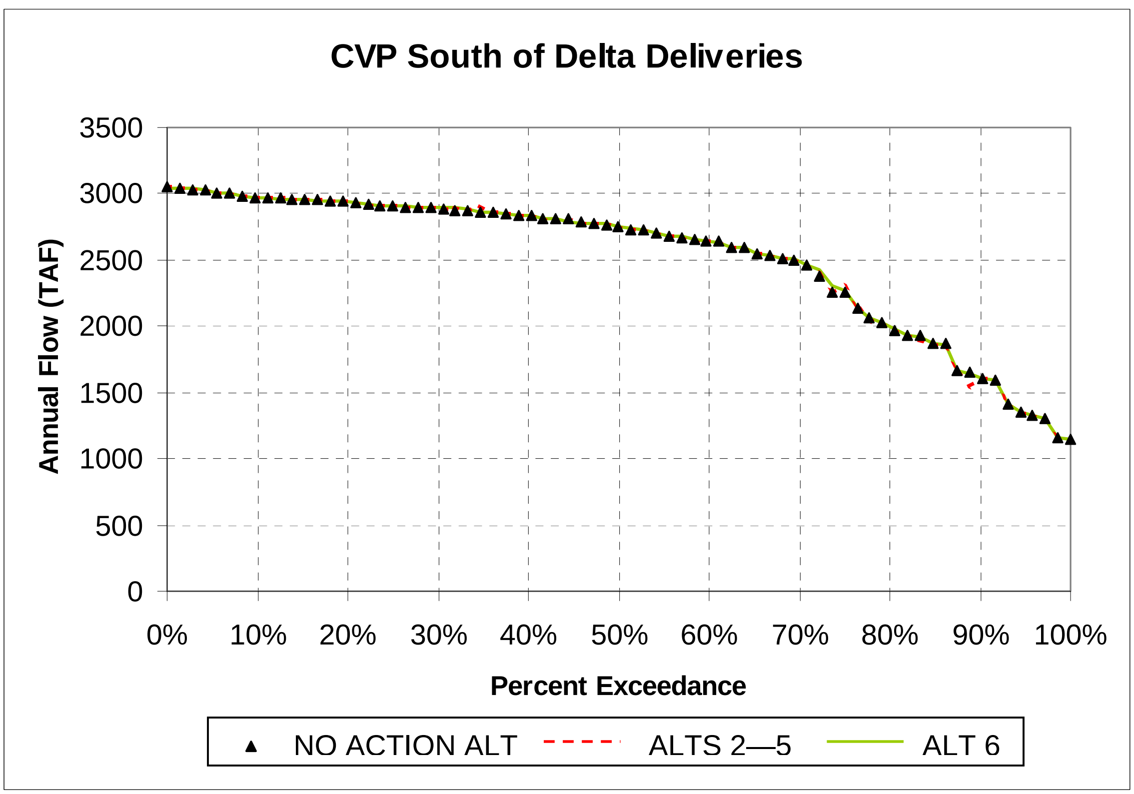
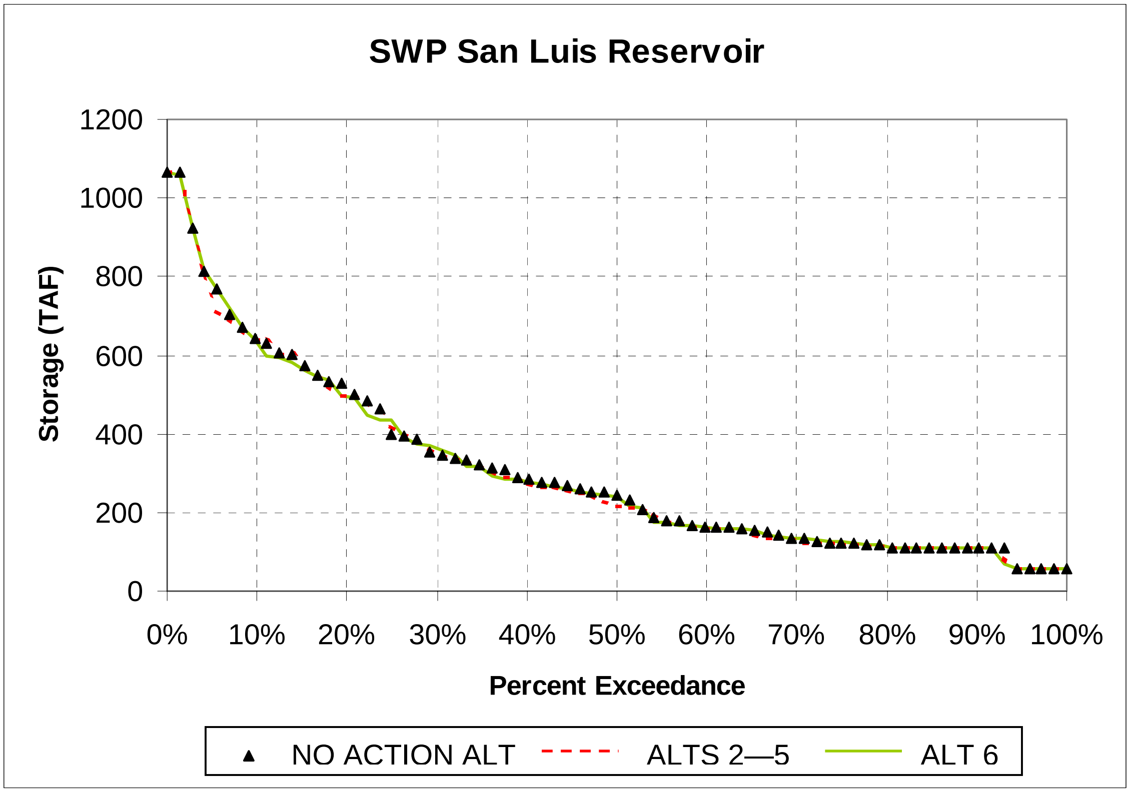


Figure 3-12.
Frequency Distribution of SWP and CVP South of Delta Deliveries



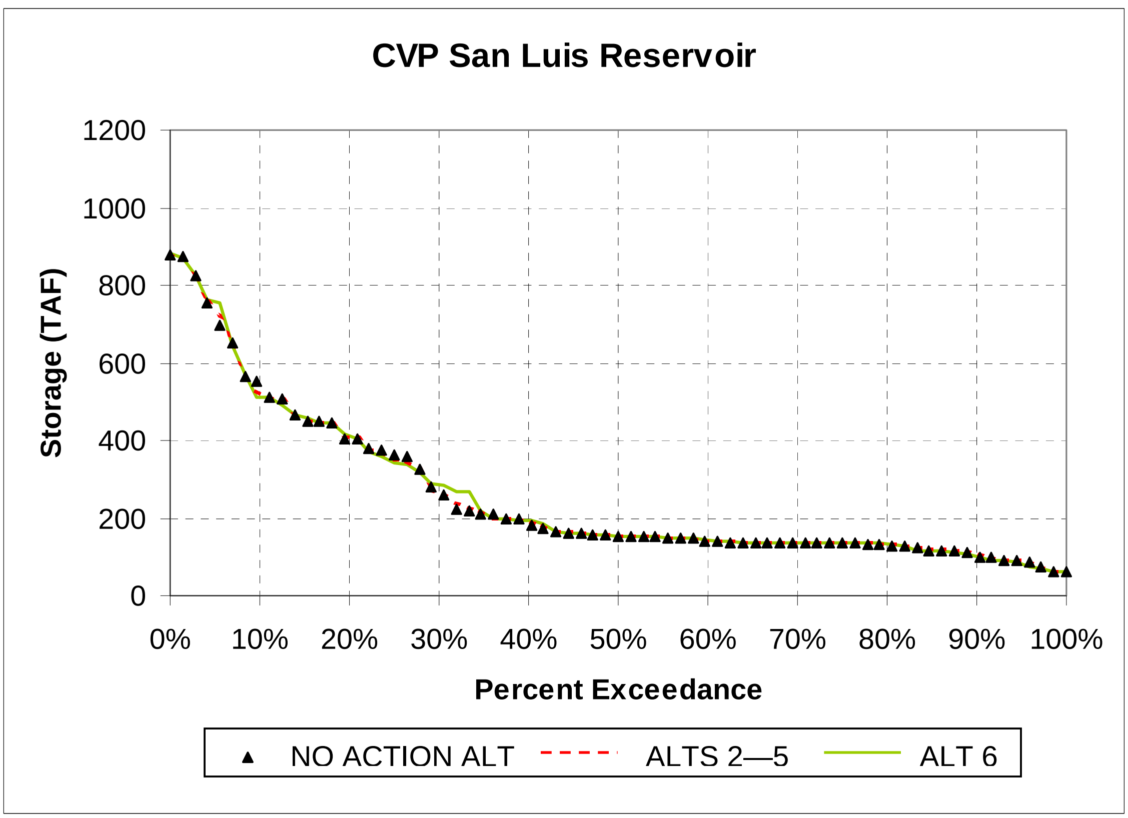


Figure 3-13.
Frequency Distribution of CVP and SWP Storage in San Luis Reservoir

frequency distributions of Delta outflow and X2 position for all alternatives. Average annual Delta outflow would be reduced by 35,000 af compared to the no-action conditions (Table 3-1). The average monthly X2 position would not change appreciably. These changes are not substantial and represent less-than-significant impacts. See Section 3.4.4 of the Modeling Technical Appendix, Volume 3 of this EIR/EIS, for detailed information.

Impact 3-7: Changes in Mokelumne River Basin Hydrologic Conditions

Pardee and Camanche Reservoirs

Figure 3-10 shows Pardee and Camanche Reservoirs end-of-September storage data for all alternatives based on EBMUDSIM model results. Figure 3-10 shows that, under Alternative 6, Pardee and Camanche storage levels would be higher than the without-project case in most years, but would be drawn down in dry years. Table 3-1 shows that, under Alternative 6, average annual carryover storage would be 117,000 af greater in Pardee and 25,000 af greater in Camanche than under existing conditions. Camanche Reservoir levels are higher than no project because the enlarged Pardee Reservoir would provide more flood control space allowing less flood control space to be reserved in Camanche Reservoir. The combined average change in carryover storage in both reservoirs would be an additional 142,000 af. During the 1928–1934 dry period, Pardee storage would be increased by 90,000 af, while Camanche storage would decrease by 5,000 af compared to the No Action Alternative. Figure 3-10 shows that the additional storage in Pardee Reservoir provides the greatest monthly change in storage during the dry and critically dry water years.

Figure 3-14 shows the seasonal pattern of Pardee Reservoir storage that would result following construction of the new dam for the historical 1928–1934 dry water year period and 1967–1971 wet year period for all alternatives. Storage in Pardee Reservoir would be maintained at a higher level in most months, and inflows would be sufficient in the wet year period to maintain full storage conditions in the reservoir. However, inflows during critically dry periods would still be insufficient to maintain reservoir storage levels, and storage volumes would be reduced to identical levels as under base conditions. Figure 3-15 shows that seasonal patterns of Camanche Reservoir storage are very similar during both dry and wet periods for all alternatives. Camanche storage under the enlarged dam scenario shows a pattern similar to Pardee Reservoir. During wet periods, the reservoir tends to remain at maximum allowable levels, but during prolonged dry periods, the reservoir is drawn down as releases exceed inflows. These changes are not substantial and represent less-than-significant impacts. See Section 3.4.4 of the Modeling Technical Appendix, Volume 3 of this EIR/EIS, for detailed information.

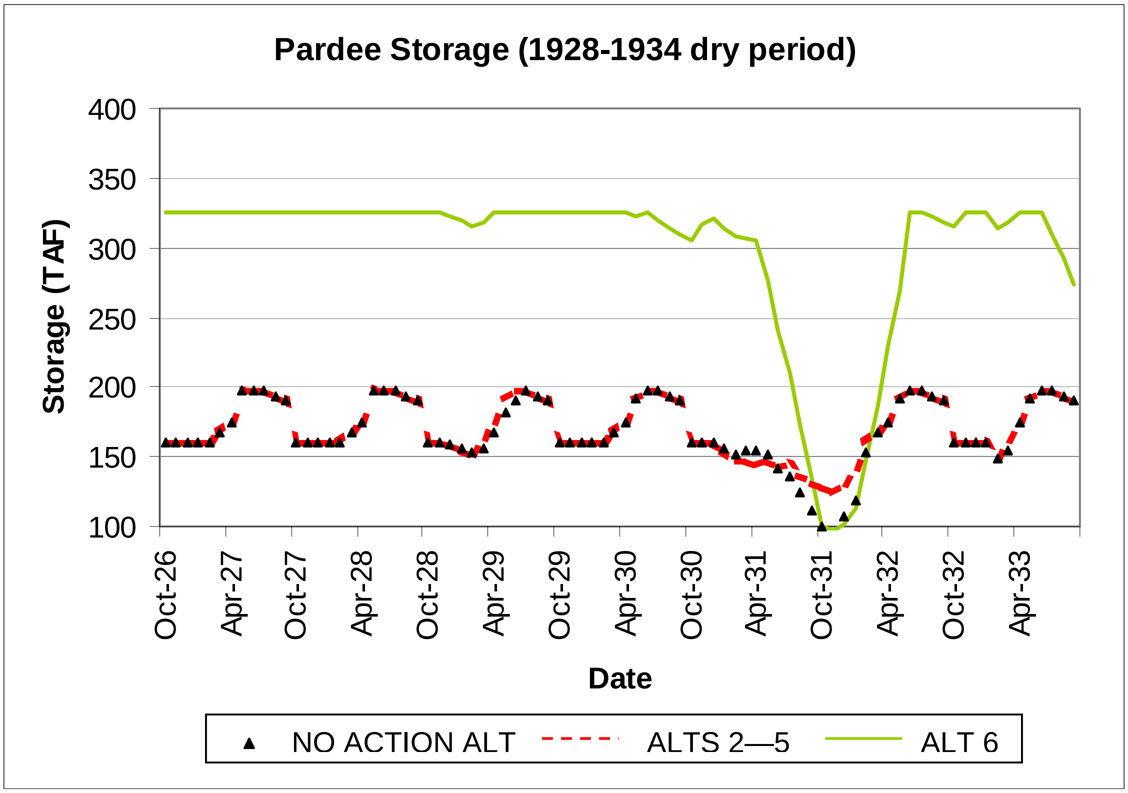
Lower Mokelumne River

Figure 3-11 shows the frequency distribution of Mokelumne River flows released from Camanche Reservoir and Mokelumne River inflow to the Delta for all alternatives. This figure shows that Mokelumne flows are generally less than without project in the 20 to 50% exceedance range. Table 3-1 shows that, under this alternative, average annual inflow to the Delta would decrease by about 14,000 af compared to the no-action conditions, while during the 1928–1934 dry period, inflows would be unchanged. Individual monthly flows would increase in some months because of increased fishery flows. However, the changes would occur primarily during normal or wetter year types; average flows would not change appreciably during critically dry year types because fishery flow requirements control conditions in these years. However, the frequency of critically dry years would decrease per Joint Settlement Agreement provisions.

Figure 3-16 shows the seasonal pattern of Mokelumne River inflow at Woodbridge for the 1928–1934 dry period and 1967–1971 wet period for all alternatives. The plots indicate that there is no strong pattern in the monthly pattern of higher and lower flows relative to the base scenario for either dry or wet water year periods that would occur upon implementation of the project. These changes are not substantial and represent less-than-significant impacts. See Sections 3.4.4 and 3.4.5 of the Modeling Technical Appendix, Volume 3 of this EIR/EIS, for detailed information.

Impact 3-8: Changes in South-of-Delta Water Supply Delivery Operations

Figures 3-12 and 3-13 show the frequency distribution of CVP and SWP south-of-Delta deliveries and the CVP and SWP portions of end-of-September storage volume in San Luis Reservoir, respectively, for all alternatives. Table 3-1 shows summary statistics for changes in Banks and Tracy pumping plants and CVP and SWP deliveries. Similar to other variables, the relatively small additional diversions of Mokelumne River basin water to the EBMUD service area cause negligible changes in the frequency distributions of these variables. Annual average CVP south-of-Delta deliveries would increase by 1,000 af, and SWP deliveries would decrease by approximately 7,000 af compared to no-project conditions. On a percentage basis of total CVP and SWP south-of-Delta deliveries, the changes reflect a 0.0% increase and a 0.2% reduction, respectively. The average annual total CVP and SWP end-of-September storage in San Luis Reservoir (Table 3-1) would decrease by 3,000 af, representing a reduction of approximately 0.6%. These changes are not substantial and represent less-than-significant impacts. See Sections 3.4.6, 3.4.7, and 3.4.8 of the Modeling Technical Appendix, Volume 3 of this EIR/EIS, for detailed information.



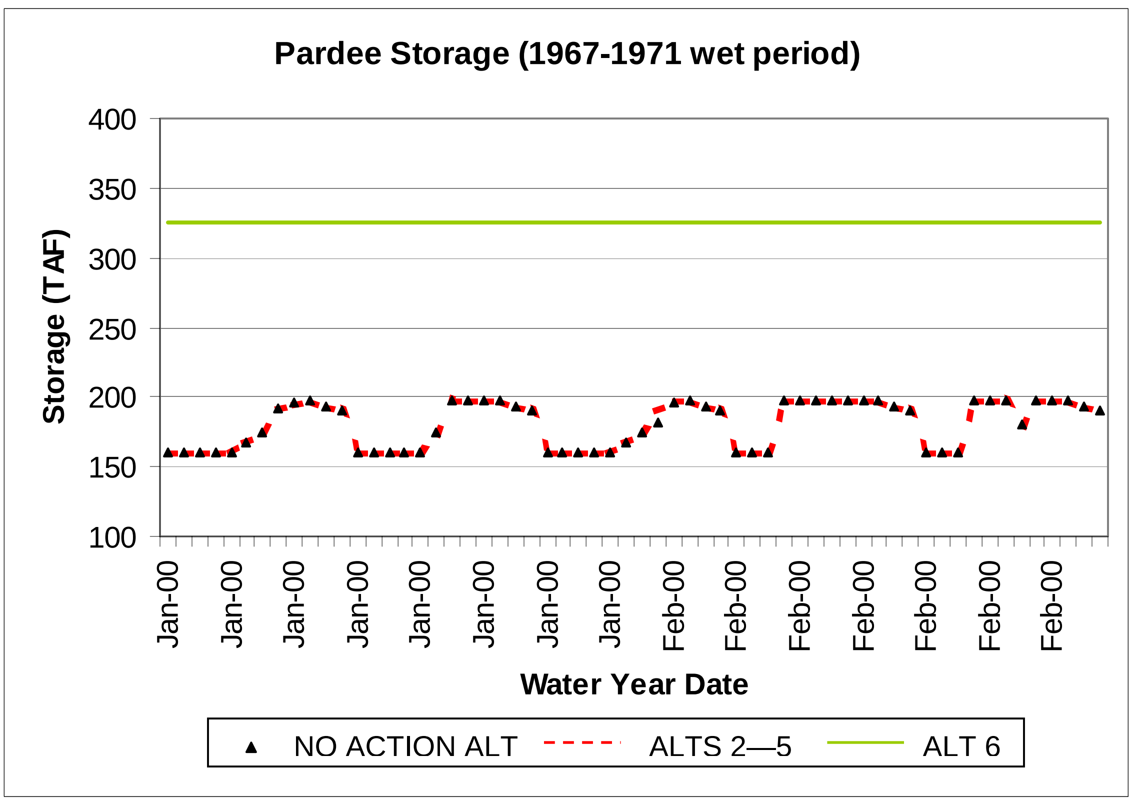
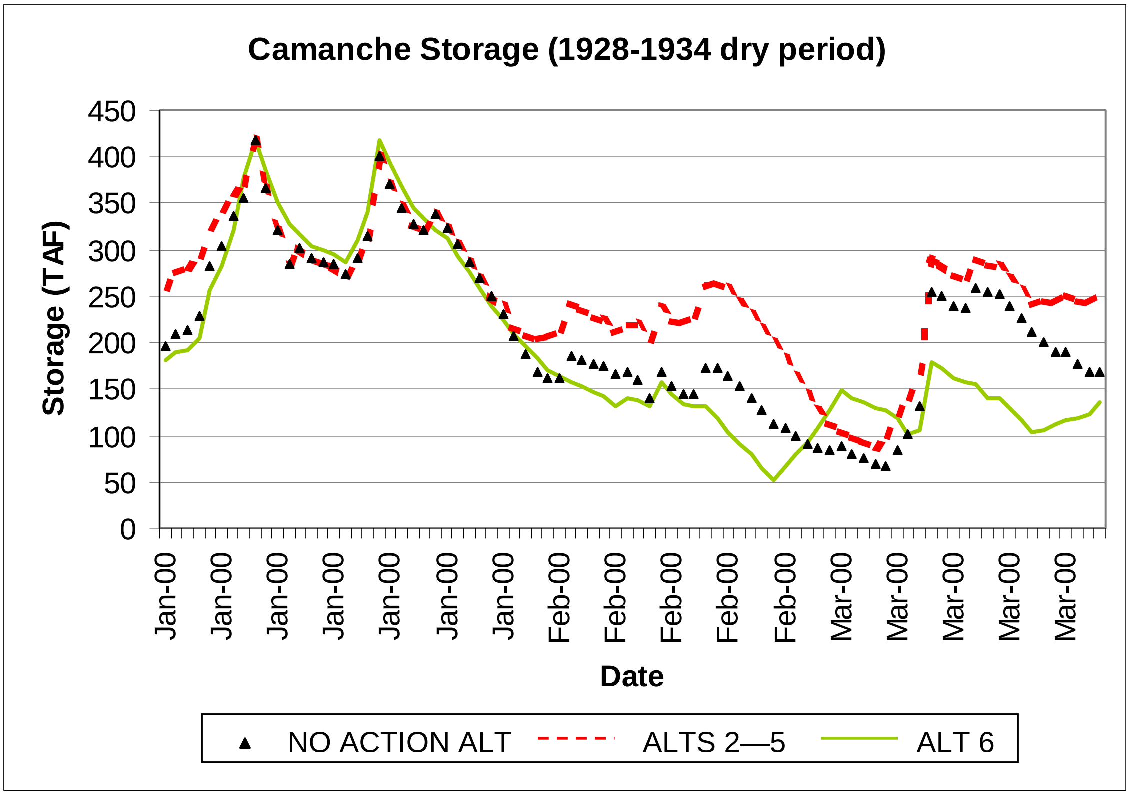


Figure 3-14.
Time Series of Pardee Reservoir Storage



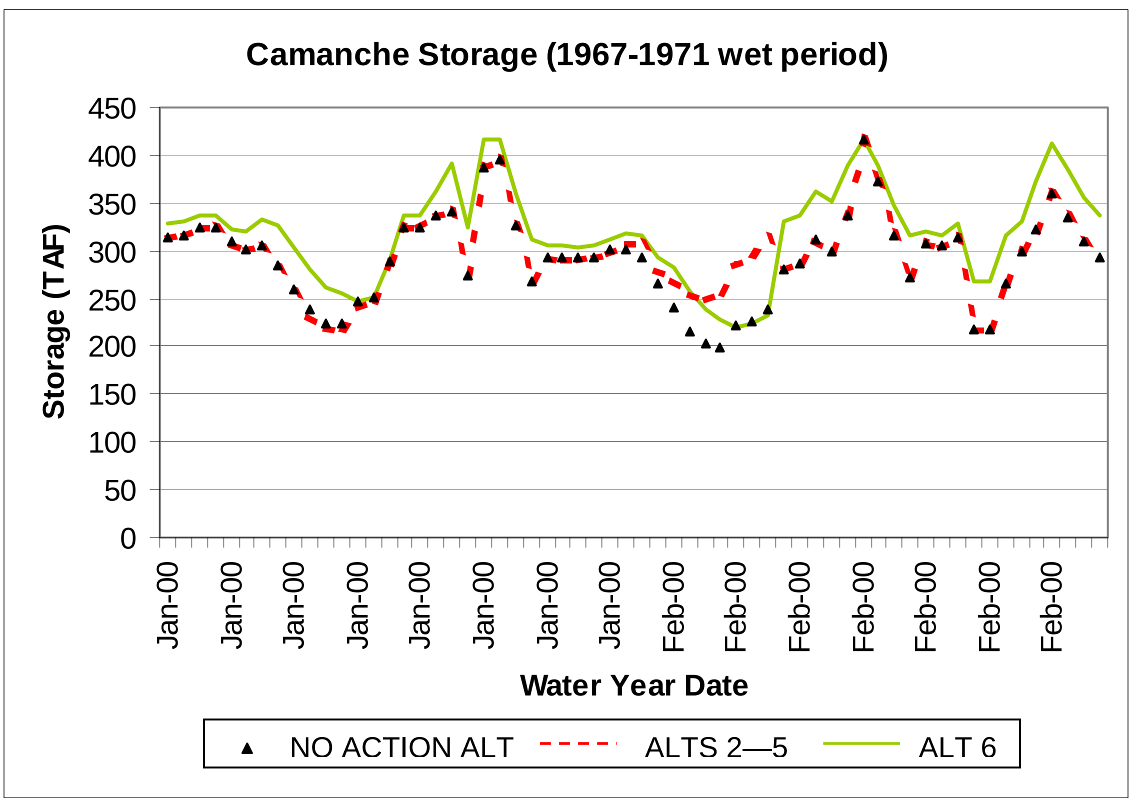
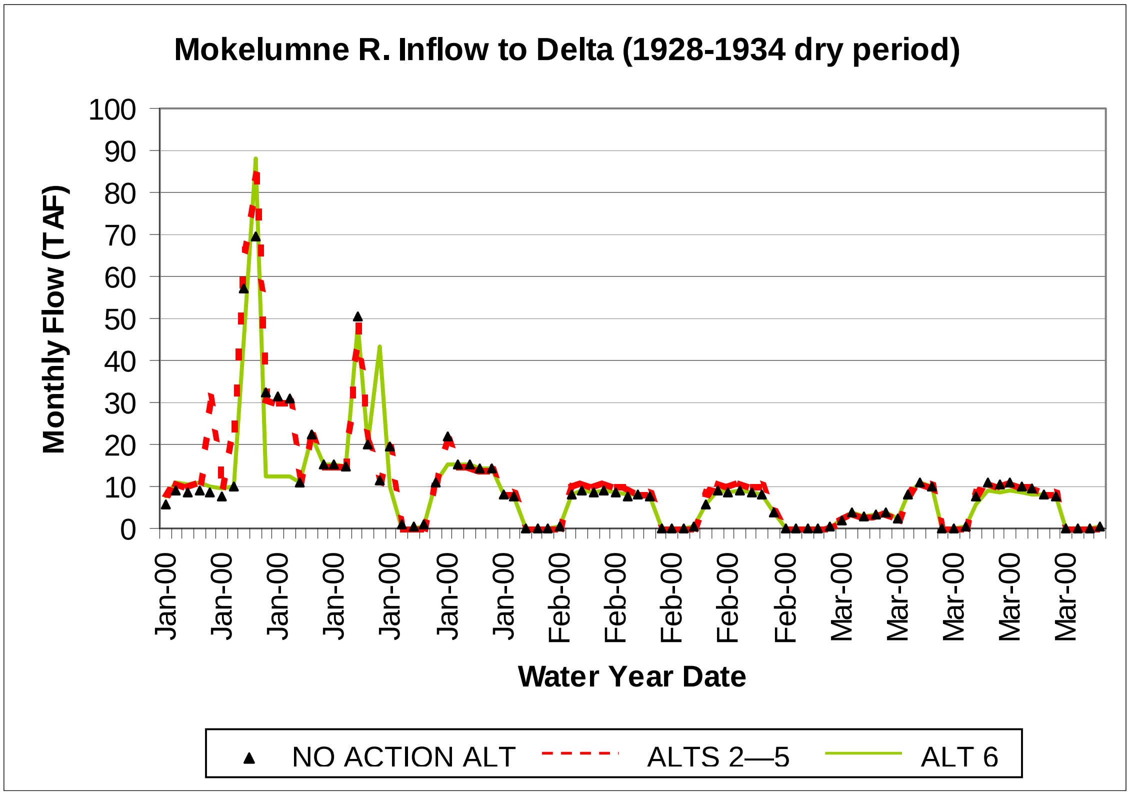


Figure 3-15.
Time Series of Camanche Reservoir Storage



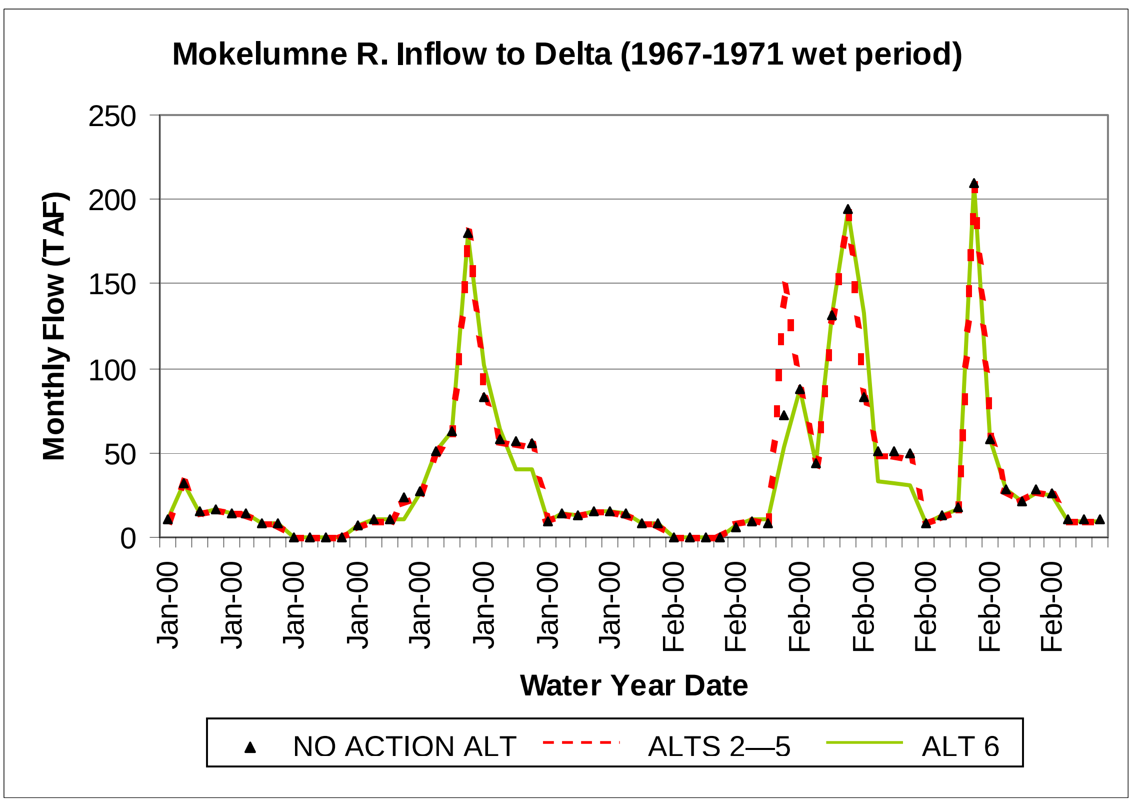


Figure 3-16.
Time Series of Mokelumne River Inflow to the Delta

Modeling Results for Hydropower Resources and Energy Production

Impact 3-9: Hydropower and Energy Production

A summary of the annual energy generated at CVP facilities under Alternative 1 and changes induced under each alternative are shown in Table 3-2. Overall, energy production at CVP facilities would be reduced a very small amount under future the project alternatives as compared to the No Action Alternative (existing conditions). Power generation corresponds to revised release patterns that provide for operation of the FRWP alternatives. Compared to Alternative 1, energy production under Alternatives 2–5 and Alternative 6 would be reduced by 2 GWh (0.04%) and 0 GWh, respectively.

Table 3-2. Comparison of Annual Power Generation for Each Alternative

Alternative	Annual Power Generated (GWh [a]) CVP North Facilities
Alternative 1 (no action/existing conditions)	4,918
Alternatives 2–5 minus Alternative 1	-2
Alternative 6 minus Alternative 1	-0
Future no action	4,704
Alternatives 2–5 cumulative minus future no action	-2
Alternative 6 cumulative minus future no action	-0

[a] 1 GWh is equivalent to 1,000 MW hours.

Under cumulative conditions, average annual power generation would be reduced by approximately 214 GWh without implementation of any of the FRWP alternatives. Similar to current conditions, implementation of the FRWP alternatives would reduce CVP power generation by 2 GWh (0.04%) and 0 GWh, respectively. These reductions are exceedingly small under both existing and cumulative conditions. These impacts are less than significant.

Cumulative Impacts

Methods and Assumptions

Methods and assumptions for the cumulative effects analysis are essentially identical to those described for the project alternatives analysis.

Modeling Procedures and Assumptions

CALSIM II was also used to assess the potential cumulative effects of the project alternatives when reviewed together with past, present, and reasonably foreseeable future actions. For purposes of this analysis, cumulative future conditions are composed of projected hydrology, water supply, and power supply conditions as represented by the CALSIM II 2020 benchmark study (modified to remove the demands for SCWA that are assumed to be met in that benchmark study; This case also represents a likely "future no-action" condition), with the project alternatives then added to the modified CALSIM II 2020 benchmark study. This CALSIM II analysis is then compared to existing conditions, as represented by the CALSIM II 2001 benchmark study. To determine the potential incremental contribution of the project alternatives to any potential cumulative effects, the results are also compared to the modified 2020 CALSIM II benchmark study (future no action). Although the results of the modeling are complex, this comparison provides insight into the potential contribution of the alternative to any cumulative impacts.

Hydrologic Modeling Results

Cumulative Conditions

Table 3-3 shows summary statistics for CALSIM and EBMUDSIM results for cumulative conditions with Alternatives 2–5, including changes in reservoir storage, river flows, and deliveries for the dry (1928–1934) hydrologic period, and the average of all 74 water years. As described above, the cumulative effects are represented by the difference between 2020 conditions with the project alternatives and the 2001 no-action conditions. The incremental changes potentially attributable to the project alternatives are represented by the difference between the simulated 2020 conditions with the project alternatives and the 2020 no-action conditions. The data indicate that under 2020 no-action conditions, SWP and CVP systemwide north-of-Delta and south-of-Delta water demands and associated deliveries will increase substantially. Increased south-of-Delta deliveries would occur through additional Delta exports and additional reliance on storage reserves in San Luis Reservoir. Increased water demands and deliveries are reflected in reduced carryover storage in northern California reservoirs and reduced Delta outflow. Changes in Pardee Reservoir carryover storage are small under no-action conditions; however, increased demand in the lower basin results in substantial reduction in Mokelumne River inflow to the Delta.

The increments of change between 2001 and 2020 cumulative conditions that are attributable to Alternatives 2–5 relative to the total change varies from locations to location and are generally small (Table 3-3). The project-related contribution is uniformly small compared to the cumulative change at all locations. In some cases, such as Trinity Reservoir, the project-related contribution to the average change for the 1928–1934 period comprises all of the observed cumulative

Table 3-3. Summary Statistics of CALSIM and EBMUDSIM Hydrologic Modeling Parameters for Alternatives 2–5 at a 2020 Level of Development

Location/Resource	Year Type [a]	No Action (2001) [b]	2020 Alternatives 2–5 [b]	2020 No Project [b]	2020 Change	2020 Change (%)
Trinity Reservoir Storage (TAF) [c]	Dry	584	673	696	-23	-3.3
	Average	1318	1314	1318	-4	-0.3
Shasta Reservoir Storage (TAF) [c]	Dry	1512	1400	1438	-38	-2.6
	Average	2672	2568	2582	-15	-0.6
Oroville Reservoir Storage (TAF) [c]	Dry	1528	1502	1517	-15	-1.0
	Average	2113	2054	2066	-11	-0.5
Folsom Reservoir Storage (TAF) [c]	Dry	400	348	355	-7	-2.0
	Average	503	476	479	-3	-0.6
San Luis Reservoir Storage (TAF) [c]	Dry	603	606	609	-3	-0.5
	Average	573	554	558	-4	-0.7
Pardee Reservoir Storage (TAF) [c]	Dry	179	181	173	8	4.4
	Average	176	180	173	7	4.0
Camanche Reservoir Storage (TAF) [c]	Dry	174	212	157	55	35.0
	Average	221	232	211	21	10.0
Mokelumne Inflow to Delta (TAF)	Dry	86	86	83	4	4.9
	Average	284	284	270	15	5.5
Delta Outflow (TAF)	Dry	6611	6562	6563	-1	0.0
	Average	14473	14265	14291	-26	-0.3
Exports, Banks Pumping Plant (TAF)	Dry	1947	1964	1983	-16	-0.8
	Average	3170	3226	3229	-2	-0.1
Exports, Tracy Pumping Plant (TAF)	Dry	1636	1651	1665	-14	-0.8
	Average	2300	2260	2267	-7	-0.3

Location/Resource	Year Type [a]	No Action (2001) [b]	2020 Alternatives 2–5 [b]	2020 No Project [b]	2020 Change	2020 Change (%)
X2 Position (km)	Dry	81	81	81	0.0	0.0
	Average	76	76	76	0.0	0.1
CVP Deliveries North of Delta (TAF) [d]	Dry	1959	1984	1986	-2	-0.1
	Average	2210	2274	2274	0	0.0
CVP Deliveries South of Delta (TAF)	Dry	1668	1655	1672	-17	-1.0
	Average	2595	2520	2526	-6	-0.2
SWP Deliveries South of Delta (TAF)	Dry	2132	2120	2137	-17	-0.8
	Average	3213	3313	3319	-6	-0.2

[a] “Average” is the average value of 72-year simulation period (1922–1993). “Dry” is the average value of 1928–1934 dry period.

[b] Annual values are based on water years (October–September).

[c] End of September carry-over storage.

[d] Does not include American River Division and FRWP deliveries.

Table 3-4. Summary Statistics of CALSIM and EBMUDSIM Hydrologic Modeling Parameters for Alternatives 6 at a 2020 Level of Development

Location/Resource	Year Type [a]	No Action [b] (2001)	2020 Alternative 6 [b]	2020 No Project [b]	2020 Change	2020 Change (%)
Trinity Reservoir Storage (TAF)	Dry	584	692	696	-4	-0.6
	Average	1318	1316	1318	-2	-0.2
Shasta Reservoir Storage (TAF)	Dry	1512	1430	1438	-8	-0.6
	Average	2672	2578	2582	-5	-0.2
Oroville Reservoir Storage (TAF)	Dry	1528	1512	1517	-5	-0.3
	Average	2113	2053	2066	-13	-0.6
Folsom Reservoir Storage (TAF)	Dry	400	353	355	-2	-0.6
	Average	503	477	479	-2	-0.4
San Luis Reservoir Storage (TAF)	Dry	603	607	609	-2	-0.3
	Average	573	555	558	-3	-0.5
Pardee Reservoir Storage (TAF)	Dry	179	260	173	87	50.3
	Average	176	290	173	117	67.6
Camanche Reservoir Storage (TAF)	Dry	174	169	157	12	7.6
	Average	221	242	211	30	14.2
Mokelumne Inflow to Delta (TAF)	Dry	86	85	83	3	3.7
	Average	284	267	270	-8	-2.9
Delta Outflow (TAF)	Dry	6611	6547	6563	-16	-0.2
	Average	14473	14264	14291	-28	-0.2
Exports, Banks Pumping Plant (TAF) [c]	Dry	1947	1979	1983	-3	-0.2
	Average	3170	3230	3299	1	0.0
Exports, Tracy Pumping Plant (TAF)	Dry	1636	1659	1665	-6	-0.4
	Average	2300	2263	2267	-4	-0.2

Table 3-4. Continued

Location/Resource	Year Type [a]	No Action [b] (2001)	2020 Alternative 6 [b]	2020 No Project [b]	2020 Change	2020 Change (%)
X2 Position (km)	Dry	81	81	81	0.0	0.0
	Average	76	76	76	0.0	0.0
CVP Deliveries North of Delta (TAF) [d]	Dry	1959	1986	1986	0	0.0
	Average	2210	2275	2274	1	0.0
CVP Deliveries South of Delta (TAF)	Dry	1668	1665	1672	-7	-0.4
	Average	2595	2523	2526	-3	-0.1
SWP Deliveries South of Delta (TAF)	Dry	2132	2132	2137	-6	-0.3
	Average	3213	3214	3319	-5	-0.2

[a] "Average" is the average value of 72-year simulation period (1922–1993). "Dry" is the average value of 1928–1934 dry period.

[b] Annual values are based on water years (October–September).

[c] End of September carry-over storage.

[d] Does not include American River Division and FRWP deliveries.

change. The larger project-related incremental change occurs because there is no change between the 2001 no-action and 2020 no-action conditions under SWP and CVP operations. In other cases, such as Oroville Reservoir storage, the project-related increment during dry or wet hydrologic periods appears to be larger than the cumulative change simply because the conditions change between the 2001 no-action and 2020 no-action conditions. Project-related effects on Delta exports and CVP/SWP deliveries are relatively small. Project-related effects to cumulative changes in the Mokelumne River basin (i.e., Camanche Reservoir storage, lower Mokelumne River flow) are also negligible because EBMUD demands were simulated at 2020 conditions for both model scenarios. Consequently, cumulative changes observed are attributable solely to increase demands for other uses in the lower basin. These cumulative impacts are considered less than significant.

Table 3-4 shows similar summary statistics for cumulative conditions with Alternative 6 and the increment attributable to this alternative. With the enlarged Pardee Dam and reservoir, in combination with an intake facility at Freeport, similar cumulative changes are observed with reductions in northern California reservoir storage levels and Delta outflow, and increases in Delta exports and deliveries. The changes are slightly less than under cumulative conditions with Alternatives 2–5 because increased Pardee Reservoir water supply storage would be the primary source for EBMUD water supply needs. Camanche Reservoir carryover storage would be reduced considerably as a result of the combined effect of EBMUD deliveries from Pardee Reservoir and increased lower basin water supply demands. These cumulative impacts are considered less than significant.

The pattern of project-related contribution to cumulative changes is similar to that described for the cumulative conditions under the scenario for Alternatives 2–5. However, under this cumulative conditions scenario, there would be minor increased changes in the Mokelumne River system attributable to the project alternative. See Sections 3.5.3, 3.5.4, 3.5.5, 3.5.6, 3.5.7, and 3.5.8 of the Modeling Technical Appendix, Volume 3 of this EIR/EIS, for detailed information.

Chapter 4

Water Quality

Chapter 4
Water Quality

Affected Environment

Sacramento River and American River Basins

The upper regions of the Sacramento River and American River basins generally produce high-quality water suitable for all beneficial uses. Upper watershed source waters generally have excellent mineral and nutrient quality, with low total dissolved solids content. As water flows from the upper watersheds into the Central Valley, water quality typically changes as a result of water diversions and return water. Sources of degradation include waste discharges such as treated municipal wastewater treatment plant discharges, urban stormwater runoff, and irrigated agricultural return flows. Natural water quality changes also occur in the valley, such as temperature increases during warmer months, natural erosion, and suspended sediment transport of organic and mineral matter.

Table 4-1 shows average constituent concentrations for water quality data that have been collected from the Sacramento River at or near Freeport for several monitoring programs. Available information for FSC and the American River at Nimbus Dam is also shown to represent the quality of water in the FSC. The data generally indicate that the Sacramento River at Freeport has relatively low concentrations of most constituents compared to applicable regulatory criteria or guideline values. Most parameters do not exhibit strong seasonal or water year–type variation. Total inorganic ion content as reflected in total dissolved solids (TDS), electrical conductivity (EC), total hardness, pH, and total alkalinity values is low relative to applicable regulatory Basin Plan water quality objectives, drinking water standards, and recommended guidelines (see "Regulatory Setting" discussion below). Average TDS concentrations are well below the state secondary drinking water maximum contaminant level (MCL) of 500 mg/l. Average total hardness values are considered moderate for municipal and industrial uses. TDS and electrical conductivity (EC) data indicate slight differences within the winter and summer seasons of the year and between different water-year types, indicating that values are generally higher during lower flow periods than during high flow periods.

Nutrient data shown in Table 4-1 vary depending on the data source; two sets of data are shown to represent the range of conditions that have been observed.

Summary statistics from several monitoring programs indicate generally larger differences in dissolved inorganic nitrogen and dissolved/total phosphorus levels between the Sacramento River and American River compared to a recent set of synoptic sample data (i.e., samples collected on same day) collected for the U.S. Geological Survey (USGS) National Ambient Water Quality Assessment (NAWQA) Program (2001). However, the average nutrient concentrations from both data sets are sufficient to stimulate aquatic algae growth. Nitrate levels are well below the regulatory drinking water standard.

A review of the data sets shown in Table 4-1 indicate that concentrations of some parameters vary substantially during the year in regular seasonal patterns include temperature, which ranges from 52 to 76°F (10 to 22°C), and dissolved oxygen, which ranges between 10 mg/l in the winter and 8 mg/l in the summer. Total suspended sediment concentrations (TSS) can vary substantially in the river as a result of storm-induced transport of organic matter and eroded mineral soil particles. Monitoring for fecal coliform levels as an indicator for human health pathogens has shown sporadic high values typically associated with high flow events; however, the average concentration has remained well below previous Basin Plan criteria for contact recreation. The RWQCB recently adopted new water quality objectives for E. coli, and available concentration data from the Sacramento River and American River are also less than the new criteria.

Table 4-1. Summary of Water Quality in the Sacramento River, American River, and Folsom South Canal

		Existing Conditions *		
Constituent	Regulatory Objective	American River	Folsom South Canal **	Sacramento River
Temperature (ºC)	<2.6 ºC [a]	13 [1]	15.0 / 17.6 / 18.3	15 [1]
pH (std units)	6.5 to 8.5	7.2 [1]	7.7 / 7.8 / 7.9	7.6 [1]
Turbidity (NTU)	<1 NTU; <20% [b]	1.8 [1]	2.7 / 0.7 / 0.7	16 [1]
TSS (mg/l)	Narrative [c]	3.8 [1]	_ _	35 [1]
TDS (mg/l)	Narrative [c] 500 mg/l [d]	42 [1]	45 / 46 / 50	99 [1]
Hardness (mg/l $CaCO_3$)	N/A	_ _	20 / _ _ / 26	56 [1]
Chloride (mg/l)	250 mg/l [d]	1.6 [1]	1.6 / 1.7 / 1.7	6.0 [1]
Silica (mg/l SiO_2)	N/A	_ _	10.9 / _ _ / 9.7	18.8 [2]
TOC (mg/l)	2 mg/l [e]	1.8 [1]	1.5 / 1.9 / 3.0	2.5 [1]
Inorganic nitrogen [f] (mg/l N)	NO_3 < 10 mg/l [g]	0.14 [3]; 0.08 [4]	0.07 / 0.06 / 0.06	0.15 [3]; 0.18 [4]
Dissolved orthophosphorus (mg/l P)	N/A	<0.01 [3]; 0.027 [4]	0.019 / 0.014 / 0.014	0.022 [3]; 0.030 [4]
Total phosphorus (mg/l P)	N/A	0.03 [3]; 0.019 [4]	0.027 / 0.021 / 0.025	0.05 [3]; 0.061 [4]
E. coli (MPN/100mL)	126; 235 [h]	71 [1]	66 / 17 / 55	38 [1]
Fecal coliform (MPN/100mL)	200; 400 [h]	111 [1]	_ _	204 [1]
Total coliform (MPN/100mL)	N/A	342 [1]	511 / 316 / 406	1022 [1]

Constituent	Regulatory Objective	Existing Conditions *		
		American River	Folsom South Canal **	Sacramento River
Giardia, confirmed (cysts/L)				
Barium (: g/L)	100 [l]	19	16 ***	11
Copper (: g/L)	2.85 (CCC) [j]	0.57 / 0.83 [1, 5]	_ _	1.45 / 4.15 [1, 5]
Lead (: g/L)	0.54 (CCC) [j]	0.034 / 0.15 [1, 5]	_ _	0.07 / 0.64 [1, 5]
Mercury (: g/L)	0.050 [j]	0.00099 [1, 5]	_ _	0.00175 [1, 5]
Methylmercury (: g/L)	0.000050 [k]	0.000015 [1]	_ _	0.000043 [1]
Diazinon (: g/L)	0.050 [l]	0.090 [1]	_ _	0.140 [1]

Notes:

* All values reported as average concentrations.

** EBMUD data collected in Folsom South Canal during the period of July 1997–October 2001. Data reported for the 3 sample locations as “at Nimbus Dam / Grant Line Road / Terminus”.

*** Sacramento Municipal Utility District, Cosumnes Power Plant Application for Certification, September 13, 2001.

[1] Sacramento Coordinated Monitoring Program 2002: summary statistical data for Sacramento River at Freeport and lower American River at Nimbus for December 1992–June 2002.

[2] USGS internet available National Water Information System data for 1958-2001.

[3] USGS NAWQA Program (2003): synoptic data for Sacramento River at Freeport and lower American River for January 1996–April 1998.

[4] Merritt-Smith Consulting 2001: summary of USGS data from Sacramento River at Freeport for dry years only (1984, 1987–1992, and 1994); American River at Nimbus for July 1997–October 2001.

[5] Copper, lead, and methylmercury values shown as dissolved / total; mercury shown as total.

[a] Basin Plan Water Quality Objective—change resulting from controllable factor to be less than 2.6 ºC (5 ºF).

[b] Basin Plan Water Quality Objective—change resulting from controllable factor should be less than 1 nephelometric turbidity unit (NTU) for background less than 5 NTU; change less than 20% for background value between 5 and 50 NTU

[c] Basin Plan narrative water quality objective—water shall not contain constituent in concentrations that would cause a nuisance or adversely affect beneficial uses.

[d] Secondary drinking water MCL

[e] Total organic carbon (TOC) treatment threshold included in the Environmental Protection Agency, Safe Drinking Water Act, Stage 1 Disinfectants/Disinfection By-products Rule. For running annual average source water TOC ranges between 2.0 and 4.0 mg/l; removal of up to 35% of TOC (alkalinity dependent) may be required unless other specific quality conditions or treatment technology exists. For running average source water TOC greater than 4.0 mg/l, up to 45% removal may be required.

[f] Composed of dissolved ammonia, nitrate, and nitrite.

[g] Primary drinking water MCL

[h] Basin Plan water quality objective for *E. coli* in waters with contact recreation as (geometric mean concentration of at 5 samples per 30-day period / single sample value in 1 month). Basin Plan water quality objective for fecal coliforms in waters with contact recreation as (geometric mean concentration of at 5 samples per 30-day period / value not to be exceeded in more than 10% of

Constituent	Regulatory Objective	Existing Conditions * American River	Existing Conditions * Folsom South Canal **	Existing Conditions * Sacramento River

samples in any 30-day period).

[i] Basin Plan water quality objective for dissolved barium

[j] California Toxics Rule criteria: hardness dependent dissolved copper and lead continuous criteria concentration (CCC) for aquatic life protection. Total recoverable mercury human health criteria applicable to consumption of water and organisms.

[k] No federal or state regulatory water quality criteria exist. Sacramento River Watershed Program guidance level for dissolved methylmercury water quality objective.

[l] No federal or state regulatory water quality criteria exists. California Department of Fish and Game recommended guidance CCC value for aquatic life protection.

Table 4-1 also provides average concentration values for American River and Folsom South Canal data. EBMUD collected samples in the American River at Nimbus, at a mid-point location (Grant Line Road) in the FSC, and at the FSC terminus from July 1997 to October 2001. Mineral content concentrations in the American River are typically lower than those measured in the Sacramento River. Comparisons of synoptic data collected for the USGS NAWQA program between 1996 and 1998 indicated that TDS and hardness values in the American River are typically about 50% of the concurrent Sacramento River values. Average TSS values in the American River are also much less than corresponding measurements from the Sacramento River. Nitrogen and phosphorus concentrations are slightly less than in the Sacramento River.

The water quality in the FSC is generally similar to that in the lower American River; however, there are some changes in water quality that occur during the time that water is traveling within the FSC. EBMUD data indicate that water temperatures during the summer months typically increase by about 15°F (8°C) between Lake Natoma and the FSC terminus. Parameters that are influenced by algae growth within the canal also exhibit modest changes. Increases in pH, and reductions in nitrate, in the summer reflect the effect of nutrient uptake by algae for photosynthesis. Slight increases in total hardness, TDS, and total alkalinity indicate that elevated evaporation rates during the summer presumably contribute to evaporative concentration of dissolved minerals. Most parameters do not show large changes in concentration over the travel distance, particularly during winter months.

Within the project area near Sacramento, the lower American River (i.e., downstream of Nimbus Dam) is listed as impaired by group A pesticides (i.e., composed primarily of organochlorine pesticides), mercury, and unknown aquatic toxicity on the Environmental Protection Agency's (EPA's) Clean Water Act (CWA) Section 303 (d) list of impaired water bodies. The Sacramento River is listed as impaired for mercury, the pesticide diazinon, and unknown toxicity. Water quality monitoring of both the Sacramento River and American River watersheds has been ongoing in recent years as part of the Sacramento River

Watershed Program (SRWP) and the Sacramento Coordinated Monitoring Program (CMP). The SRWP monitoring program has been focused on identifying characteristics of toxic contaminant problems in Sacramento River and its tributaries from Sacramento to the upper watershed above Shasta Reservoir since 1998 (Sacramento River Watershed Program 2003). Annual wet weather and dry weather background monitoring of the American River and Sacramento River started in 1992 for the CMP and includes testing for heavy metals and conventional parameters (Larry Walker Associates 2001). Results indicate that water quality generally meets applicable ambient water quality standards for drinking water and aquatic life protection at all of the monitored sites. The USGS NAWQA monitoring program also collected monthly samples for a wide variety of conventional and toxic constituents in 1996 through 1998.

The monitoring programs for toxic constituents listed above represent the best available data for characterizing health and aquatic life risk factors of chemical constituents in the Sacramento River and American River basins. In general, water samples and organism tissue samples indicate that mercury deposited in streams from historical resource extraction and gold mining activity continues to be detected on a routine basis and is a primary constituent of concern. Methylmercury is detected less frequently; however, it is also of prime concern because it is much more toxic than the elemental form. The statistical summary of total mercury data collected from the different monitoring programs indicates that of approximately 160 samples collected in the Sacramento River near Freeport, the chemical is routinely detected but none of the samples have exceeded the regulatory California Toxics Rule (CTR) criteria of 0.05 µg/L. Total mercury is also routinely detected in the American River at Discovery Park near the confluence with the Sacramento River, and concentrations are generally less than comparable Sacramento River values.

A total of 22 and 19 samples have been evaluated for methylmercury in the Sacramento River and American River, respectively, for the CMP monitoring program, with average dissolved concentrations of 0.000043 : g/L and 0.000015 : g/L (Table 4-1). The SRWP monitoring program has been collecting total methylmercury data for the Sacramento River at Freeport since 1996 (65 samples) and dissolved fractions since 2000 (23 samples). The average dissolved and total concentrations are very similar to the CMP data. The RWQCB reported a median methylmercury concentration of 0.00012 : g/L among 27 samples collected during a limited time period (i.e., 1993–1994 and wet season of 1994–1995). Neither California nor the EPA has established regulatory criteria for dissolved or total methylmercury in water. SRWP in coordination with the Delta Tributaries Mercury Council (2002) recently prepared a review of available water criteria for mercury and methylmercury and identified a target level for dissolved methylmercury of 0.000050 : g/L as being protective of human health from fish consumption and bioaccumulation in aquatic life. SRWP data indicate average dissolved methylmercury concentrations in the Sacramento River and American River have been lower than the target level of 0.000050 : g/L. EPA is also currently considering a regulatory human health criterion based on the concentration of methylmercury in fish tissue that is consumed of 0.3 mg/kg (Environmental Protection Agency 2001). A fish tissue level of 1 mg/kg total mercury is the federal Food and Drug Administration action level at which fish consumption health advisories are typically issued. The California Office of Environmental Health and Hazard Assessment issues fish consumption advisories; a fish consumption advisory is currently in effect for mercury in the Delta. There is no comprehensive assessment available for methylmercury levels in the tissues of fish from either the American River or the Sacramento River watershed. SRWP fish tissue data for total mercury collected since 1998 indicate that largemouth bass exhibit the highest average concentration at 0.69 mg/mg; the peak value of 1.14 mg/kg was detected in a fish from the Feather River.

Chlorpyrifos and diazinon are primary pesticides of concern in the area in urban stormwater. These pesticides are being phased out for some uses, but are still widely available. Chlorpyrifos has not been detected in CMP samples from the Sacramento River and American River. Of about 60 samples analyzed for diazinon in each river, the detections of the pesticide in samples have been too infrequent to calculate a mean concentration. DFG has established a recommended chronic (4-day average) criteria guidance value of 0.05 : g/L. The maximum concentrations in the Sacramento River (0.105 : g/L) and American River (0.09 : g/L) are both higher than the DFG-recommended acute (1-hour) criteria of 0.08 : g/L.

The Sacramento River in the project area receives inputs of wastes from a variety of point and nonpoint sources. A number of large stormwater pump stations that collect urban runoff from the Sacramento metropolitan area discharge to the river upstream of the proposed Freeport intake facility. Urban runoff from the Sacramento area, and associated discharges from these stormwater pump stations, typically occurs in intermittent and infrequent intervals over several hours or days. Initial stormwater runoff events during the fall and early winter can contain greater loading of contaminants than storms in late winter or spring as a result of contaminant accumulation on soil and impervious surfaces during the summer. However, stormwater discharge events are also highly diluted because background receiving water streamflow is also typically large during the storm events.

The SRCSD operates the SRWWTP, which is located about 1 mile downstream of the proposed location for the Freeport intake facility and is the nearest major point source discharge of contaminants to the Sacramento River. The SRWWTP has a daily average dry-weather effluent discharge of about 154 MGD and a design capacity of 180 MGD. The City of West Sacramento wastewater treatment plant discharge is located farther downstream of the SRWWTP discharge.

Mokelumne River Basin, Pardee and Camanche Reservoirs, and East Bay Terminal Storage Reservoirs

Source waters from the Sierra Nevada to the upper Mokelumne River basin provide excellent water quality, and the river provides water that is suitable for all of the designated beneficial uses identified in the basin plan. Body contact recreation is not allowed in Pardee Reservoir to reduce potential drinking water contamination; body contact recreation is allowed in Camanche Reservoir. Factors influencing water quality in the lower Mokelumne River historically included acid mine drainage from the Penn Mine, which lies within the Camanche Reservoir watershed and water temperature increases during low flows. Penn Mine was historically a source of trace metal contaminant transport to Camanche Reservoir via runoff from the mine site to several stream channels and waste disposal activities that had occurred near the reservoir shoreline. EBMUD conducted an extensive cleanup process for the mine site that was completed in 2000 involving waste removal, disposal, stabilization, and site restoration. Ongoing post-restoration activities include surface and groundwater quality monitoring and routine and emergency operations and maintenance of the restoration features. EBMUD operates a hypolimnetic oxygenation system in Camanche Reservoir to maintain acceptable dissolved oxygen (DO) levels in the bottom water. Prior to installation of the oxygenation system, the quality of water released from Camanche Reservoir was periodically impaired by elevated levels of toxic hydrogen sulfide resulting from low DO levels.

Typically, the temperature of water released from Camanche Reservoir during the winter months is about 50°F. Temperatures gradually increase through the spring and summer months and reach a maximum of about 60°F at the end of September. Release temperatures have been higher when Camanche Reservoir storage levels were low during dry water year types. Summer water temperature patterns downstream of Camanche Dam are influenced by direct solar radiation and air temperatures. Temperatures downstream of the Woodbridge Dam are generally 10°F to 15°F higher than Camanche Reservoir release temperatures.

Terminal storage reservoirs in the EBMUD service area generally have good water quality for beneficial uses. EBMUD has been evaluating recent increases in taste and odor events in source water from its terminal reservoirs that are caused by specific types of algae and potentially from fungus-like organisms. The prediction of taste and odor problems is difficult, and they can be related to physical and chemical (e.g., nutrient) cycles in the reservoirs, inflow water quality, and weather patterns. Some taste and odor problems are also difficult to effectively reduce with treatment.

Sacramento–San Joaquin Delta

Water quality in the Delta is controlled by complex circulation patterns that are affected by inflows, pumping for Delta agricultural operations and exports, operation of flow control structures, and tidal action. Over the long-term average of hydrological conditions, approximately 30% of Delta inflows is used for CVP and SWP exports, 10% is used locally, 20% is required for salinity control, and the remaining 40% is Delta outflow that results largely from winter precipitation and runoff. The SWP and CVP export pumping plants exert a considerable influence on water circulation in the Delta by creating a net flow of water from northern regions of the Delta southward through Old River and Middle River.

The Delta waterways within the Central Valley RWQCB are listed as impaired for dissolved oxygen, electrical conductivity, mercury, Group A pesticides, organophosphorus pesticides of diazinon and chlorpyrifos, and unknown toxicity. The western Delta under jurisdiction of the San Francisco Bay RWQCB is listed as impaired on EPA's 303(d) list for copper, mercury, nickel, selenium, dibenzo dioxin compounds, dibenzo furan compounds, polychlorinated biphenyl compounds (PCBs), Group A pesticides, diazinon, and unknown toxicity. Constituents of concern in the Delta include potentially harmful disinfection by-products (DBPs) that can be formed during certain disinfection treatment processes used for drinking water. Bromate and trihalomethane (THM) compounds and their precursors (dissolved organic carbon and bromide) are of the greatest concern for DBP formation. High-salinity water from Suisun Bay intrudes into the Delta during periods of low Delta outflow and can adversely affect agricultural and municipal uses. Salinity standards at the Contra Costa Canal intake (municipal objective) and at Jersey Point (agricultural objective) on the San Joaquin River are often controlling variables that determine required releases by upstream SWP and CVP reservoirs to maintain adequate Delta outflow. Agricultural drainage in the Delta contains high levels of nutrients, suspended solids, organic carbon, minerals (salinity), and trace chemicals such as the organophosphate, carbamate, and organochlorine pesticides. Synthetic organic chemicals, particularly the chlorinated pesticides, and heavy metals (e.g., mercury) accumulate in Delta fish in quantities that occasionally exceed acceptable standards for human consumption (San Francisco Bay-Delta Aquatic Habitat Institute 1991).

Table 4-2 provides summary information on average concentrations for several water constituents of concern to users of Delta water supplies for municipal drinking water. Salinity input from tidal exchange of seawater is the major source of TDS and chloride in the Delta. Incremental addition of salts from the extensive irrigated agricultural areas of the San Joaquin Valley result in typically elevated TDS concentrations in the San Joaquin River. Other sources of salts include municipal wastewater treatment plant discharges and urban stormwater runoff. As a common constituent in seawater, bromide is present in the Delta primarily from tidal exchange and is therefore typically at higher concentrations in the western Delta. However, other sources may include groundwater, agricultural drainage, and contaminants such as methyl bromide. Dissolved organic carbon is a byproduct of decaying vegetation and is present in Delta inflows and agricultural drainage from the predominantly peat soils of the Delta. Concentrations of DOC in the Delta follow a regular seasonal cycle with higher concentrations typically present during the higher winter flow period.

Table 4-2. Summary of Water Quality in the Delta

	Existing Conditions			
Location	TDS (mg/l)	Chloride (mg/l)	Bromide (mg/l)	DOC (mg/l)
Sacramento River at Greene's Landing	100	6.8	0.018	2.5
North Bay Aqueduct	192	26	0.015	5.3
Clifton Court Forebay	286	77	0.269	4.0
Tracy Pumping Plant	258	81	0.269	3.7
San Joaquin R. at Vernalis	459	102	0.313	3.9
CCWD Intake at Rock Slough	305	109	0.455	3.4

DOC = dissolved organic carbon
CCWD = Contra Costa Water District
Source: CALFED Final Programmatic EIS/EIR – July 2000.

Regulatory Setting

The beneficial uses and water quality objectives for waters within the Sacramento River and Mokelumne River basins are established in the Water Quality Control Plan (Basin Plan) for the Central Valley RWQCB. Water quality objectives are designed to protect beneficial uses such as agricultural, municipal, and industrial supply; fish and wildlife; and body contact and noncontact recreation. The Basin Plan contains numerical and narrative water quality objectives for physical and chemical parameters. The CTR also governs water quality criteria for about 130 priority pollutant trace metals and organic compounds. The CTR criteria establish numerical criteria for aquatic life and human health protection. Water quality standards for the Delta are established in the 1995 Water Quality Control Plan. The Delta water quality standards were established primarily to regulate the effects of Delta chloride and salinity conditions for aquatic life protection and municipal water supply deliveries.

The Safe Drinking Water Act and associated amendments serve to control water quality constituent concentrations of treated water that is delivered to users of municipal drinking water supply systems. The California Department of Health Services has primary administrative authority for developing drinking water standards for human health protection. Primary and secondary MCLs are established for numerous constituents of concern including turbidity, TDS, chloride and fluoride, nitrate, priority pollutant metals and organic compounds, selenium, bromate, trihalomethane precursors, radioactive compounds, and gross radioactivity. The Stage 1 Surface Disinfectants and Disinfection By-products

Rule serves to regulate municipal drinking water treatment requirements based on constituent concentrations in source water.

The RWQCB regulates potential waste discharges primarily through the issuance of permits for programs under their jurisdiction. The RWQCB has authority to issue Waste Discharge Requirements (WDRs) for municipal and industrial wastewater and stormwater discharges associated with the Basin Plan regulations policies and federal permitting programs. The RWQCB also administers the federal NPDES permits and Section 401 water quality certification programs pursuant to the federal CWA. General NPDES stormwater permits are required for certain industrial activities, construction activities, and so-called low threat discharges, including construction site dewatering, pump testing, and pipeline testing activities. NPDES permits require preparation of a SWPPP that identifies BMPs to be employed to prevent discharges of pollutants such as eroded soil, petroleum-based fuels and oils, and other hazardous materials that could contaminate nearby water resources and exceed the established water quality objectives. Activities that are performed under the U.S. Army Corps of Engineers jurisdiction for Section 404 of the CWA are an example of a federal action that requires a Section 401 water quality certification from the RWQCB. Construction activities within the bed or bank of a river or lake are permitted by the DFG under the Streambed Alteration Agreement program. Local grading and erosion control ordinances may also apply for components of projects that involve substantial soil disturbance.

Environmental Consequences

Methods and Assumptions

Each of the project alternatives under consideration could potentially result in both short-term water quality impacts related to construction activities, and long-term water quality changes related to potential changes in CVP and SWP operations. The type and magnitude of these potential water quality impacts were evaluated both qualitatively and quantitatively. FRWA has used the best available technology to extensively model hydrologic and water quality conditions. This section includes a summary of the water quality modeling and related assumptions used for the analysis. There are a number of constituents of interest in the lower Sacramento River and Delta. The analysis in this EIR/EIS focuses on salinity as a representative parameter to quantify changes in water quality. This focus is appropriate because change in salinity resulting from seawater intrusion is the major variable that has the potential to be affected by the implementation of the FRWP alternatives. Detailed information on modeling methods and results are included in Section 4 of the Modeling Technical Appendix, Volume 3 of this EIR/EIS.

Water quality modeling data served as the primary assessment tool for the evaluation of potential project-related water quality impacts. Potential impacts on salinity conditions in the Delta were evaluated with three numerical hydrodynamic models of the Delta; the Fischer Delta Model (FDM), the Delta Simulation Model (DSM2), and a regression relationship known as the G-model. Data input for the FDM and DSM2 models used monthly average hydrologic variables simulated with the DWR/Reclamation water supply operations model, CALSIM II. The G-model estimated salinity at a few Delta locations based on CALSIM II-simulated monthly average Delta outflow. EBMUD's water supply operations model (EBMUDSIM) was used to simulate water supply operations in the Mokelumne River basin and provide additional inputs for the CALSIM II model. A detailed discussion of how the CALSIM II and EBMUDSIM hydrologic data were used to support the evaluations is included in the "Methods and Assumptions" section of Chapter 3, "Hydrology, Water Supply, and Power."

Water Quality Modeling Methods

Operations for Alternatives 2–5 or constructing a new Pardee Dam and enlarging Pardee Reservoir in combination with an intake facility at Freeport and pipeline to the Zone 40 Surface WTP (Alternative 6) were evaluated to determine whether these alternatives may cause changes in Delta inflows and whether such changes could cause a corresponding change in Delta salinity at various locations within the Delta. Salinity is of particular concern at municipal and industrial (M&I) intake facility locations (i.e., CCWD Rock Slough, Old River pumping plants, and the SWP Banks and CVP Tracy pumping plants).

Results of the three modeling methods described above were evaluated to thoroughly evaluate the potential changes in Delta salinity conditions caused by the FRWP alternatives. River flow results from the CALSIM II studies were used to simulate water quality within the Sacramento/San Joaquin Delta using the FDM. DSM2 and the G model were used to confirm the FDM modeling results. Regulatory water quality objectives established in the SWRCB 1995 Water Quality Control Plan for the Delta were used as a guide to evaluate relative effects of modeled water quality changes that may be related to project-related water deliveries. The potential water quality impacts were also evaluated using summary statistical analyses of the seasonality, magnitude, range, and standard deviation of predicted changes. The applicable standards include chloride concentration limits at M&I intake facility locations and salinity objectives for agriculture at Jersey Point (San Joaquin River) and Emmaton (Sacramento River). In addition, salinity in the western Delta area is presented because it gives the most direct estimate of potential seawater intrusion resulting from simulated changes in hydrologic conditions that might result under the project alternatives. Existing no project conditions and project-related effects on chloride concentrations were evaluated for the entrance of Rock Slough representative of CCWD intake conditions, Old River at Highway 4 near CCWD's intake for Los Vaqueros Reservoir, West Canal near Clifton Court Forebay, and DMC at the CVP Tracy Pumping Plant.

The FDM and DSM2 models are tidal hydraulic and salinity models of the Delta channels that simulate tidal flows and mixing and the corresponding salinity (i.e., evaluated with simulated EC or chloride concentrations) throughout the Delta.

The models have been extensively calibrated by DWR, Reclamation, Flow Science Inc., and CCWD. These models have been used to evaluate the changes in salinity that might result from changes in Delta inflow, outflow, and Delta water supply export operations. The models use the monthly inflows, exports, and net Delta diversions that have been simulated with the CALSIM II model for each alternative. Model input also includes estimates of agricultural drainage volumes and salinity, as well as the Sacramento River and San Joaquin River inflow salinity values. The differences in the monthly average salinity estimates between the project alternatives and the no-action conditions are used as a measure of the likely change in salinity caused by each project alternative.

The G-model, developed by CCWD, estimates salinity in Rock Slough and a few other locations on the Sacramento River and the San Joaquin River. The G-model calculations were applied to the sequence of CALSIM II-simulated monthly average Delta outflow values for each project alternative. Weighted time-average G-model output for Jersey Point salinity is used to estimate chloride concentrations at Rock Slough. Results from all three models (FDM, DSM2, and G-Model) are presented in detail in Section 4 of the Modeling Technical Appendix, Volume 3 of this EIR/EIS.

Interpretation of Graphs

This chapter contains a series of graphs that are used to help explain the modeling results in terms of chloride concentrations at various locations. This section explains how to interpret these specific graphs.

In each graph (e.g., Figure 4-1), the action alternatives are compared to the no action alternative in terms of both a ranked distribution and simulated absolute change. This dual comparison results in each graph showing two results, both relying on the same data but different axis.

To accomplish the ranked distribution, each data point (i.e., monthly chloride value) for the no action alternative is sorted from lowest to highest. Those data are then used to create a line that is measured against both the horizontal axis and the left (blue) vertical axis. A similar process is repeated for each alternative and each location except that the monthly values are matched (e.g., November 1974 under the no action alternative against November 1974 under Alternatives 2–5) and shown as blue "diamonds" on the graph. Each blue diamond represents a monthly chloride value. The left (blue) vertical axis provides a comparison of no action versus action alternative values. Where the blue diamond is above or below line created by the base condition values, it means that the model simulated different values for that particular month. The left axis is used to show the base value, the alternative value, and the difference between the two values.

These graphs also contain plots of just those months with changes in chloride values with an expanded scale to show more clearly the absolute differences between the no action alternative and the action alternatives. The changes are shown as red squares and are measured against the right (red) vertical axis. The no-action alternative is represented as the “0.0” line, and each month under the action alternative is measured against the identical month under the no action alternative. The right axis shows the change from the no action alternative and the horizontal axis shows the simulated chloride concentration of the no action alternative.

Significance Criteria

The primary potential water quality issues of the proposed project include temporary construction-related discharges of contaminants from general construction practices and instream disturbances; changes to the temperature of Pardee and Camanche Reservoir releases; changes in receiving waters, including the FSC and EBMUD’s terminal reservoirs; and changes in ambient water quality variables in the Sacramento River and Delta.

Numerous environmental documents have been published over the past 10 years that have addressed potential impacts on water quality in Central Valley rivers and the Delta. Each document used a different significance threshold to evaluate water quality impacts. A review of significance criteria used in those previous documents was undertaken to determine appropriate significance thresholds for this EIR/EIS. Examples of the documents reviewed include, among others:

- Programmatic EIS for the Central Valley Project Improvement Act,
- Programmatic EIS for the CALFED Bay-Delta Program,
- Los Vaqueros Reservoir EIR/EIS,
- Delta Wetlands EIR/EIS, and
- Trinity River Mainstream Fisheries Restoration Program EIS.

During the scoping process for this EIR/EIS, comments were received suggesting that the EIR/EIS use water quality analysis methods and significance thresholds similar to those used in CCWD’s Los Vaqueros Reservoir Project EIR/EIS. FRWA reviewed the significance thresholds and methods in all of these reports, and based on the potential impacts of the FRWP alternatives analyzed in this EIR/EIS, the following significance criteria were determined to be appropriate thresholds for this analysis.

An alternative may result in a significant impact if it would result in the following:

- beneficial uses of water are substantially adversely affected,
- existing adopted water quality standards are exceeded,
- a substantive undesirable effect on public health or environmental receptors is produced.

Less-than-Significant Impacts

Alternative 1

Under the no-action scenario, there would be no project implemented, and water quality conditions would not change.

Alternatives 2–5

Alternatives 2 through 5 differ only in the pipeline alignments from the Freeport intake facility to the FSC. Project construction and operation for Alternatives 2 through 5 are very similar. Impacts related to water quality for each alternative differ only slightly from each other; therefore, the results for Alternatives 2 through 5 are presented together but are representative of each individual alternative, unless otherwise noted.

Impact 4-1: Potential Contaminant Discharges during Construction

Extensive construction activities will be required to construct the Freeport intake facility in the Sacramento River and install buried pipelines extending from the intake facility to the Zone 40 Surface WTP and FSC and from the FSC to the Mokelumne Aqueducts. The construction activities have the potential for short-term water quality impacts from exposure to winter storms and potential stormwater runoff. Potential temporary construction-related water quality impact mechanisms include in-water work conducted at any time of the year that may consist of cofferdam and sheet pile installation, sediment removal or disturbance, facility construction with concrete and other materials potentially hazardous to aquatic habitats, channel and bank vegetation removal, and stream crossings. Construction-related water quality impacts could also occur as a result of construction site exposure to stormwater during the winter rainfall and runoff season. Activities that could be sources of contaminants for stormwater runoff include vegetation clearing and grubbing operations, grading and excavation, facility construction, trench excavation, cut and fills, and stockpiling of spoils. Large construction sites typically contain substances such as fuels and oils, concrete, and other materials potentially harmful to streams and wetlands if released to the environment. Trench construction in some areas with shallow perched groundwater may require trench dewatering and surface discharge operations. Construction would last for up to 4 years, and disturbed construction areas would be exposed to storms that could transport materials. As described in Chapter 2, “Project Description—Environmental Commitments,” FRWA and its contractors would obtain all required local permits, clearances, and NPDES permits or other WDRs from the RWQCB and implement appropriate BMPs to protect water resources from contamination. This impact is less than significant because potential discharges of contaminants would be minimized to the extent possible through the implementation of approved standard use of BMPs required for compliance with NPDES permits that would minimize potential on-site and off-site contaminant transport to surface water and groundwater resources. Therefore, beneficial uses of water would not be adversely affected, existing adopted water quality standards would not be exceeded, and no substantive effect on public health or environmental receptors would be produced. No mitigation is required.

Impact 4-2: Operational Effects during Reverse Flow in the Sacramento River

The Sacramento River flow rate is influenced by tides up to approximately the confluence with the American River. This influence is greatest during the dry summer season when background Sacramento River streamflow is low. Hydrologic conditions during the peak of a higher high tide in combination with background daily average Sacramento River streamflow rates of less than about 10,000 cfs can result in reverse flow events in the river that may result in diluted discharges from the SRWWTP traveling upstream, possibly as far as the intake facility. Operating the intake facility when the background Sacramento River flows are extremely low could very slightly reduce the amount of dilution water available to the SRWWTP for compliance with their NPDES effluent discharge limits. The SRWWTP must cease effluent discharges and store the effluent on site when there is less than a 14:1 available dilution ratio. The peak project-related diversion rate of 185 MGD, which occurs infrequently, is equivalent to 286 cfs. Given an average dry-weather effluent discharge rate of 154 MGD from the SRWWTP outfall, instantaneous background river flows must be less than about 3,300 cfs for effluent storage to be required. This instantaneous flow rate can occur when average daily flows are higher (generally up to approximately 10,000 cfs) because of tidal influence. Continued FRWP diversions during such low flow conditions could increase the length of time that the SRWWTP would need to store effluent. Based on CALSIM II modeling (2001 LOD), operation of the FRWP will reduce flow in the Sacramento River immediately upstream of the SRWWTP outfall by 112 cfs on average. Average total project diversions are 121 cfs. During periods when the river flow is less than 10,000 cfs, when it is possible that reverse flows would occur, operation of the FRWP is expected to reduce river flow upstream of the outfall by 88 cfs. It is estimated that reducing river flow by this amount will extend by approximately 2 minutes the duration of the period when effluent discharge to the river must be suspended. Considering it takes approximately 20 minutes to close the valve on the outfall and another 20 minutes to open the valve, and that suspension of effluent diversions commonly occur for 1 to 3 hours, the potential effect of the FRWP is not significant.

In addition, when monthly average Sacramento River flow is less than about 7,000 cfs, which occurs very infrequently, tidally induced reverse flows can be large enough to result in the upstream reverse transport of treated SRWWTP wastewater effluent to beyond the Freeport intake facility. However, as discussed below, the intake facility will be operated to restrict diversions during these periods to avoid diversion of water that may contain treated wastewater from the SRWWTP discharge.

Modeling of two worst-case reverse flow conditions in the river (i.e., largest magnitude reverse flow condition, longest duration reverse flow condition) based on model data was conducted by Flow Science Inc. (2002) to evaluate the potential interaction of SRWWTP effluent discharge operations and FRWP diversions. The modeling results indicate that continuous FRWP diversion during these conditions could result in SRWWTP effluent being entrained in the FRWP diversions. The potential for FRWP diversions to contain highly diluted treated wastewater is mostly a concern over public perception regarding the quality of the water supply and is not considered an environmental impact because the maximum quantity potentially entrained by FRWP diversions under most likely conditions would be very small (less than 3%) and would occur for only the short period of a few hours (less than 4 hours) even if the intake were operated continuously during the most severe reverse flow events. Existing water diversions from the Delta used for municipal water supplies generally contain some fraction of treated wastewater from the many municipalities that utilize Delta and upstream receiving waters as a component of their wastewater treatment systems. Overall, low river flows combined with high tides that cause large reverse flows occur relatively infrequently based on historical streamflow patterns. Water quality changes during large magnitude reverse flow events would generally not be expected to change appreciably in either the FRWP diversions or the Sacramento River downstream of the SRWWTP because there would still be a large dilution capacity in the river.

The FRWP would also not adversely affect the ability of SRWWTP discharge operations to maintain compliance with their required 14:1 dilution ratio in the Sacramento River. As described in Chapter 2, under "Environmental Commitments," FRWA and the SRCSD, operator of the SRWWTP, would coordinate their operations with automated streamflow monitoring equipment. FRWP diversions would also be coordinated with the SRWWTP to not cause the utilization of effluent storage when it would otherwise not be necessary, or cause SRWWTP to exceed effluent storage capacity if it would otherwise have sufficient storage capacity. The intake facility would also generally not be operated during the few hours of the peak higher high-tide during extreme low-flow/high-tide events if there is potential to exacerbate water quality concerns associated with reverse flow conditions.

This impact is less than significant because potential project-related water quality effects on Sacramento River water quality changes are small and infrequent and FRWA operations would be coordinated with the SRWWTP operations. Therefore, beneficial uses of water would not be adversely affected, existing adopted water quality standards would not be exceeded, and no substantive effect on public health or environmental receptors would be produced. No mitigation is required.

Impact 4-3: Operational Water Quality Effects in Sacramento River downstream of Diversion

Under these alternatives, FRWA diversions from the Sacramento River could slightly affect water quality conditions in the Sacramento River downstream of the SRWWTP effluent discharge outfall as a result of two indirect influences. FRWA diversions would incrementally reduce the background streamflow in the Sacramento River and thereby reduce the quantity of dilution water in the river for assimilation of wastes associated with the SRWWTP effluent discharges and other downstream discharges. The combination of EBMUD and SCWA diversions would reduce flow in the Sacramento River up to the maximum peak rate of diversion (i.e., 185 MGD or 286 cfs). When only SCWA is operating the intake facility, Sacramento River flows would be reduced by up to a maximum of 85 MGD (66 cfs). These maximum diversion rates occur very infrequently and are worst-case events.

Less background streamflow in the Sacramento River will reduce the effective dilution for SRWWTP discharges and other downstream waste dischargers. The potential water quality changes in the Sacramento River resulting from reduced available dilution in the river are expected to be negligible because the rates of project-related diversions are small relative to background streamflow in the river. At most times of the year the peak diversion rate of 185 MGD (286 cfs) will constitute a small fraction of background river flow and only slightly reduce dilution of SRWWTP discharges under typical conditions. Average monthly streamflow over the entire 72-year CALSIM II simulated hydrology is lowest in October at about 12,000 cfs; the lowest single monthly average streamflow is about 6,200 cfs. Consequently, the combination of reduced background river flows and additional wastewater return flows could reduce the effective dilution ratio by about 2.3% under long-term average monthly river flow, and about 4.6% under the single lowest average monthly river flow.

A second indirect effect is the future production of additional wastewater return flows to the Sacramento River via the SRWWTP resulting from SCWA's diversion and distribution of water for new residential and commercial developments in central Sacramento County. The indirect water quality effects of increased municipal wastewater flows to the Sacramento River from central Sacramento County include increased quantities of typical contaminants associated with wastewater, including inorganic salts, nutrients (e.g., nitrogen and phosphorus), and trace inorganic and organic constituents. Assuming wastewater return flows are about 60% of domestic consumption, approximately 51 MGD (78 cfs) of increased SRWWTP discharges will be produced from project-related deliveries. The SRWWTP is currently permitted for a daily average dry-weather flow rate of 181 MGD, and the actual discharge averages 154 MGD. The SRCSD is currently preparing a Master Plan for SRWWTP expansion and facility upgrades that are needed to provide plant capacity for projected inflows through the year 2020 of about 218 MGD. Environmental compliance for the planned SRWWTP expansion was started in May 2002 with the formal CEQA scoping process; the draft EIR for the project is expected to be released in 2003.

The indirect water quality impacts associated with future increased SRWWTP effluent discharges resulting from SCWA deliveries of water to central Sacramento County are expected to be small, and SRWWTP operations will not be significantly affected. As noted above, SRWWTP discharges are curtailed when the background river flows provide less than a 14:1 dilution ratio and these operations would not change. Therefore, there would be no substantial difference in river water quality conditions during low-flow conditions because the 14:1 dilution ratio would be maintained. Future specific water quality conditions in the Sacramento River cannot be predicted; however, the quality of SRWWTP effluent discharges will not change substantially following construction of expanded treatment plant facilities. The SRCSD will continue to meet regulatory water quality objectives for its discharges.

As described above, maximum diversions under these alternatives would be a very small percentage of river flows even during low-flow events. Additionally, these maximum diversions during low flow events would occur very infrequently. Therefore, the slight reduction in river flows described above would not substantially alter water quality.

This impact is less than significant because beneficial uses of water would not be adversely affected, existing adopted water quality standards would not be exceeded, and no substantive effect on public health or environmental receptors would be produced. No mitigation is required.

Impact 4-4: Changes to Reservoir Temperature Patterns

Under these alternatives, supplemental water provided by the FRWP diversions will generally result in a lower frequency of extremely low Pardee Reservoir and Camanche Reservoir storage levels (refer to Chapter 3 for description of EBMUDSIM model results). Water depth is directly related to reservoir storage and reservoir temperature patterns are generally cooler when storage levels are maintained at higher levels into the late summer. Reservoirs tend to become thermally stratified during the summer whereby a relatively shallow surface water layer (i.e., upper 20 to 30 feet) becomes warmer and more buoyant from solar input than the cooler and denser water underneath. The density differences between the water layers are resistant to wind and wave mixing action, thereby limiting the amount of heat input to the lower layer. If reservoir storage levels are reduced to a point where the total depth becomes small relative to the thermal stratification, the lower layer can also become warmer. Temperatures of Camanche Reservoir release flows in particular historically have exhibited elevated temperatures when reservoir storage levels are very low, and cold water from Pardee Reservoir is not available to maintain the coldwater pool in Camanche Reservoir.

Under these alternatives, reservoir storage and associated water depth will be higher more frequently in both reservoirs. Consequently, Camanche Reservoir release temperatures are expected to improve because the frequency of these low storage conditions will decrease. In addition, simulated Camanche Reservoir storage levels during specific years of drought water year periods such as 1928-1934, 1976-1978, and 1989-1993 indicate that water depth would be substantially greater than no-action conditions and thereby have a positive effect on prolonging the ability to store cold water. Cooler release temperatures to the lower Mokelumne River from Camanche Dam is considered a beneficial effect of the project. No mitigation is required.

Impact 4-5: Increased Frequency or Duration of Taste and Odor Events from EBMUD Terminal Reservoirs

Conveyance of Sacramento River water to EBMUD terminal reservoirs via the Freeport intake facility has the potential to have elevated levels of TDS, total hardness, turbidity, pathogens, TOC, and biostimulatory nutrients compared to the water quality of EBMUD's existing deliveries from the Mokelumne River basin. Increased inorganic mineral content and nutrients could incrementally increase the frequency or duration of adverse taste and odor events in EBMUD terminal reservoirs. However, water diverted from the Sacramento River would be treated and disinfected before being added into the terminal reservoirs. This treatment would reduce the levels of potential contaminants such as turbidity, pathogens, and constituents that are associated with suspended particulate matter (i.e., organic matter, nutrients, trace metals and synthetic organic compounds).

Although it can generally be assumed that nutrient content in Sacramento River water is slightly higher than in the headwater areas of the Mokelumne River, it is difficult to predict what the numerical effect of the new water source would be on existing algae populations in the terminal reservoirs. The intermittent and supplemental water supply would result in temporary effects and therefore be considered minor relative to the normal range of water quality conditions within EBMUD's overall water supply sources. In addition, not all water delivered to the EBMUD service area would be stored in the terminal reservoirs. Upper San Leandro Reservoir and San Pablo Reservoir would be the primary storage reservoirs and water quality is already variable within these reservoirs. The terminal reservoirs would also not necessarily receive much of the Sacramento River water if demands were sufficient to deliver FRWP diversions via EBMUD's in-line treatment plants, which are supplied directly from the Mokelumne aqueducts. The potential water quality changes would generally depend on the existing water quality conditions occurring in the reservoirs and quality of FRWP diversions. FRWP diversions to Upper San Leandro Reservoir could generally improve late summer water quality conditions that are currently periodically reduced due to lack of supply and circulation.

This impact is considered less than significant because FRWP diversions would receive treatment to remove particulates prior to placement in the Mokelumne Aqueducts. Storage of FRWP water in EBMUD terminal reservoirs would be intermittent and only occur in the projected dry years, and deliveries of FRWP water may not be stored in terminal reservoirs if distributed immediately into EBMUD's service area. To the extent that there is any potential to reduce water quality, there are approved methods available to EBMUD for the control of algae and other organisms that produce the compounds that cause taste and odor problems in drinking water supplies. Some control of algae problems can be exerted through physical and management approaches, including selective watershed land use management techniques; control of nutrient-laden runoff within the reservoir's watershed; and physical manipulation of the reservoir through blending of different waters, artificial circulation, or aeration. In addition, the treatment plants fed from the terminal reservoirs have treatment processes (i.e., ozonation) to reduce taste and odor compounds. Because effective and environmentally safe methods of control are available for algae and taste and odor control, this impact is less than significant. Beneficial uses of water would not be adversely affected, existing adopted water quality standards would not be exceeded, and no substantive effect on public health or environmental receptors would be produced. No mitigation is required.

Impact 4-6: Changes to Folsom South Canal Water Quality

Project-related diversions of Sacramento River water for EBMUD will be delivered to the FSC approximately at its midpoint and conveyed about 15 miles to the terminus of the FSC and the new canal pumping facility. The water in the FSC from the discharge point to the terminus of the canal will thereby contain a blend of Sacramento River water and American River water. Currently, SMUD is the only consistent user of water from this portion of the FSC. SMUD uses FSC water primarily for dilution water at the Rancho Seco power plant. SMUD discharges the water to Clay Creek. Approximately 30% of the FSC water used by SMUD is diverted temporarily to Rancho Seco Reservoir during the day, and then withdrawn at night. SMUD has also proposed to construct the Cosumnes Power Plant that would require the additional use of FSC water for cooling. As described in the "Affected Environment" section, the concentrations of some physical and chemical constituents in Sacramento River water are generally higher than in American River water. Consequently, the quality of water delivered to SMUD when project-related deliveries to EBMUD are occurring will change. SMUD prepared a report that explored the possible FSC water quality changes produced by the FRWP and how any changes could affect existing operations and future operations when the Cosumnes Power Plant project is completed (MFG Inc. 2003).

The magnitude of changes that can reasonably be expected to occur based on available historical data is shown in Table 4-3. The predicted values are based on a mass balance assessment of the maximum EBMUD delivery rate and information provided from SMUD on current and projected uses during the peak use summer period. EBMUD's portion of the diversions at Freeport would occur at a maximum rate of 100 MGD; SMUD's current peak summer water use rate is about 13 MGD and would increase to about 19 MGD if the Cosumnes Power Plant is constructed. The blended water during peak summer conditions of FRWA diversions and SMUD use would consist of about 16% American River water and 84% Sacramento River water.

In general, the blended Sacramento River water and American River water will be very low in all constituents and not adversely affect existing beneficial uses or preclude the use of FSC water for any other designated Basin Plan beneficial uses. However, constituent concentrations in the FSC will increase, and transport of suspended sediment in the form of TSS and turbidity would likely increase. Fine sediment material would remain in suspension and be transported to downstream users (i.e., SMUD) and ultimately be discharged into Clay Creek. The fate and transport of suspended sediment conveyed from the point of diversion at the Sacramento River to the terminus of the FSC was modeled to estimated amounts and locations of sediment deposition (CH2M HILL 2002). The analysis indicates that a substantial portion (approximately 28%) of the suspended sediment diverted at the FRWA pumping facility will be immediately removed at the intake. Approximately 56% of the suspended sediment delivered to the FSC will settle to the bottom of the canal. Removal of suspended sediment at the Freeport intake facility and through settling in the FSC combined is approximately 67%. Accumulation estimates show that it would take approximately 25 years for sediment buildup to reach about 1 foot deep for the first mile of the canal and many more years for substantial quantities of sediment to settle out in the remainder of the canal.

Table 4-3. Existing and Projected Folsom South Canal Water Quality Conditions

		River Conditions		Projected FSC Conditions [1]	
Constituent	Regulatory Objective	American River/ Folsom South Canal	Sacramento River	Current Flows	Future Flows
TDS [3] (mg/l)	Narrative [b] 500 mg/l [d]	42	99	93	91
TSS (mg/l)	Narrative [b] 30 mg/l monthly average 45 mg/l weekly average 60 mg/l daily maximum [c]	1.5 [3]	93 [5]	28	27
Turbidity (NTU)	<20% increase in receiving water body [a]	0.7 [2]	16 [3]	4.3 [4]	4.1 [4]
Inorganic nitrogen [6, 7] (mg/l N)	NO3 < 10 mg/l [e]	0.08	0.18	0.17	0.16
Dissolved orthophosphorus [6] (mg/l P)	N/A	0.027	0.030	0.030	0.030
Total phosphorus [6] (mg/l P)	N/A	0.019	0.061	0.056	0.054

Notes:

1 Blended concentrations for all parameters except turbidity and TSS are based on full EBMUD delivery rate of 100 MGD in combination with current average January–November SMUD delivery rate of 12.3 MGD and future delivery of 17.1 MGD. Blended turbidity and TSS concentrations based on sediment transport analysis (CH2M HILL 2002) for March with EBMUD delivery rate of 100 MGD and SMUD current and future delivery rate of 11.8 MGD and 16.6 MGD, respectively.

2 EBMUD data prepared for SMUD (unpublished) for terminus of Folsom South Canal for July 1997–October 2001.

3 Sacramento Coordinated Monitoring Program 2002: synoptic data for Sacramento River at Freeport and lower American River at Nimbus for December 1992–June 2002.

4 Blended turbidity concentration in FSC based on suspended sediment fraction remaining after settling within the FSC based on CH2M HILL (2002) analysis. Turbidity reduced in equal proportion to the removal rate of settleable material; colloidal material assumed to not settle.

5 Source is CH2M HILL (2002); TSS value is median concentration in Sacramento River during March based on USGS data for 1973-2001.

6 Merritt-Smith Consulting 2001: summary of USGS data from Sacramento River at Freeport for dry years only (1984, 1987–1992, and 1994); American River at Nimbus for July 1997–October 2001.

7 Comprised of dissolved ammonia, nitrate, and nitrogen

a Basin Plan Water Quality Objective—change resulting from controllable factor should be less than 1 NTU for background less than 5 NTU; change less than 20% for background value between 5 and 50 NTU

b Basin Plan–water shall not contain constituent in concentrations that would cause nuisance or adversely affect beneficial uses.

c Existing permit limit included in SMUD's Waste Discharge Requirements issued by the RWQCB.

d Secondary drinking water MCL.

f Primary drinking water MCL.

Water quality delivered to other FSC water users and downstream receiving waters (i.e., Rancho Seco Reservoir and Clay Creek) will most likely change on a seasonal basis. Potential water quality changes in the FSC were estimated by calculating the blended average concentration of constituents that would result through a combination of the two water sources (i.e., American River and Sacramento River). Table 4-3 shows estimated seasonal changes for the major constituents of concern and applicable reference water quality criteria and existing NPDES permit conditions of SMUD's current operations for tritium dilution at the Rancho Seco facility. The data indicate that the blended water passing downstream in the FSC will have very good water quality. However, estimated FSC water quality conditions in March that are representative of typical EBMUD delivery and peak average TSS concentrations in the Sacramento River indicate that TSS would increase when blended. The blended TSS levels would not be expected to exceed SMUD's NPDES permit limit for under normal conditions because a large majority of sediment would settle within the forebay at the Freeport intake facility and within the FSC. Based on a large set of historical TSS data from the Sacramento River at Freeport, the 95% percentile concentrations representing fairly infrequent conditions would result in a blended TSS concentration in the FSC that would be less than SMUD's 30 mg/l limit specified in their NPDES permit. In addition, the blended TSS and turbidity concentrations in other months of a typical EBMUD delivery period would be much lower than the infrequent high streamflow and stormwater runoff periods because average concentrations of these parameters are low.

Nutrient levels are also higher in the Sacramento River and increased receiving water concentrations could occur on a seasonal basis. A preliminary analysis of potential effects of nutrients (Merritt-Smith Consulting 2002) indicated that the blend of water sources could increase attached algae growth within the FSC. However, the estimated nutrient changes are relatively small and are not expected to appreciably change conditions in Rancho Seco Reservoir or Clay Creek. There is also the possibility of intermittent increases in other constituents, such as trace metals, pesticides such as diazinon, and coliform bacteria. However, the magnitude of the changes would not exceed regulatory criteria and would not adversely affect beneficial uses.

In summary, the expected increases in turbidity and TSS, mineral content, nutrients, and other potential contaminants are not expected to adversely affect existing beneficial uses of the FSC or downstream receiving waters because Sacramento River water currently is of adequate quality for the beneficial uses of interest. In addition, the potential changes would be infrequent because EBMUD diversions were simulated to be required in only about 20% of the months over the entire 72-year CALSIM II record. Impacts to receiving waters would be expected to be minimal relative to existing beneficial uses because Clay Creek does not generally contain flow during the summer and recreation is the primary use at Rancho Seco Reservoir and would not be limited by the importation of Sacramento River water.

There is the potential for water quality changes in FSC to affect SMUD operations. SMUD has expressed concerns that FSC water would need to have additional treatment for use at the Cosumnes Power Plant to be suitable as process water for the existing project design. Potential operational changes that SMUD may encounter associated with these elements of future FSC water quality conditions (i.e., mineral content, sediment, algae growth) in their industrial processes or Rancho Seco Reservoir are considered to be economic effects rather than environmental impacts. SMUD also has indicated concern for future regulatory actions that may be associated with trace metals (particularly copper, mercury, and lead) and some organic compounds (e.g.; diazinon, polycyclic aromatic hydrocarbons). Elevated concentrations for these trace metal and organic constituents occur infrequently and concentrations are routinely below regulatory limits or guideline threshold criteria. Additionally, trace metal and organic compound transport is generally at least partially associated with suspended sediment transport. Much of the suspended sediment in water diverted at the intake facility will either be removed in the forebay or settle in the pipeline and FSC. Therefore, at least some reduction in these constituents can be expected and thereby lessen the potential effects during infrequent conditions when trace metals and organic compounds are elevated. This impact is less than significant because beneficial uses of water would not be adversely affected, existing adopted water quality standards would not be exceeded, and no substantive effect on public health or environmental receptors would be produced. No mitigation is necessary.

Impact 4-7: Operation Effects on Delta Water Quality

As shown in CALSIM II model results presented in Chapter 3, "Hydrology, Water Supply, and Power," water diverted at the intake facility would slightly reduce total average Delta outflow. However, there was no project-related change in the X2 position value (Table 3-1) that is a significant indicator of water quality in the western Delta. Changes in Delta hydrology result in changes in Delta salinity variables simulated with the DSM2, FDM, and G-model methods. Section 4.4 of the Modeling Technical Appendix (Volume 3) contains detailed results of the water quality modeling. Results from the different models examined are similar and are consistent with each other. Table 4-4 shows summary statistics for changes in chloride based on the FDM results at several key locations in the western Delta, and changes in EC at Jersey Point based on G-model results. Figures 4-1 through 4-5 show a comparison of simulated average monthly chloride concentrations at Rock Slough, Old River at Highway 4, West Canal near the Clifton Court Forebay, DMC at the Tracy Pumping Plant, and EC for the San Joaquin River at Jersey Point for the no-action condition and correlated changes predicted for Alternatives 2–5. Additional information on water quality modeling is contained in Section 4 of the Modeling Technical Appendix (Volume 3).

Rock Slough Chloride Conditions. Figure 4-1 indicates that project related diversions would result in small changes to chloride levels at Rock Slough relative to regulatory standards and the normal range of variation in ambient background salinity conditions of the western Delta. Monthly averaged simulated chloride concentrations under the No Action Alternative range from a low of 9 mg/l to a high of 315 mg/l, and average 78 mg/l. The average Rock Slough chloride concentrations for the entire 1922–1993 data set as predicted with the FDM would increase under Alternatives 2–5 by about 0.5 mg/l compared to the no-action conditions. The maximum single monthly increase is

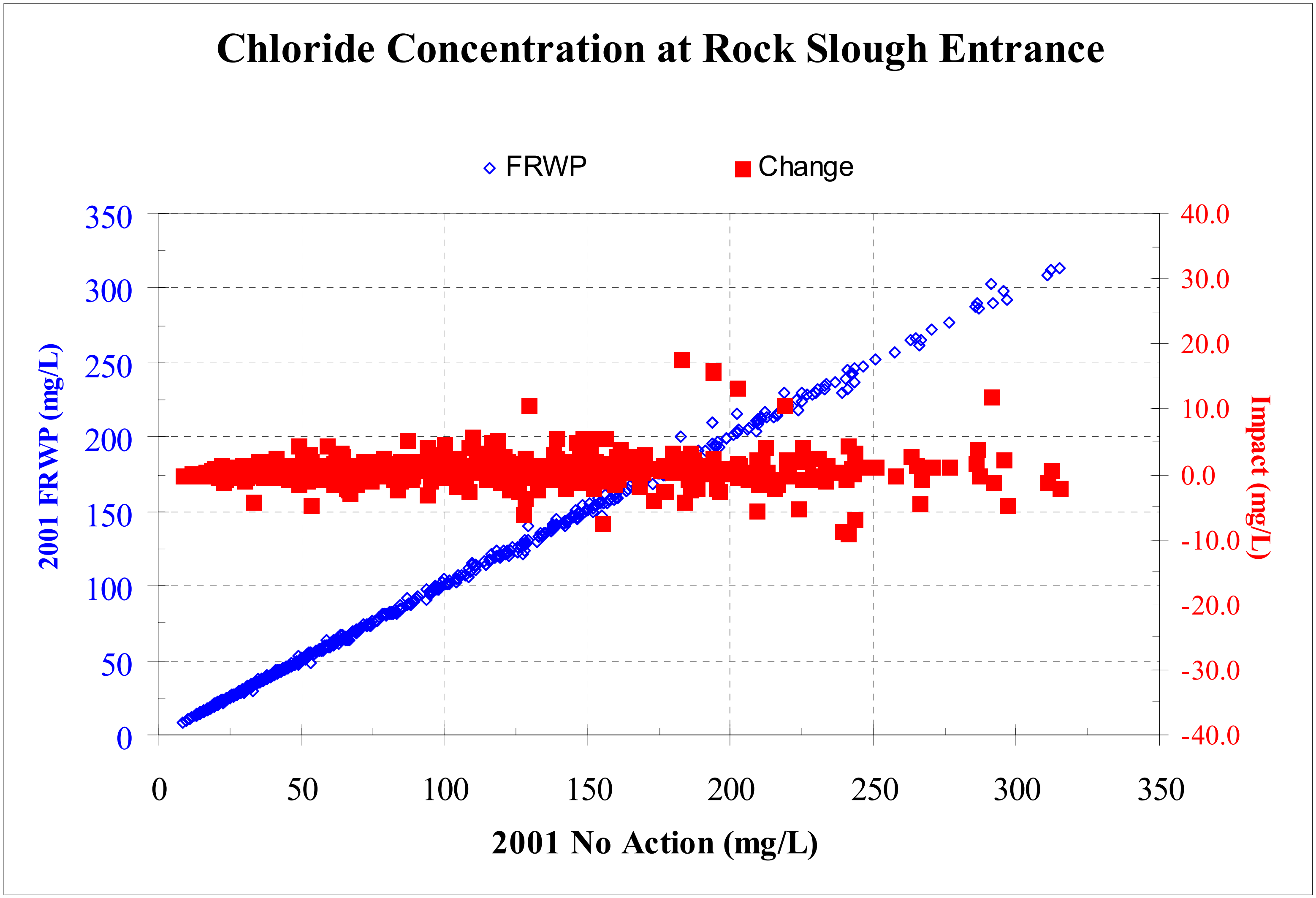


Figure 4-1. Simulated Rock Slough Chloride Concentrations for Alternatives 2-5 at the 2001 Level of Development

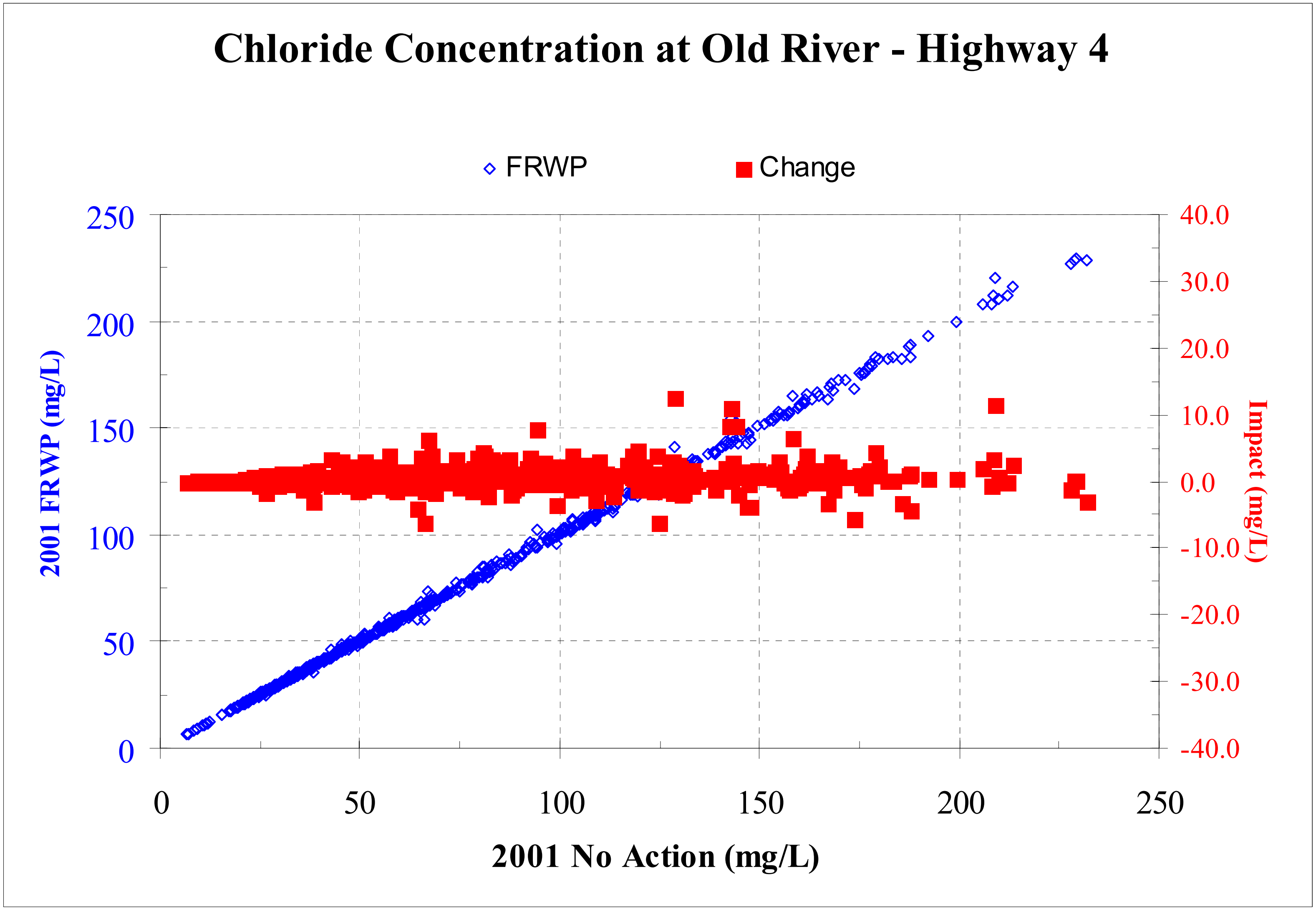


Figure 4-2. Simulated Old River at Highway 4 Chloride Concentrations for Alternatives 2-5 at the 2001 Level of Development

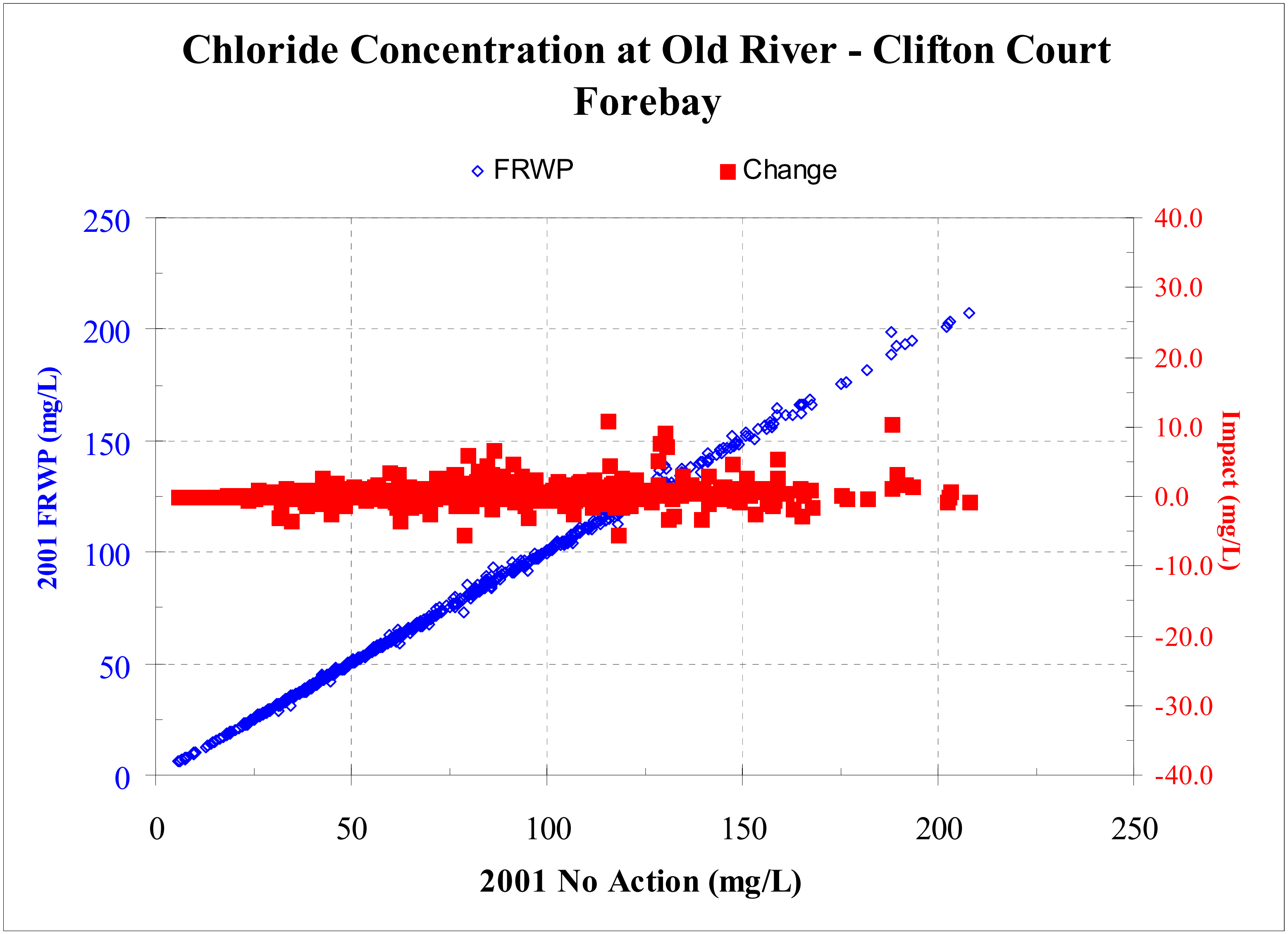


Figure 4-3. Simulated Clifton Court Forebay Chloride Concentrations for Alternatives 2-5 at the 2001 Level of Development

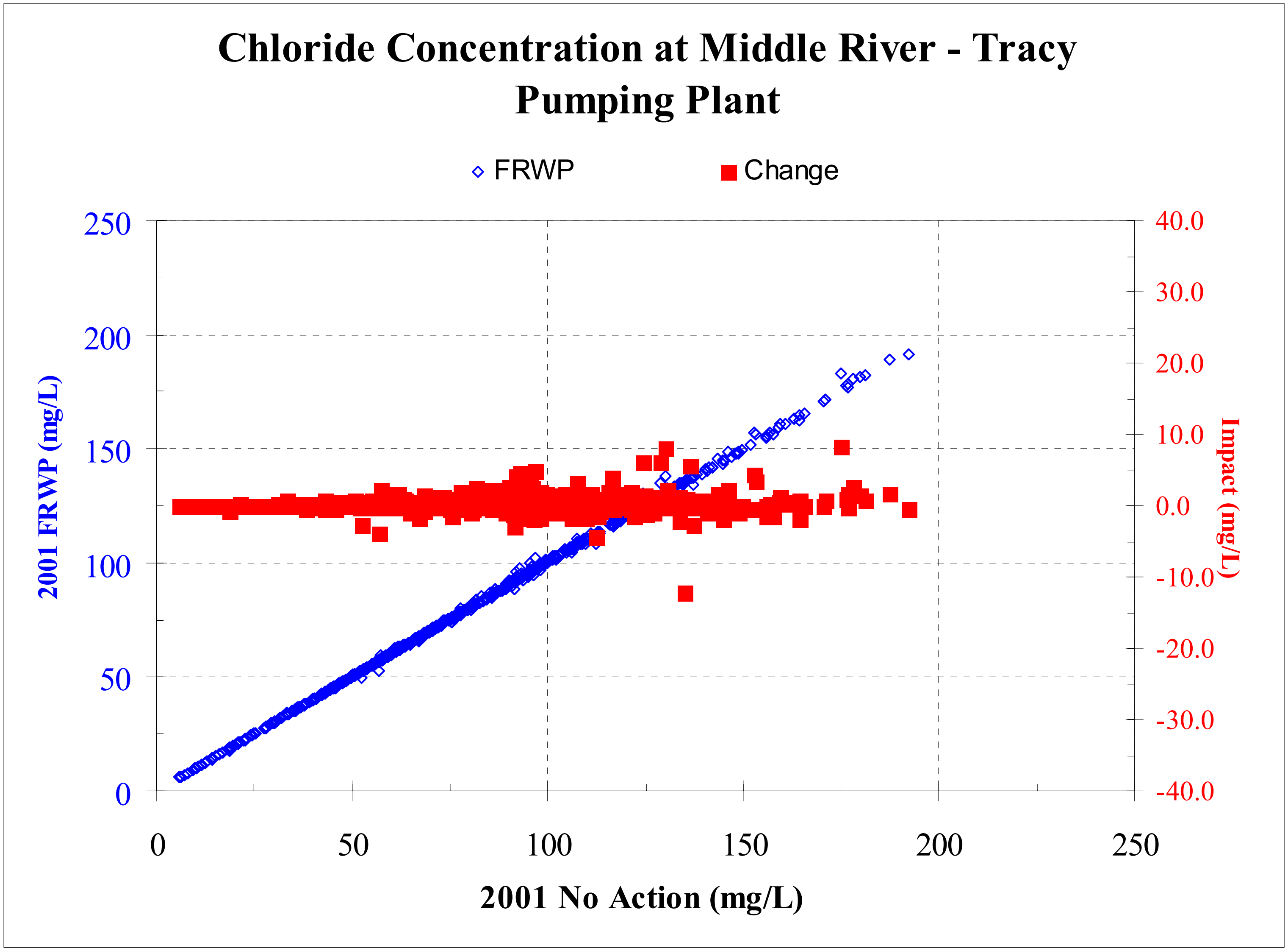


Figure 4-4. Simulated Middle River Chloride Concentrations for Alternatives 2-5 at the 2001 Level of Development

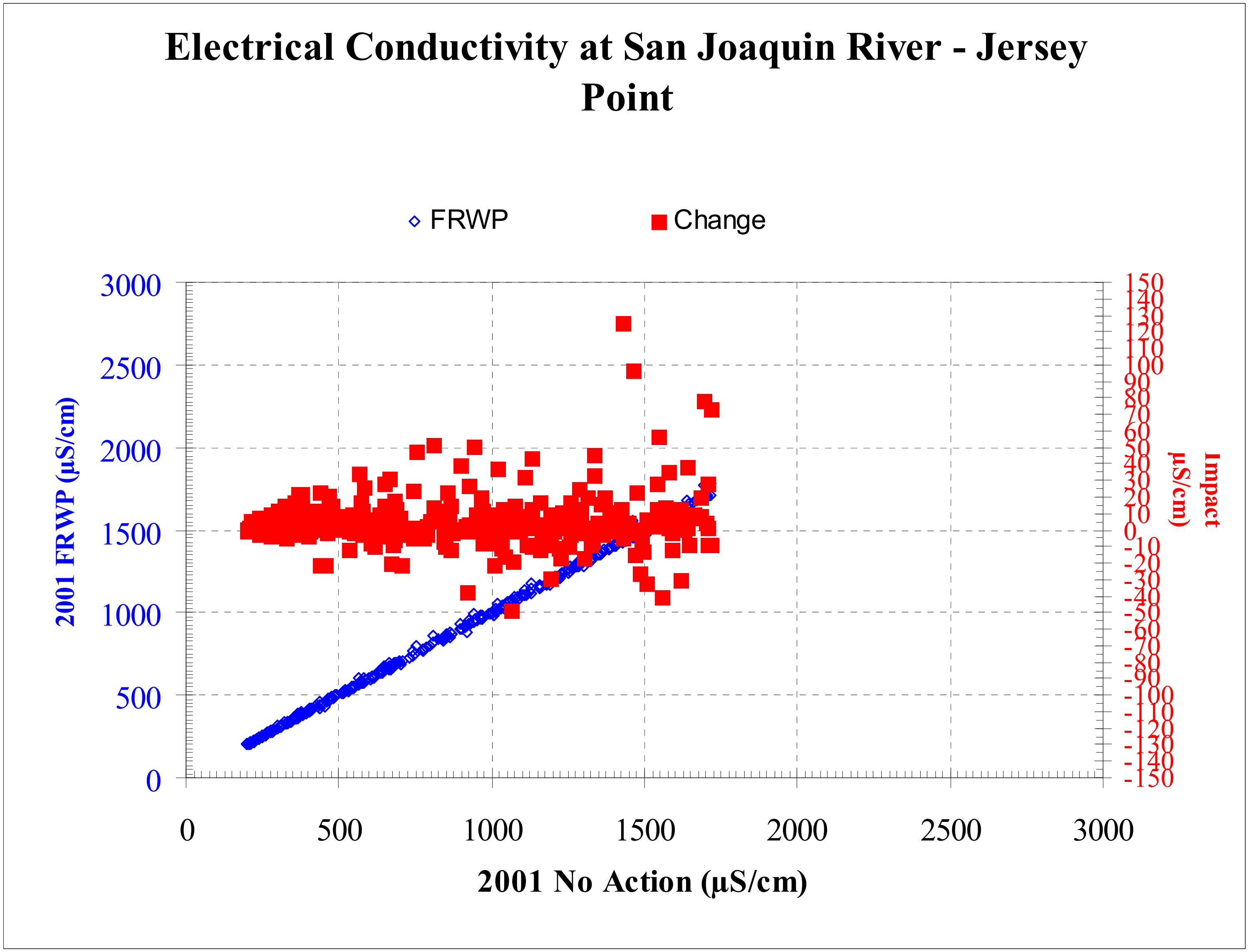


Figure 4-5. Simulated Jersey Point EC Concentrations for Alternatives 2-5 at the 2001 Level of Development

about 18 mg/l, the maximum single monthly decrease is 9 mg/l, and the standard deviation (i.e., the range that spans about 67% of the predicted monthly values) is +/- 1.9 mg/l. The comparable results for Rock Slough chloride concentrations based on the G-model are less than predicted with the FDM (i.e., average increase of 0.3 mg/l; maximum increase of 10 mg/l; and standard deviation of +/- 0.9 mg/l).

It should be noted that there is an existing problem of intermittent high chloride levels that exceed the 250 mg/l regulatory limit in Rock Slough when CCWD is not diverting from the slough. Agricultural drainage water is currently discharged directly to Rock Slough. Diversions from Rock Slough have been reduced in some years since CCWD completed construction of Los Vaqueros Reservoir that provided an additional point of diversion. When CCWD diversions are not occurring from Rock Slough, flushing and dilution of the channel is reduced and, therefore, salinity increases. The high salinity water is then diverted by CCWD into their water supply system when diversions are reinitiated. However, CCWD identified several actions that could be implemented to eliminate the agricultural drainage problem in the 1993 Los Vaqueros Reservoir Project EIR/EIS.

The small average difference seen in the modeled data is expected because the delivery quantity is a small fraction of Delta inflow and outflow. To be responsive to stakeholders, FRWA analyzed modeling results in a number of ways to determine the pattern and magnitude of potential salinity changes that may occur in the Delta as a supplemental analysis for impact assessment purposes. The analysis, shown in Volume 3, Modeling Technical Appendix, clearly demonstrates that use of the Los Vaqueros Reservoir Project EIR/EIS water quality analysis methods and significance thresholds would not result in a finding of a significant impact for the FRWP. The analysis identifies those salinity changes that exceed the expected error in model results and then identifies substantive seasonal changes in magnitude or duration of occurrence. A review of the modeling data indicates very few increases or decreases in Rock Slough chloride values. There is also no distinct pattern of adverse chloride changes on a seasonal basis. As a surrogate for other parameters of primary concern that are associated with Delta salinity in the source water for municipal supplies (i.e., bromate and THM formation), the results indicate that concentrations of these indirectly associated parameters would not change appreciably and beneficial uses would not be impaired.

Old River at Highway 4 Chloride Conditions. Figure 4-2 shows FDM–simulated monthly average chloride concentrations in Old River at Highway 4. The values are considerably less than at Rock Slough because the site is located further upgradient from higher salinity influx caused by tidal action. The plot indicates that there are no distinct adverse impacts, in either the magnitude or frequency of differences relative to the no-action conditions. Monthly averaged simulated chloride concentrations under the No Action Alternative range from a low of 7 mg/l to a high of 232 mg/l, and average 67 mg/l. Table 4-4 indicates that the average of all chloride differences (0.4 mg/l) is essentially the same as for Rock Slough, and range (-6 mg/l to 12 mg/l) and standard deviation of differences (+/-1.3 mg/l) are less than at Rock Slough.

West Canal at Clifton Court Forebay Chloride Conditions. Figure 4-3 shows the plot of FDM–simulated monthly average chloride concentrations near Clifton Court Forebay. The frequency and magnitude of project-related chloride concentrations and associated changes relative to no-action conditions correspond closely to those described above for the Rock Slough and Highway 4 sites. Monthly averaged simulated chloride concentrations under the No Action Alternative range from a low of 6 mg/l to a high of 208 mg/l, and average 68 mg/l. Table 4-4 indicates that the average of project-related differences (0.4 mg/l) is essentially the same as for Rock Slough and Old River at Highway 4, and the range (-5 mg/l to 11 mg/l) and standard deviation of differences (+/-1.2 mg/l) are less than those described for Rock Slough.

DMC at Tracy Pumping Plant Chloride Conditions. Figure 4-4 shows the FDM–simulated average monthly chloride concentrations in the Middle River. Monthly averaged simulated chloride concentrations under the No Action Alternative range from a low of 6 mg/l to a high of 192 mg/l, and average 75 mg/l. Table 4-4 indicates that the average of project-related differences (0.2 mg/l) is similar to the other sites, and the range (-12 mg/l to 8 mg/l) and standard deviation of differences (+/-1.0 mg/l) are similar to values described for Clifton Court. Impacts are very similar to the Clifton Court Forebay location in both magnitude and frequency.

Jersey Point EC Conditions. The regulatory objective for agricultural use protection on the San Joaquin River at Jersey Point is based on EC values. The G-model simulated average change in EC of 2.4 micro Siemens per centimeter (:S/cm) is very small relative to simulated monthly average values that range from 200 to 2,189 :S/cm under the No Action Alternative. The applicable EC objective at Jersey Point depends on the water year type and varies between 450 and 2,200 :S/cm. The range (-126 to 48 :S/cm) and standard deviation (10 :S/cm) of project-related differences indicates that project-related effects are small compared to the natural seasonal variation that occurs. Figure 4-5 shows the distribution of simulated EC values and monthly differences between project-related diversions and no action conditions. As shown with the plots of chloride at the other Delta locations, there is no adverse impact in either the magnitude or frequency of differences relative to no action conditions. Analysis of the model results indicate that the objective is not met in 19 months of the simulated 74-year period under the no action conditions and implementation of the project would not change the number of exceedances.

Table 4-4. Summary of Chloride and EC differences at Select Delta Locations for Alternatives 2–5

Statistic	Rock Slough	Old River at SR 4	Tracy Pumping Plant	Clifton Court Forebay	Jersey Point
Note: a positive value indicates an increase in salinity	Chloride (mg/l)	Chloride (mg/l)	Chloride (mg/l)	Chloride (mg/l)	EC (: S/cm)
Average	0.5	0.4	0.2	0.4	2.4
Maximum reduction	-9.0	-6.2	-12.2	-5.4	-48
Maximum increase	17.7	12.4	8.2	10.9	126
Std. deviation	1.9	1.3	1.0	1.2	10

Alternatives 2–5 may cause individual monthly salinity increases as well as decreases; however, the long-term conditions would be similar to existing conditions because the number of months with equivalent salinity reductions would be similar, and the rate of project-related diversion is small relative to Delta flow variables. Modeled increases in simulated chloride concentrations are generally offset by simulated chloride decreases in previous or subsequent months. Therefore, averaging concentrations over a period of several months or on an annual basis is the most accurate expression of potential changes in concentrations. Simulated chloride concentrations are directly related to simulated Delta inflow. If a large change in monthly inflow is triggered by a CALSIM II "step function" (an abrupt change in flow when a specified model threshold is crossed), the water quality models will predict a large change in chloride concentration for that month. However, because there is a finite amount of water available in the system, a triggered large inflow simulated in any given month is generally offset by lower inflows simulated in previous or subsequent months.

A detailed discussion of potential effects on salinity and drinking water parameters other than salinity is contained in Section 4.4.4 of the Modeling Technical Appendix (Volume 3). Specifically, potential changes in the levels of disinfection by-products in treated Delta water and volume-weighted salinity in SWP and CCWD diversions are quantified. Salinity in Rock Slough, the Delta intake subject to the largest potential changes, is used in estimating disinfection by-products formation. Potential increases in bromate concentration under all alternatives would be a fraction of measurement resolution in all 277 quarterly reports of running annual averages. Potential increases in total trihalomethanes concentration under all alternatives average much less than 1 : g/L. Actual effects on Delta agencies would be even smaller; agencies using water exported from Clifton Court Forebay would be subject to smaller salinity changes, and blending with releases from Los Vaqueros Reservoir would lead to smaller variations in source water salinity at CCWD's water treatment plants. Long-term changes in the volume-weighted salinity of export water at Banks Pumping Plant under all alternatives are less than 1%. Based on a thorough review of water quality modeling results documented in the Modeling Technical Appendix (Volume 3), these impacts are less than significant because they are minor and infrequent, and because beneficial uses of water would not be adversely affected, existing adopted water quality standards would not be exceeded, and no substantive effect on public health or environmental receptors would be produced. No mitigation is required.

Impact 4-8: Pipeline Operation Effects on Surface Drainages

As described in Chapter 3, diversions from the EBMUD portion of the FRWP facilities would be expected to be required only in relatively dry water years and may occur intermittently during a year of diversions. The water conveyance pipeline would need to be emptied at the completion of a diversion season or period when EBMUD determines that it will not be needed for the foreseeable future. Several discharge valves would be constructed along the pipeline alignment at low elevation locations to facilitate gravity drainage and evacuation of standing water in the pipeline. The drainage water would be discharged to the nearest conveniently available drainage swale or ditch. Locations would be selected so that discharges flow to existing drainage courses and would not adversely affect private property or facilities. The discharge volumes would be relatively small and flows may last for several days, depending on the length of pipe draining to a single discharge location. Because the water being conveyed would be high quality untreated Sacramento River water and the volume would be small, no adverse water quality impacts are predicted to occur. In some rare cases, the lowest point may occur near a location that lacks acceptable drainage features. During final design, the most appropriate locations for discharges would be identified to ensure proper drainage. Discharges could also be easily controlled at a low rate to reduce off-site impacts should there be no appropriate-sized drainage swales nearby. Therefore, there should be no substantial operations-related water quality impacts from these discharges because the volumes would be small relative to natural runoff rates. Project-related discharges would require authorization through the RWQCB General Order for dewatering and other low threat discharges to surface waters (refer to Chapter 2, Environmental Commitments, for additional detail). This impact is less than significant because beneficial uses of water would not be adversely affected, existing adopted water quality standards would not be exceeded, and no substantive effect on public health or environmental receptors would be produced. No mitigation is required.

Alternative 6

As described in Chapter 2, "Project Description," Alternative 6 consists of enlarging Pardee Reservoir and conveying water from the Sacramento River. Alternative 6 includes the following project components: enlarge Pardee Reservoir (which includes additional components), Freeport intake facility, pipeline from intake facility to the Zone 40 Surface WTP, and the Zone 40 Surface WTP. Though slightly different in size, the Freeport intake facility, pipeline from the intake facility to the Zone 40 Surface WTP, and the Zone 40 Surface WTP project components are the same as those that make up Alternative 5. Therefore, several of the impacts associated with Alternative 5 (described above) are also associated with Alternative 6 and are restated below. Additionally, impacts associated with the enlarge Pardee Reservoir component of this alternative are described below.

Impact 4-9: Potential Contaminant Discharges during Construction

This potential project-related construction and operation impact would be similar in magnitude and duration as those described for Alternatives 2–5. However, the intensity of the potential effects would generally be less because the size and maximum delivery capacity of the intake facility would be smaller than for Alternatives 2–5. This impact is less than significant. No mitigation is required.

Impact 4-10: Operational Effects during Reverse Flow in the Sacramento River

This potential project-related construction and operation impact would be similar in magnitude and duration to those described for Alternatives 2–5. However, the intensity of the potential effects would generally be less because the size and maximum delivery capacity of the intake facility would be smaller than for Alternatives 2–5. This impact is less than significant. No mitigation is required.

Impact 4-11: Operational Water Quality Effects in Sacramento River downstream of Diversion

This potential project-related construction and operation impact would be similar in magnitude and duration to those described for Alternatives 2–5. However, the intensity of the potential effects would generally be less because the size and maximum delivery capacity of the intake facility would be smaller than for Alternatives 2–5. This impact is less than significant. No mitigation is required.

Impact 4-12: Changes to Reservoir Temperature Patterns

These potential project-related effects in Pardee Reservoir and Camanche Reservoir would be similar to those described for Alternatives 2–5. Simulated storage levels (refer to Chapter 3) indicate that the frequency of below-normal water storage conditions would decrease compared to the no action conditions, and water depth during critically dry years would be greater in both reservoirs. Greater water depth in the reservoirs would help to conserve the coldwater pool later into the summer and fall and provide for cooler temperatures of water releases from the dams. Cooler release temperatures to the lower Mokelumne

River from Camanche Dam are considered a beneficial effect of the project. No mitigation is required.

Impact 4-13: Potential Contaminant Discharges during Construction of Pardee Dam and Facilities

Construction activities for the new dam, saddle dams, aggregate material borrow sites, new SR 49 bridge and approach alignment, and inlet tower and powerhouse facilities would involve substantial disturbance of existing vegetation cover and soils. In addition, construction activities for the Freeport intake facility would be similar to that described above; however, the structure and pipeline to the Zone 40 Surface WTP would be smaller. Potential temporary construction-related water quality impact mechanisms include in-water work conducted at any time of the year that may consist of cofferdam and sheet pile installation, sediment removal or disturbance, facility construction with concrete and other materials potentially hazardous to aquatic habitats, and vegetation removal. These land disturbances would expose bare soil that later could be subject to wind-, rain-, and wave-induced erosion. Discharges of sediment and other contaminants in stormwater runoff also could occur during construction activities that occur during the winter rainfall months. Other substances typically used during construction such as fuels, oils, concrete, cleaning products, and paints also inadvertently may be spilled or otherwise discharged and later transported in runoff. Construction activities for the new dam would involve extensive operations subject to potential wind- and rain-induced erosion including major excavation, grading, explosive blasting, facility construction, and material hauling activities. Blasting for demolition of the existing Pardee Dam following completion of the new dam also would discharge large amounts of waste material into the reservoir. Construction would last for approximately 3 years.

The area subject to additional inundation around Pardee Reservoir following completion and filling of the enlarged reservoir would be cleared of vegetation up to the normal reservoir water storage operating level. The settleable material associated with shoreline erosion would deposit in the reservoir and not cause adverse siltation downstream of Pardee Dam. Small particles released from shoreline erosion could contribute to suspended turbidity in the reservoir and be transported downstream or in the Mokelumne Aqueduct deliveries to EBMUD's terminal reservoirs. The erosion would be expected to remove most of the shallow soil material within the region between the existing water supply pool elevation and the future water supply pool elevation of 601 feet over several years (refer to Chapter 9, "Geology, Soils, Seismicity, and Groundwater"). However, erosion rates and associated sedimentation and turbidity transport would eventually decrease to negligible levels as the soil material is removed and more resistant base material and bedrock areas become exposed.

As described in Chapter 2, "Project Description," Environmental Commitments, EBMUD is committed to complete these extensive construction activities in coordination with local, state, and federal authorities and obtain all required local permits, clearances, and NPDES permits from the RWQCB to ensure that appropriate BMPs for water quality protection are implemented. This impact is less than significant because beneficial uses of water would not be adversely affected, existing adopted water quality standards would not be exceeded, and no substantive effect on public health or environmental receptors would be produced. No additional mitigation is required.

Impact 4-14: Operation Effects on Delta Water Quality

Section 4.4 of the Modeling Technical Appendix (Volume 3) contains detailed results of the water quality modeling. Figures 4-6 through 4-9 show the comparison of FDM–simulated average monthly chloride concentrations at the selected western Delta locations (Rock Slough, Old River at Highway 4, Old River near Clifton Court Forebay, Middle River near Tracy Pumping Plant) for the no action condition and correlated changes predicted for Alternative 6. Figure 4-10 shows the similar plot of average monthly EC concentrations for the San Joaquin River at Jersey Point. The plots indicate that FRWP project-related diversions would result in relatively small changes in chloride levels relative to regulatory objectives. The average Rock Slough chloride concentrations predicted with the FDM would increase by about 0.7 mg/l compared to the no-action conditions. The results for Rock Slough are representative of the largest magnitude of simulated changes with a maximum single monthly increase is 23 mg/l, and the standard deviation (i.e., the range that spans about 67% of the predicted monthly values) of +/-2.4 mg/l. The comparable results for Rock Slough chloride concentrations based on the G-model are less than predicted with the FDM (i.e., average increase of 0.3 mg/l; maximum increase of 15 mg/l; and standard deviation of +/-1.4 mg/l). There was also no project-related change in the CALSIM II-simulated X2 position value (Table 3-1) between the alternative and no action conditions.

The FDM–simulated chloride values shown in Table 4-5 indicate that average concentration differences between with- and without-project conditions at other Delta locations are small and similar to the pattern described for Rock Slough. Analysis of G-model EC values for Jersey Point indicate that the objective is not met in 19 months of the simulated 74-year period under the no action conditions and implementation of the project would not change the number of exceedances.

Table 4-5. Summary of Chloride and EC Differences at Select Delta Locations for Alternative 6

Statistic	Rock Slough Chloride (mg/l)	Old River at SR 4 Chloride (mg/l)	Tracy Pumping Plant Chloride (mg/l)	Clifton Court Forebay Chloride (mg/l)	Jersey Point EC (µS/cm)
Average	0.7	0.6	0.3	0.5	2.8
Maximum reduction	-8.6	-6.0	-9.9	-4.6	-74
Maximum increase	23	15.8	8.6	13.3	182
Std. Deviation	2.4	1.7	1.1	1.5	14.7

Alternative 6 may cause individual monthly salinity increases as well as decreases; however, the long-term conditions would be similar to existing conditions because the number of months with equivalent salinity reductions would be similar and the rate of project-related diversion is small relative to Delta flow variables. Modeled increases in simulated chloride concentrations are generally offset by simulated chloride decreases in previous or subsequent months. Therefore, averaging concentrations over a period of several months or on an annual basis is the most accurate expression of potential changes in concentrations. Simulated chloride concentrations are directly related to simulated Delta inflow. If a large change in monthly inflow is triggered by a CALSIM II "step function" (an abrupt change in flow when a specified model threshold is crossed), the water quality models will simulate a large change in chloride concentration for that month. However, as there is a finite amount of water available in the system, a triggered large inflow simulated in any given month is generally offset by lower inflows simulated in previous or subsequent months.

A detailed discussion of potential effects on salinity and drinking water parameters other than salinity is contained in Section 4.4.4 of the Modeling Technical Appendix (Volume 3). Specifically, potential changes in the levels of disinfection by-products in treated Delta water and volume-weighted salinity in SWP and CCWD diversions are quantified. Salinity in Rock Slough, the Delta intake subject to the largest potential changes, is used in estimating disinfection by-products formation. Potential increases in bromate concentration under all alternatives would be a fraction of measurement resolution in all 277 quarterly reports of running annual averages. Potential increases in total trihalomethanes concentration under all alternatives average much less than 1 μg/L. Actual effects on Delta agencies would be even smaller; agencies using water exported from Clifton Court Forebay would be subject to smaller salinity changes, and blending with releases from Los Vaqueros Reservoir would lead to smaller variations in source water salinity at CCWD's water treatment plants. Long-term changes in the volume-weighted salinity of export water at Banks Pumping Plant under all alternatives are less than 1%. Additional information on water quality modeling is contained in Section 4 of the Modeling Technical Appendix (Volume 3). These potential salinity impacts are less than significant because they are minor and infrequent, and because beneficial uses of water would not be adversely affected, existing adopted water quality standards would not be exceeded, and no substantive effect on public health or environmental receptors would be produced. No mitigation is required.

Significant Impacts and Mitigation Measures

None of the project alternatives would result in significant construction-related or operation-related impacts on water quality, and no mitigation measures are necessary.

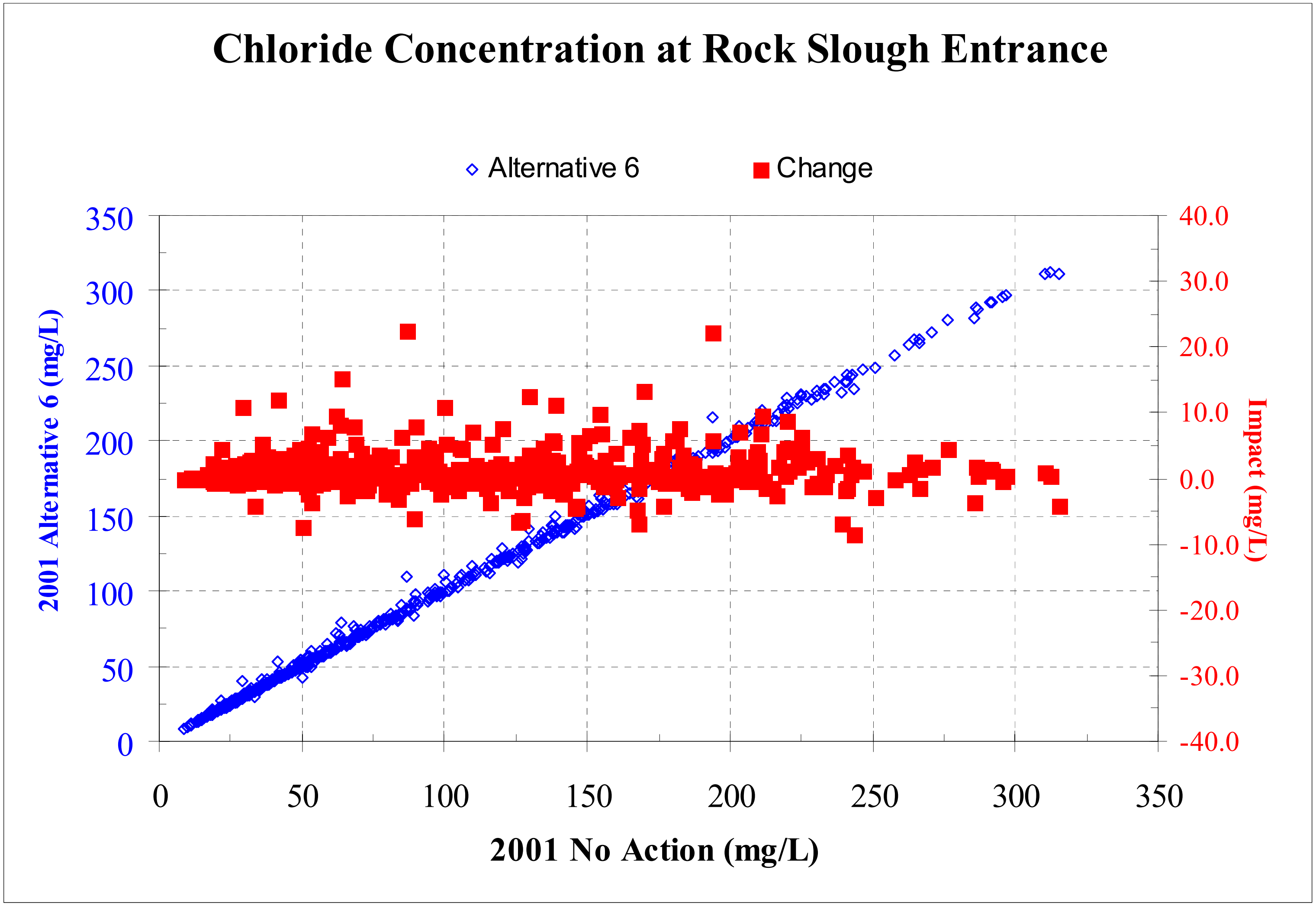


Figure 4-6. Simulated Rock Slough Chloride Concentrations for Alternative 6 at the 2001 Level of Development

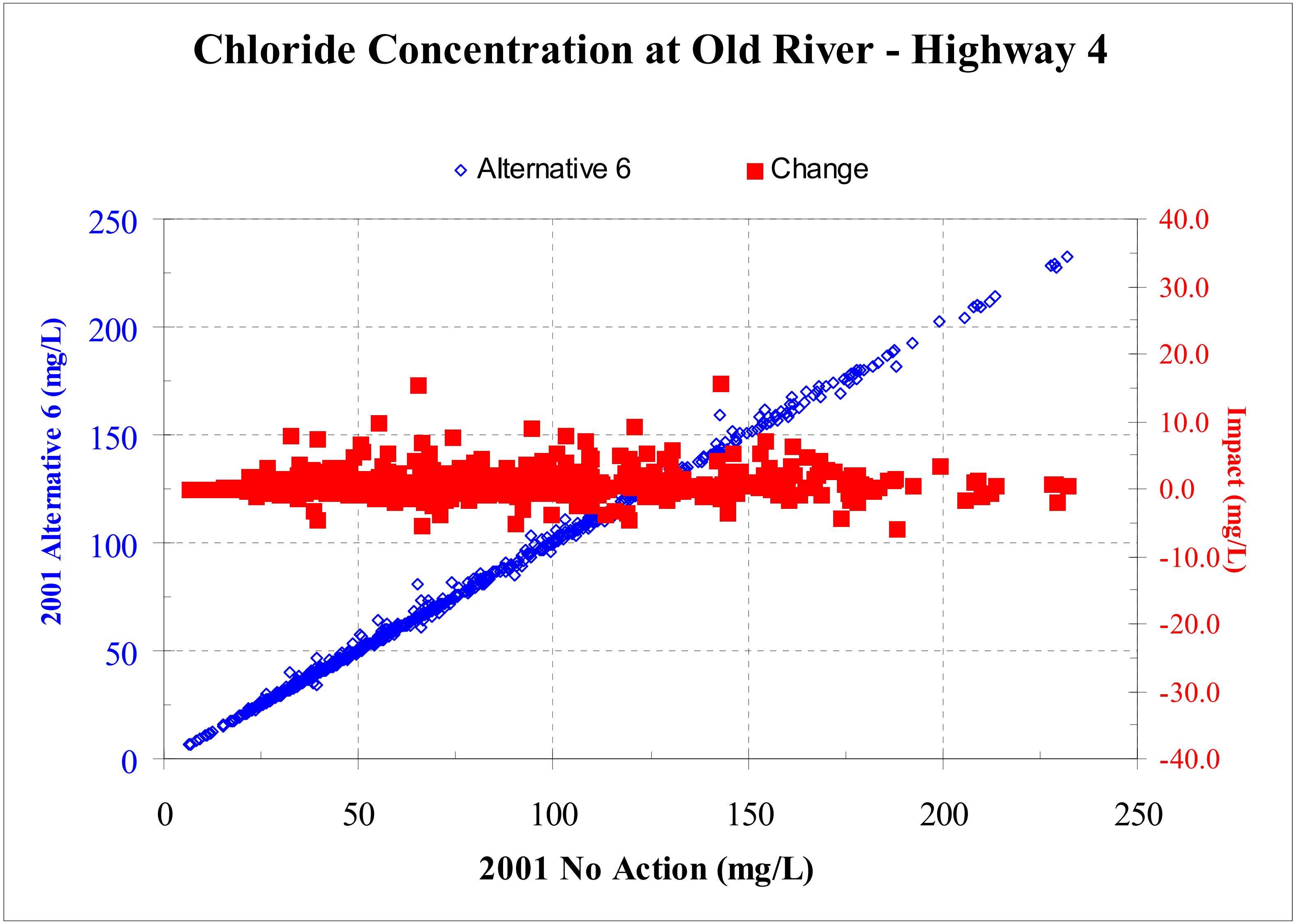


Figure 4-7. Simulated Old River at Highway 4 Chloride Concentrations for Alternative 6 at the 2001 Level of Development

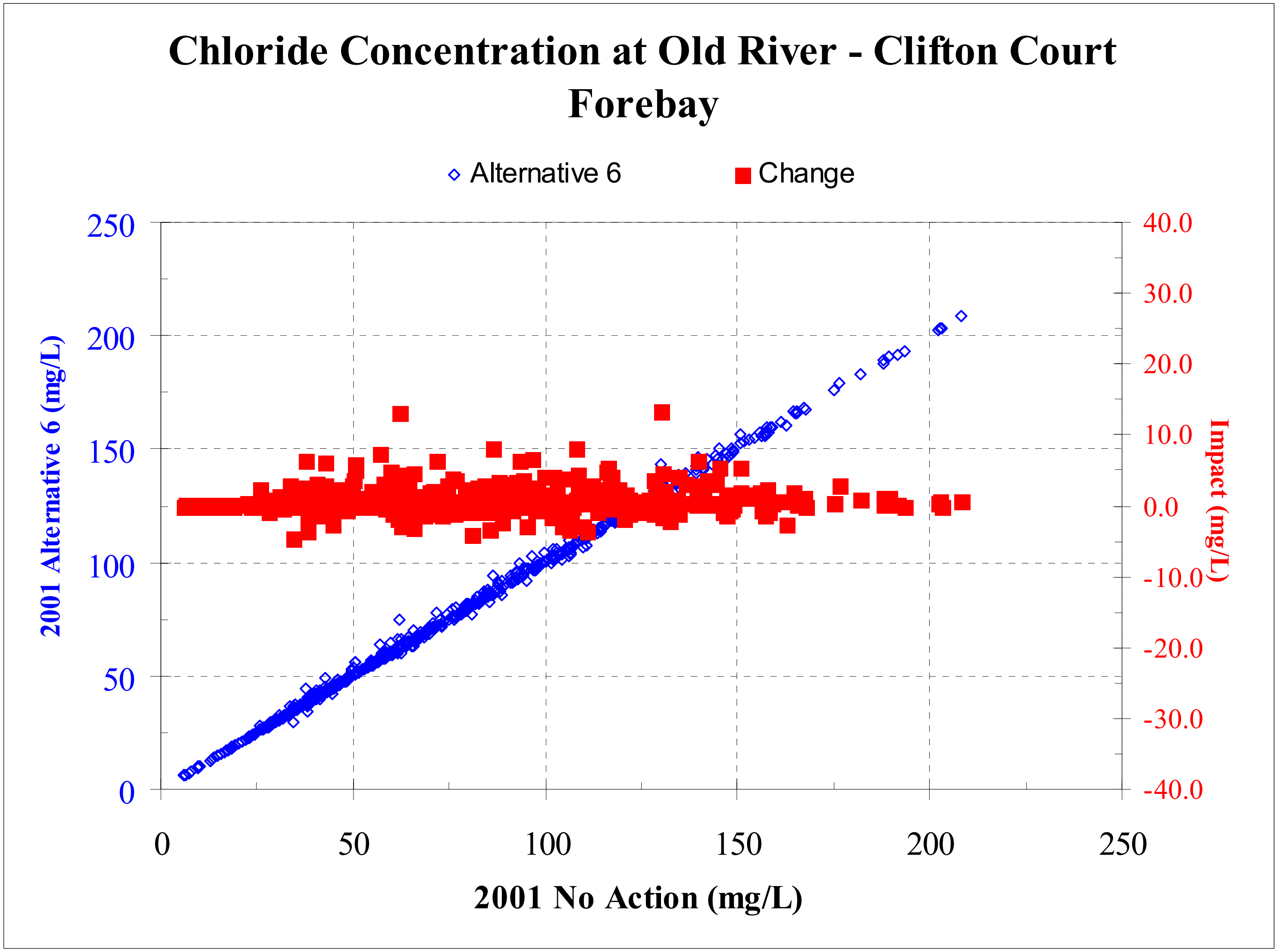


Figure 4-8. Simulated Clifton Court Forebay Concentrations for Alternative 6 at the 2001 Level of Development

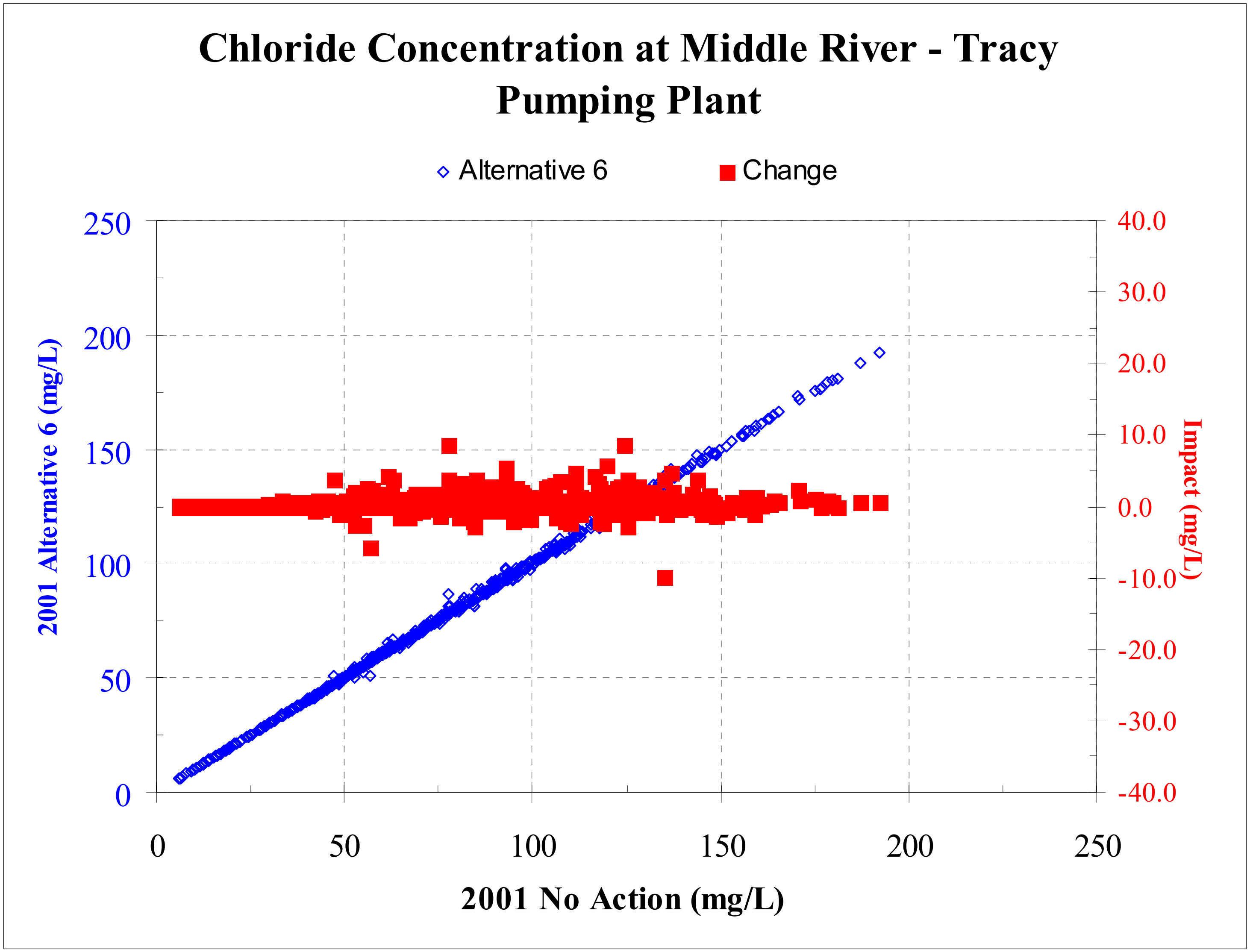


Figure 4-9. Simulated Middle River Chloride Concentrations for Alternative 6 at the 2001 Level of Development

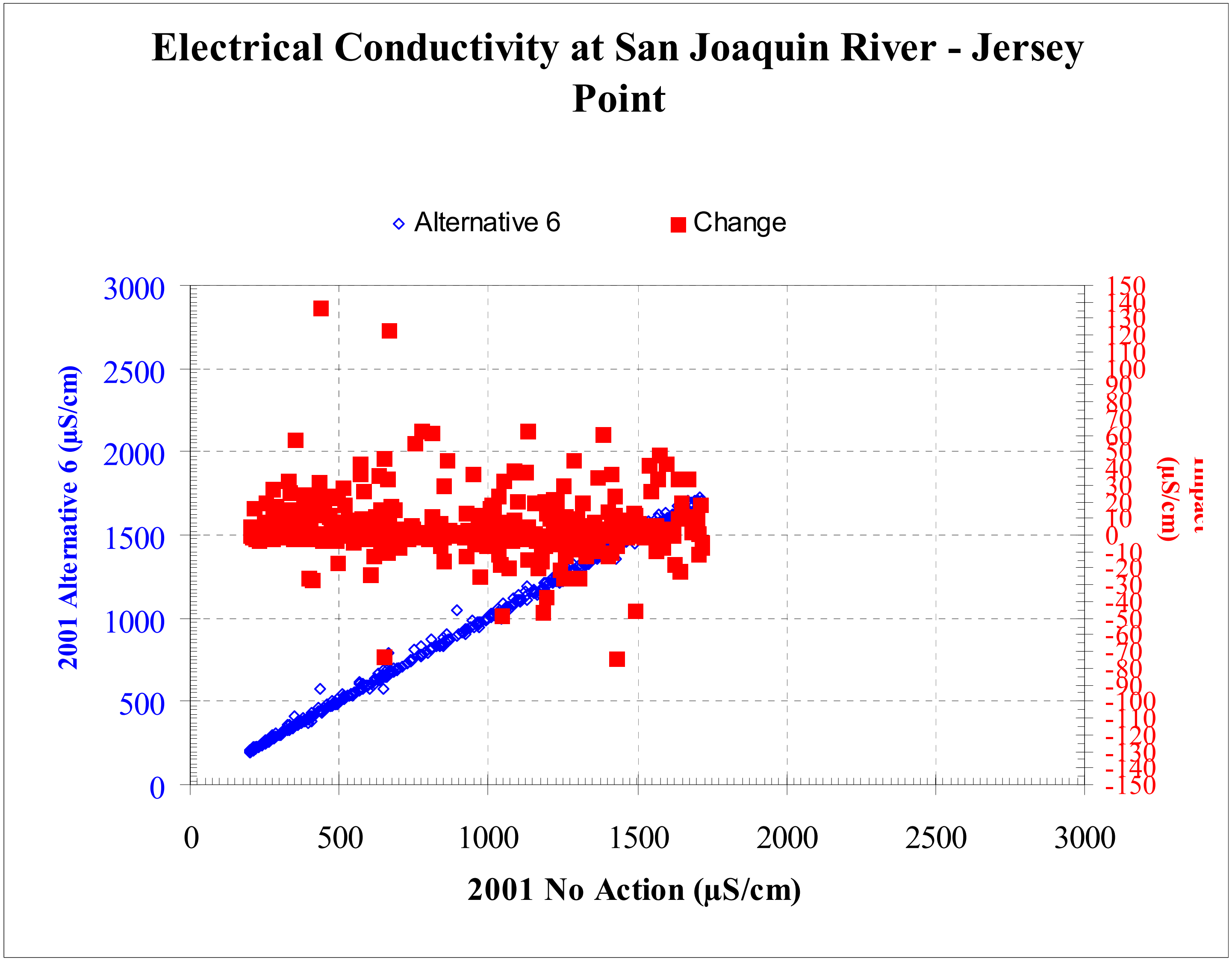


Figure 4-10. Simulated Jersey Point EC for Alternative 6 at the 2001 Level of Development

Cumulative Impacts

Methods

Cumulative impacts were evaluated for those conditions where the proposed project alternatives may exacerbate or cause cumulatively significant impacts in combination with past, present, or reasonably foreseeable future conditions. The California water supply and demand conditions are a primary factor of future water quality conditions within the project area. Chapter 3 describes the analysis conducted with CALSIM II and EBMUDSIM water supply models to estimate hydrologic conditions at the 2020 level of water demands and systemwide development. Section 4.4 of the Modeling Technical Appendix (Volume 3) contains detailed results of the water quality modeling. The assessment of cumulative impacts was based on a comparison to simulated 2001 no-action data to represent the change that would occur. The incremental differences between the simulated 2020 project conditions and 2020 no-action scenario were used to represent the project-related contributions to cumulative impacts. The CALSIM II and EBMUDSIM simulated estimates of future conditions represent the best available information.

Alternatives 2–5

Impact: Temporary Construction Water Quality Effects and Operations Water Quality Effects to Folsom South Canal, Mokelumne River Facilities, and EBMUD Terminal Reservoirs

There would be no differences in temporary construction-related water quality impacts because no additional construction activities would occur for the project in the future. Operational water quality effects of the FRWP diversions to Folsom South Canal, Pardee Reservoir and Camanche Reservoir, and terminal EBMUD reservoirs would not change because the rate and quantity of water diverted to EBMUD would be the same as described for the 2001 scenario. CALSIM II modeling results for the cumulative scenario at the 2020 level of development were described in Chapter 3 and indicate that flows in the lower Sacramento River would decrease considerably in most months compared to the 2001 conditions. The maximum average decrease at Freeport of 645 cfs would occur in September and represents a difference of slightly less than 5% from the average background flow rate in September of about 14,000 cfs. The incremental effect of the proposed project as reflected in the difference of 2020 data and no action 2020 conditions is a small fraction the total change. Overall changes in water quality that may be related to these changes in river flow rates are unknown and presumably would not be large because the increment of change is small.

Impact: Operations Water Quality Effects in the Lower Sacramento River

Under cumulative conditions, the slightly reduced streamflow in the lower Sacramento River in combination with increased SRWWTP discharges will tend to correspond with an increased frequency and magnitude of reverse flow events at the intake facility near Freeport. Operating the intake facility when background Sacramento River flows in combination with higher high tide events could increase the frequency of reverse flow events or limit dilution water in the river that is available for SRWTP effluent discharge compliance. The project-related incremental effect primarily reflects SWP and CVP operational adjustments, as the monthly average and total annual FRWP diversions to SCWA will not change appreciably and EBMUD diversions are identical for the 2001 and 2020 model scenarios. As described for Impact 4-2, the impact is less than significant because SCWA and SRWWTP operations would be coordinated and the intake facility would cease diversions during these extreme events.

As described under Impact 4-3, reduced streamflow in the lower Sacramento River will also reduce the dilution and assimilative capacity of the river for increased SRWWTP discharges and other downstream waste discharges. The frequency of potential impacts would increase incrementally; however, the changes are small relative to the much larger average river dilution capacity. In combination with the overall SRWWTP facility upgrades, the cumulative water quality conditions would meet water quality objectives and cumulative impacts would be less than significant.

Impact: Operations Effects to Delta Water Quality

Future changes in water demands on CVP and SWP water supply operations will affect Delta inflow, export water supply pumping operations, and associated Delta outflow. CALSIM II model results described in Chapter 3 were used as input for the FDM analysis to evaluate cumulative effects to salinity at the western Delta locations of concern (Rock Slough, San Joaquin River at Jersey Point, West Canal at Clifton Court, Old River and Highway 4, and the DMC at Tracy). See Section 4.4 of the Modeling Technical Appendix (Volume 3) for detailed water quality modeling results.

The Rock Slough chloride values serve as a good indicator of the overall potential effect of the project. Overall, water quality conditions are very similar under 2001 and 2020 conditions (Table 4-6).

Table 4-6. Comparison of Monthly No Action Rock Slough Chloride Concentrations

	2001	2020
Maximum	315	318
Median	46	47
Average	78	79
Minimum	9	8

Under cumulative (2020) conditions with Alternatives 2–5, the FDM–predicted average annual Rock Slough chloride concentrations would be slightly higher (1 mg/l) than the 2020 no action conditions. The changes (maximum increase of 8 mg/l; maximum decrease of 36 mg/l, standard deviation of 2 mg/l) would be similar to those simulated under 2001 conditions.

The incremental changes in FDM data between 2020 with- and without-project conditions indicate that the average difference (i.e., average increase of 0.2 mg/l) is less than the water quality effects identified above under existing (2001) conditions. The incremental changes between 2020 with- and without-project conditions indicate that the maximum increase would be considerably less than project-related effects under 2001 conditions. The data indicate that there are individual monthly changes; however, the overall pattern indicates that Delta operations would cause a similar magnitude and frequency of salinity increases and decreases, and the changes would generally be small compared to normal background variation. These potential salinity impacts are less than significant because the cumulative salinity increases and decreases are similar in magnitude, frequency, and pattern of occurrence.

Alternative 6

Impact: Temporary Construction Effects and Operations Water Quality Effects to Mokelumne River Facilities, EBMUD Terminal Reservoirs, and the Lower Sacramento River

The potential water quality impacts associated with construction and operational elements of Alternative 6 would be essentially the same as those described for 2001 conditions because no additional construction would occur under cumulative conditions. The potential operations water quality impacts would also be similar to those described for the 2001 level of development because EBMUDSIM model simulations of additional water deliveries to EBMUD terminal reservoirs from Pardee Reservoir were evaluated at the 2020 level of development. The simulated SCWA diversions from the Freeport intake facility and associated operations water quality effects in the lower Sacramento River would be similar to the description of cumulative Alternatives 2–5 impacts because the diversion rates would be identical and CALSIM II simulated Sacramento River flows would be similar.

Impact: Operations Effects to Delta Water Quality

Under cumulative conditions for Alternatives 6, additional systemwide demands at the 2020 level of development would occur in addition to deliveries to EBMUD from an enlarged Pardee Reservoir and SCWA deliveries from the Freeport intake facility. Section 4.4 of the Modeling Technical Appendix (Volume 3) contains detailed results of the water quality modeling. Incremental changes in Delta inflows and outflows would occur and change Delta salinity conditions compared to the 2001 no-action conditions. Overall, water quality conditions are very similar under 2001 and 2020 conditions (Table 4-6).

FDM–predicted average annual Rock Slough chloride concentrations would be similar to the 2001 no-action conditions. The changes between 2020 with- and without-project conditions indicate that incremental project-related effects compared to cumulative changes are small (i.e., average increase of 0.6 mg/l; maximum increase of 16 mg/l; maximum decrease of 34 mg/l; and standard deviation of 2.5 mg/l). The data indicate that there are individual monthly changes; however, overall pattern indicates that Delta operations would cause similar salinity increases and decreases, and the changes would generally be small compared to normal background variation. The data indicate that the incremental project-related contribution to the cumulative effects on Delta outflow would be small relative to systemwide changes in water supply operations and similar to the effects described for the 2001 model scenario. These potential salinity impacts are less than significant because the cumulative salinity increases and decreases are similar in magnitude, frequency, and pattern of occurrence to those described for 2001.

Chapter 5

Fish

Chapter 5
Fish

Affected Environment

The project alternatives include various combinations of construction activities on the Sacramento River near Freeport, and within and around Camanche and Pardee Reservoirs that could potentially affect fish and fish habitat. In addition, implementation of the alternatives has the potential to change water supply operations and diversions, potentially affecting river flow and the dependent fish habitat in the Trinity, Sacramento, Feather, American, and Mokelumne Rivers and in the Sacramento–San Joaquin Delta estuary.

Although other fish species are potentially affected by the alternatives, this chapter focuses primarily on fish species listed under the federal and California Endangered Species Acts (ESAs). The full range of environmental conditions and fish habitat elements potentially affected are encompassed by the assessment for the species specifically discussed. The response of the selected species to project actions provides an indicator of the potential response by other species. Mitigation measures that reduce impacts on the species discussed are also likely to reduce impacts on the other species. Where the location and timing of project actions and the potential effects on a fish species or habitat are not captured by the analysis for the selected species, the specific effects on other species are described.

Status and Occurrence of Fish Species

Central Valley steelhead, Sacramento River winter-run chinook salmon, Central Valley spring-run chinook salmon, delta smelt, and splittail occur in streams of the Central Valley and are listed under the federal ESA (see Table 5-1). Southern Oregon/northern California coasts coho salmon occurs in the Trinity River and is also listed under the ESA. The coho salmon is included in the impact analysis because operation of Reclamation facilities in response to changes in CVP water supply distribution has the potential to affect Trinity River flows.

Steelhead, chinook salmon, coho salmon, delta smelt, and splittail have experienced declines in abundance as a result of natural and human-related factors. Major factors that contributed to the decline of salmon and steelhead

Table 5-1. Status and Occurrence of Fish Species Listed under the Federal Endangered Species Act

Listed Fish Species	Scientific Name	Status and Occurrence	Critical Habitat
Central Valley Steelhead	*Oncorhynchus mykiss*	Federally listed as threatened on March 19, 1998 (63FR 13347); occurs in rivers and streams of the Central Valley, including the Sacramento, Feather, American, and Mokelumne Rivers, and migrates through the Sacramento–San Joaquin Delta	Withdrawn in April 2002
Sacramento River winter-run chinook salmon	*Oncorhynchus. tshawytscha*	Federally listed as endangered on January 4, 1994 (59 FR 440); listed as endangered under the California Endangered Species Act (CESA); occurs in the Sacramento River and migrates through the Sacramento–San Joaquin Delta	Designated on June 16, 1993 (58 FR 33212)
Central Valley spring-run chinook salmon	*Oncorhynchus. tshawytscha*	Federally listed as threatened on September 16, 1999 (64 FR 50393); listed as threatened under CESA; occurs in the Sacramento and Feather Rivers and several minor tributaries and migrates through the Sacramento–San Joaquin Delta	Withdrawn in April 2002
Southern Oregon/northern California coasts coho salmon	*Oncorhynchus. kisutch*	Federally listed as threatened on May 6, 1997 (62 FR 24588); occurs in coastal rivers of northern California and southern Oregon, including the Trinity River	Designated on May 5, 1999 (64 FR 24049)
Delta smelt	*Hypomesus transpacificus*	Federally listed as threatened on March 5, 1993 (58 FR 12854); listed as threatened under CESA; occurs in the Sacramento–San Joaquin Delta estuary	Designated on December 19, 1994 (59 FR 65256)
Splittail	*Pogonychthys macrolepidotus*	Federally listed as threatened on March 10, 1999 (64 FR 25); occurs in Suisun Bay, Sacramento–San Joaquin Delta estuary, and lower reaches of the Sacramento, Feather, American, San Joaquin, and Mokelumne Rivers	Does not have critical habitat

include blockage of fish from spawning and rearing habitat by dams, deleterious water temperature, rapid flow fluctuation downstream of dams, entrainment in unscreened and poorly screened diversions, previous hatchery practices, and harvest. The decline in delta smelt abundance has been attributed to reduced outflow, entrainment losses to water diversions, changes in food organisms, toxic substances, disease, competition and predation by nonnative species, and potential inbreeding with the nonnative wakasagi. Splittail have been adversely affected by loss of floodplain attributable to levees and channelization.

Other species that occur within Central Valley streams and rivers include fall-run chinook salmon, striped bass, American shad, largemouth bass, and several species of minnows, sunfish, and catfish (see Table 5-2). Central Valley reservoirs, the lower portions of Central Valley rivers, and the Delta are dominated by nonnative species, a contributing factor in the decline in abundance of native species.

Table 5-2. Central Valley Species Potentially Affected by the Proposed Alternatives

Common Name—Origin	Scientific Name	Distribution
Lamprey (2 species)—native	*Lampetra* spp.	Central Valley rivers; Delta; San Francisco Bay estuary
Chinook salmon (winter, spring, fall, and late-fall runs)—native	*Oncorhynchus tshawytscha*	Central Valley rivers; Delta; San Francisco Bay estuary
Chum salmon—rare	*Oncorhynchus keta*	Central Valley rivers; Delta and San Francisco Bay estuary
Kokanee—nonnative	*Oncorhynchus nerka*	Central Valley reservoirs
Steelhead/rainbow trout—native	*Oncorhynchus mykiss*	Central Valley rivers; Delta and San Francisco Bay estuary
Brown trout—nonnative	*Salmo trutta*	Central Valley reservoirs
White sturgeon—native	*Acipenser transmontanus*	Central Valley rivers; Delta; San Francisco Bay estuary
Green sturgeon—native	*Acipenser medirostris*	Central Valley rivers; Delta; San Francisco Bay estuary
Longfin smelt—native	*Spirinchus thaleichthys*	Delta and San Francisco Bay estuary
Delta smelt—native	*Hypomesus transpacificus*	Delta and San Francisco Bay estuary
Wakasagi—nonnative	*Hypomesus nipponensis*	Central Valley rivers and reservoirs; Delta
Sacramento sucker—native	*Catostomus occidentalis*	Central Valley rivers; Delta
Sacramento squawfish—native	*Ptychocheilus grandis*	Central Valley rivers; Delta
Splittail—native	*Pogonichthys macrolepidotus*	Central Valley rivers; Delta and San Francisco Bay estuary
Sacramento blackfish—native	*Orthodon microlepidotus*	Central Valley rivers; Delta

Common Name—Origin	Scientific Name	Distribution
Hardhead—native	*Mylopharodon conocephalus*	Central Valley rivers; Delta
Speckled dace	*Rhinichthys osculus*	Sacramento River and tributaries
California roach	*Lavinia symmetricus*	Central Valley Rivers
Hitch—native	*Lavina exilicauda*	Central Valley rivers; Delta
Golden shiner—nonnative	*Notemigonus crysoleucas*	Central Valley rivers and reservoirs; Delta
Fathead minnow—nonnative	*Pimephales promelas*	Central Valley rivers and reservoirs; Delta
Goldfish—nonnative	*Carassius auratus*	Central Valley rivers and reservoirs; Delta
Carp—nonnative	*Cyprinus carpio*	Central Valley rivers and reservoirs; Delta
Threadfin shad—nonnative	*Dorosoma petenense*	Central Valley rivers and reservoirs; Delta
American shad—nonnative	*Alosa sapidissima*	Central Valley rivers; Delta; San Francisco Bay estuary
Black bullhead—nonnative	*Ictalurus melas*	Central Valley rivers and reservoirs; Delta
Brown bullhead—nonnative	*Ictalurus nebulosus*	Central Valley rivers and reservoirs; Delta
White catfish—nonnative	*Ictalurus catus*	Central Valley rivers; Delta
Channel catfish—nonnative	*Ictalurus punctatus*	Central Valley rivers and reservoirs; Delta
Mosquito fish—nonnative	*Gambusia affinis*	Central Valley rivers and reservoirs; Delta
Inland silverside—nonnative	*Menidia audena*	Central Valley rivers; Delta
Threespine stickleback—native	*Gasterosteus aculaetus*	Central Valley rivers; Delta; San Francisco Bay estuary
Striped bass—nonnative	*Morone saxatilis*	Central Valley rivers and reservoirs; Delta; San Francisco Bay estuary
Bluegill—nonnative	*Lepomis macrochirus*	Central Valley rivers and reservoirs; Delta
Green sunfish—nonnative	*Lepomis cyanellus*	Central Valley rivers and reservoirs; Delta
Redear sunfish—nonnative	*Lepomis microlophus*	Central Valley rivers and reservoirs; Delta
Warmouth—nonnative	*Lepomis gulosus*	Central Valley rivers and reservoirs; Delta

Common Name—Origin	Scientific Name	Distribution
White crappie—nonnative	*Pomoxis annularis*	Central Valley rivers and reservoirs; Delta
Black crappie—nonnative	*Pomoxis nigromaculatus*	Central Valley rivers and reservoirs; Delta
Largemouth bass—nonnative	*Micropterus salmoides*	Central Valley rivers and reservoirs; Delta
Redeye Bass	*Micropterus coosae*	Central Valley rivers and reservoirs
Spotted bass—nonnative	*Micropterus punctulatus*	Central Valley rivers and reservoirs; Delta
Small mouth bass—nonnative	*Micropterus dolomieui*	Central Valley rivers and reservoirs; Delta
Bigscale logperch—nonnative	*Percina macrolepida*	Central Valley rivers; Delta
Yellowfin goby—nonnative	*Acanthogobius flavimanus*	Delta and San Francisco Bay estuary
Chameleon goby—nonnative	*Tridentiger trigonocephalus*	Delta and San Francisco Bay estuary
Prickly sculpin—native	*Cottus asper*	Central Valley rivers
Tule perch—native	*Hysterocarpus traskii*	Central Valley rivers; Delta

Life Histories

Chinook Salmon

After 2–5 years in the ocean, adult chinook salmon leave the ocean and migrate upstream to the Sacramento, Feather, American and Mokelumne Rivers to spawn. Chinook salmon take advantage of the diversity and variability of river systems through variable life history adaptations. The names of the chinook salmon runs (i.e., fall, late fall, spring, and winter) reflect the variability in life history timing of the adult fish (see Table 5-3). Spawning occurs in the cool reaches of Central Valley rivers that are just downstream of the terminal dams. Adult chinook salmon spawn soon after entering fresh water, as in the case of fall-run chinook salmon, or spend time in fresh water before reaching maturity, like spring- and winter-run chinook salmon. Chinook salmon deposit their eggs in redds (i.e., gravel nests) located on riffles, runs, and pool tails. Eggs generally hatch in 6–9 weeks and yolk-sac larvae remain in the gravel for several more weeks. After emergence, juvenile chinook salmon may rear along the channel edge or begin their movement downstream (see Table 5-3). Juvenile chinook salmon may remain in fresh water for 3–14 months.

Table 5-3. Life Stage Timing and Distribution of Selected Species Potentially Affected by the Proposed Alternatives

	Distribution	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Late Fall–run Chinook Salmon													
Adult Migration	SF Bay to Upper Sacramento River and Tributaries, Mokelumne River, and San Joaquin River Tributaries	■	■								■	■	■
Spawning	Upper Sacramento River and Tributaries, Mokelumne River and San Joaquin River Tributaries	■	■	■									
Egg Incubation	Upper Sacramento River and Tributaries, Mokelumne River and San Joaquin River Tributaries	■	■	■	■	■							
Juvenile Rearing (Natal Stream)	Upper Sacramento River and Tributaries, Mokelumne River and San Joaquin River Tributaries	■	■	■	■	■	■	■	■	■	■	■	■
Juvenile Movement and Rearing	Upper Sacramento River and Tributaries, Mokelumne River and San Joaquin River Tributaries	■	■	■	■	■	■				■	■	■
Fall-run Chinook Salmon													
Adult Migration and Holding	SF Bay to Upper Sacramento River and Tributaries							■	■	■	■	■	■
Spawning[1]	Upper Sacramento River and Tributaries										■	■	■
Egg Incubation[1]	Upper Sacramento River and Tributaries	■	■	■							■	■	■
Juvenile Rearing (Natal Stream)	Upper Sacramento River and Tributaries	■	■	■	■	■	■						
Juvenile Movement	Upper Sacramento River and Tributaries to SF Bay				■	■	■						
Spring-run Chinook Salmon													
Adult Migration and Holding	SF Bay to Upper Sacramento River and Tributaries			■	■	■	■	■	■	■			
Spawning	Upper Sacramento River and Tributaries								■	■	■		
Egg Incubation	Upper Sacramento River and Tributaries								■	■	■	■	■
Juvenile Rearing (Natal Stream)	Upper Sacramento River and Tributaries	■	■	■	■	■	■	■	■	■	■	■	■
Juvenile Movement	Upper Sacramento River and Tributaries to SF Bay	■	■	■	■	■					■	■	■
Winter-run Chinook Salmon													
Adult Migration and Holding	SF Bay to Upper Sacramento River	■	■	■	■	■	■	▒					▒

Table 5-3. Continued

	Distribution	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Spawning	Upper Sacramento River				■	■	■	■	▨				
Egg Incubation	Upper Sacramento River				▨	■	■	■	■	■	▨		
Juvenile Rearing (Natal Stream)	Upper Sacramento River to SF Bay	■	■	■	■			■	■	■	■	■	■
Juvenile Movement and Rearing	Upper Sacramento River to SF Bay	■	■	■	■	▨					■	■	■
Steelhead													
Adult Migration	SF Bay to Upper Sacramento River and Tributaries	■	■	■				▨	▨	■	■	■	■
Spawning	Upper Sacramento River and Tributaries	■	■	■	■								■
Egg Incubation	Upper Sacramento River and Tributaries	■	■	■	■	■	■	▨	▨				■
Juvenile Rearing	Upper Sacramento River and Tributaries to SF Bay	■	■	■	■	■	■	■	■	■	■	■	■
Juvenile Movement	Upper Sacramento River and Tributaries to SF Bay	■	■	■	■	■	■	▨	▨				▨
Southern Oregon/Northern California Coasts Coho Salmon													
Adult Migration	Trinity River									■	■	■	■
Juvenile Rearing	Trinity River	■	■	■	■	■	■	■	■	■	■	■	■
Juvenile Movement	Trinity River			■	■	■							
Splittail													
Adult Migration	Suisun Marsh, Upper Delta, Yolo and Sutter Bypasses, Sacramento River and San Joaquin River	■	■	■	■								■
Spawning	Suisun Marsh, Upper Delta, Yolo and Sutter Bypasses, lower Sacramento, Mokelumne and San Joaquin Rivers	■	■	■	■	■	▨	▨					
Larval and Early Juvenile Rearing and Movement	Suisun Marsh, Upper Delta, Yolo Bypass, Sutter Bypass, Lower Sacramento and San Joaquin Rivers			■	■	■	■						
Adult and Juvenile Rearing	Delta, Suisun Bay	■	■	■	■	■	■	■	■	■	■	■	■

	Distribution	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Delta Smelt													
Adult Migration	Delta	■	■	■									■
Spawning	Delta, Suisun Marsh	■	■	■	■	■	▒	▒					
Larval and Early Juvenile Rearing	Delta, Suisun Marsh	■	■	■	■	■	■	▒					
Estuarine Rearing: Juveniles and Adults	Lower Delta, Suisun Bay	■	■	■	■	■	■	■	■	■	■	■	■

▒ Low probability of occurrence, not included in the assessment of the project effect

■ Primary occurrence included in the assessment of project effects

[1] Spawning and incubation occurs from October to February in the Feather, American, and Mokelumne Rivers

Sources: Brown 1991, Wang and Brown 1993, U.S. Fish and Wildlife Service 1996c, McEwan 2001, Moyle 2002, Hallock 1989.

Steelhead

Steelhead have one of the most complex life histories of any salmonid species. Steelhead are anadromous, but some individuals may never leave fresh water, instead hatching, rearing, and spawning within a given river reach. Freshwater residents typically are referred to as rainbow trout, while anadromous individuals are called steelhead.

Adult Central Valley steelhead migrate upstream from the ocean during July through March in the Sacramento River, and most adults migrate in September and October (see Table 5-3). Individual steelhead may spawn more than once, returning to the ocean between each spawning migration. Steelhead spawn in relatively clean, cool (less than 57ºF) water, building their redds and laying their eggs in clean gravel at the head of riffles. The eggs hatch between 19 and 80 days after spawning, depending on water temperature. Larvae remain in the gravel for several weeks before emerging as fry.

Juvenile steelhead rear a minimum of 1 and typically 2 or more years in fresh water before migrating to the ocean. Juvenile migration to the ocean generally occurs from December through August (see Table 5-3). The peak months of juvenile migration are January to May (McEwan 2001). After 2–3 years of ocean residence, adult steelhead return to their natal stream to spawn as 4- or 5-year-olds.

Coho Salmon

Coho salmon migrate from the ocean to spawn in tributaries of the Klamath and Trinity Rivers (and other coastal rivers) Adult coho salmon migrate upstream between September and late December, and peak migration is between October and November (Table 5-3). Spawning takes place in November and December (Moyle 2002). Female salmon dig redds near the heads of riffles in medium to small gravel that provide good flow and aeration. Spawning occurs over about a week. The female salmon constructs redds in succession, gradually moving upstream. Embryos hatch after 8–12 weeks and remain in the gravel for 4–10 weeks until their yolk sacs are absorbed. The juveniles move to slow water along the stream margins and to pools. Juvenile coho salmon are usually found where woody material provides instream cover. Growth is best at temperatures from 54ºF to 57°F. Juveniles are absent from tributaries that reach temperatures warmer than 64°F for more than a week. Juvenile coho salmon rear in tributary streams for up to 15 months before migrating to the ocean. Downstream migration occurs from March through May, with peak occurrence in late April through mid-May when conditions are favorable (Table 5-3) (Moyle 2002).

Delta Smelt

Estuarine rearing habitat for juvenile and adult delta smelt is typically found in the waters of the lower Delta and Suisun Bay where salinity is between 2 and 7 parts per thousand (ppt). Delta smelt tolerate 0-ppt to 19-ppt salinity. They typically occupy open shallow waters but also occur in the main channel in the region where fresh water and brackish water mix. The zone may be hydraulically conducive to their ability to maintain position and metabolic efficiency (Moyle 2002).

Adult delta smelt begin a spawning migration, which may encompass several months, and move into the upper Delta during December or January (Table 5-3). Spawning occurs between January and July, with peak spawning during April through mid-May (Moyle 2002). Spawning occurs in shallow edge-waters in the upper Delta channels, including the Sacramento River above Rio Vista, Cache Slough, Lindsey Slough, and Barker Slough. Spawning was also observed in the Sacramento River up to Garcia Bend during drought conditions, possibly attributable to adult movement further inland in response to saltwater intrusion (Wang and Brown 1993). Eggs are broadcast over the bottom, where they attach to firm sediment, woody material, and vegetation. Hatching takes approximately 9 to 13 days, and larvae begin feeding 4 to 5 days later. Newly hatched larvae contain a large oil globule that makes them semi-buoyant and allows them to stay off the bottom. Larval smelt feed on rotifers and other zooplankton. As their fins and swim bladder develop, they move higher into the water column. Larvae and juveniles gradually move downstream toward rearing habitat in the estuarine mixing zone (Wang 1986).

Splittail

Adult splittail migrate from Suisun Bay and the Delta to upstream spawning habitat during December through April (Table 5-3). Surveys conducted by DFG and the DWR in 1995 indicate that the Yolo and Sutter Bypasses provide important spawning habitat. Adult splittail deposit adhesive eggs over flooded terrestrial or aquatic vegetation when water temperature is between 48°F and 68°F (Moyle 2002; Wang 1986). Splittail spawn in late April and May in Suisun Marsh and between early March and May in the upper Delta and lower reaches and flood bypasses of the Sacramento and San Joaquin Rivers (Moyle et al. 1989). Spawning has been observed to occur as early as January and may continue through early July (Table 5-3)(Wang 1986; Moyle 2002).

Larval splittail are commonly found in shallow, vegetated areas near spawning habitat. Larvae eventually move into deeper and more open-water habitat as they grow and become juveniles. During late winter and spring, young-of-year juvenile splittail (i.e., production from spawning in the current year) are found in sloughs, rivers, and Delta channels near spawning habitat (Table 5-3). Juvenile splittail gradually move from shallow, nearshore areas to deeper, open water habitat of Suisun and San Pablo Bays (Wang 1986). In areas upstream of the

Delta, juvenile splittail can be expected to be present in the flood bypasses when these areas are inundated during the winter and spring (Jones & Stokes Associates 1993; Sommer et al. 1997).

Striped Bass

Striped bass are nonnative and spend most of their lives in San Pablo and San Francisco Bays and move upstream to spawn. Spawning peaks in May and June, and its location depends on water temperature, flow, and salinity. Spawning occurs in the Delta and in the Sacramento River during the spring. Striped bass are open-water spawners, and their eggs must remain suspended in the current to prevent mortality. Embryos and larvae in the Sacramento River are carried into the Delta and Suisun Bay where rearing appears to be best (Moyle 2002). Larval and juvenile striped bass feed mainly on invertebrates, including copepods and opossum shrimp. Fish become a more important part of their diet as they grow in size (Moyle 2002).

American Shad

American shad are also a nonnative species. They are present in the Sacramento River up to Red Bluff and in the lower reaches the American and Feather Rivers. American shad use the San Francisco estuary after migrating from the ocean in the fall. They move into fresh water from March to May where they spawn. American shad spawn in the American River when water temperature ranges from 63°F to 75°F, usually in May and June (Moyle 2002). Spawning takes place in main channels of rivers over a number of substrates. Shad eggs stay suspended in the water and gradually drift downstream. In the Sacramento River basin, the main summer rearing areas are the lower Feather River, the Sacramento River from Colusa to the North Delta and to some extent the South Delta. Juvenile shad move to the ocean from September to November, although juvenile migration under high outflow conditions may begin in June.

Other Species

Central Valley rivers and reservoirs include many other native and nonnative species (Table 5-2). In general, native species, such as Sacramento pikeminnow, hardhead, Sacramento sucker, and California roach spawn early in the spring. Most native fishes do not guard the young as a result of evolving in an environment relatively low in potential predators. Native fishes are also adapted to rear in flooded areas that provide abundant cover and abundant prey (Moyle 2002).

With some exceptions, nonnative species, such as green sunfish, bluegill, white and channel catfish, and largemouth bass, spawn later in the spring and in the summer. Nonnative species are more successful in disturbed environments than native species. In general, they are adapted to warm, slow-moving and nutrient-rich waters (Moyle 2002).

Shasta, Lewiston, Oroville, Folsom, Pardee and Camanche Reservoirs support cold- and warmwater fisheries that are composed primarily of nonnative fishes. Coldwater species include rainbow trout, kokanee, and brown trout. Warmwater species include largemouth bass, smallmouth bass and other sunfish, channel catfish and bullheads, and common carp. The exact species composition of each reservoir varies according to different species introductions and hatchery supplementation (Moyle 2002). Most reservoirs are relatively artificial ecosystems that rarely meet all the needs of the species present. Factors such as water-level fluctuation, limited cover and spawning habitat, and inadequate forage base may affect the reproductive success of reservoir species and the capacity for supporting sustainable populations.

Factors That Affect Abundance of Fish Species

Information relating abundance with environmental conditions is most available for listed species, especially chinook salmon. The following section, therefore, focuses on factors that have potentially affected the abundance of listed species in the Central Valley. Although not specifically referenced, many of the factors discussed for the listed species also have affected the abundance of other native and nonnative species.

The decline of chinook salmon, steelhead, and other species in the Sacramento River and its tributaries is attributed to a number of factors that have acted upon the populations in a cumulative fashion over decades. These factors include reduced key habitat quantity, reduced migration habitat conditions, warm water temperature, increased contaminants, entrainment in diversions, increased predation, reduced food, hatchery effects, and harvest.

Spawning Habitat Area

Spawning habitat area may limit the production of juveniles and subsequent adult abundance of some species. Spawning habitat area for fall-/late fall–run chinook salmon, which compose more than 90% of the chinook salmon returning to the Central Valley streams, has been identified as limiting their population abundance. Spawning habitat area has not been identified by NOAA Fisheries as a limiting factor for the less abundant winter-run and spring-run chinook salmon, although habitat may be limiting in some streams during years of high adult abundance.

Spawning habitat area is defined by a number of factors such as gravel size and quality and water depth and velocity. Although maximum usable gravel size depends on fish size, a number of studies have determined that chinook salmon require gravel ranging from approximately 0.3 cm (0.1 inch) to 15 cm

(5.9 inches) in diameter (Raleigh et al. 1986). Steelhead prefer substrate no larger than 10 cm (3.9 inches) (Bjornn and Reiser 1991). Water depth criteria for spawning vary widely, and there is little agreement among studies about the minimum and maximum values for depth (Healey 1991). Salmonids spawn in water depths that range from a few inches to several feet. A minimum depth of 0.8 foot for chinook salmon and steelhead spawning has been widely used in the literature and is within the range observed in some Central Valley rivers (California Department of Fish and Game 1991). In general, water depth should be at least deep enough to cover the adult fish during spawning. Minimum water depth for steelhead spawning has been observed to be at least deep enough to cover the fish (Bjornn and Reiser 1991). Many fish spawn in deeper water. Velocity that supports spawning ranges from 0.8 foot per second to 3.8 feet per second (U.S. Fish and Wildlife Service 1994).

Delta smelt spawn in freshwater at low tide on aquatic plants, submerged and inshore plants and over sandy and hard bottom substrates of sloughs and shallow edges of channels in the upper Delta and Sacramento River above Rio Vista (Wang 1986; Moyle 2002).

A lack of sufficient seasonally flooded vegetation may limit splittail spawning success (Young and Cech 1996). Splittail spawn over flooded vegetation and debris mostly, on floodplains that are inundated by high flow from February to early July in the Sacramento River and San Joaquin River. The onset of spawning appears to be associated with rising water levels, increasing water temperature, and day length (Moyle 2002). The Sutter and Yolo bypasses along the Sacramento River are important spawning habitat areas during high flow.

Rearing Habitat Area

Rearing habitat area may limit the production of juveniles and subsequent adult abundance of some species. USFWS has indicated rearing habitat area limits the abundance of juvenile fall-run and late fall–run chinook salmon and juvenile steelhead. Rearing habitat for salmonids is defined by environmental conditions such as water temperature, dissolved oxygen, turbidity, substrate, water velocity, water depth, and cover (Jackson 1992; Bjornn and Reiser 1991; Healey 1991).

Environmental conditions and interactions between individuals, predators, competitors, and food sources determine habitat quantity and quality and the productivity of the stream (Bjornn and Reiser 1991). Everest and Chapman (1972) found juvenile chinook salmon and steelhead of the same size using similar in-channel rearing area. Juvenile coho salmon use side-channel pools. Coho salmon prefer low velocity areas with good cover, especially in the winter (Bjornn and Reiser 1991).

Rearing area varies with flow. High flow increases the area available to juvenile chinook salmon because they extensively use submerged terrestrial vegetation on the channel edge and the floodplain. Deeper inundation provides more overhead cover and protection from avian and terrestrial predators than shallow water

(Everest and Chapman cited in Jackson 1992). In broad, low-gradient rivers, change in flow can greatly increase or decrease the lateral area available to juvenile chinook salmon, particularly in riffles and shallow glides (Jackson 1992).

Rearing habitat for delta smelt encompasses the lower reaches of the Sacramento River below Isleton, the San Joaquin River below Mossdale, through the Delta and into Suisun Bay. USFWS (1996) has indicated that loss of rearing habitat area would adversely affect the abundance of larval and juvenile delta smelt. The area and quality of estuarine rearing habitat is assumed to be dependent on the downstream location of approximately 2 ppt salinity (Moyle et al. 1992). The condition where 2-ppt salinity is located in the Delta is assumed to provide less habitat area and lower quality than the habitat provided by 2-ppt salinity located farther downstream in Suisun Bay. During years of average and high outflow, delta smelt may concentrate anywhere from the Sacramento River around Decker Island to Suisun Bay (Moyle 2002). This geographic distribution may not always be a function of outflow and 2-ppt isohaline position. Outflow and the position of the 2-ppt isohaline may account only for about 25% of the annual variation in abundance indices for delta smelt (California Department of Water Resources and U.S. Bureau of Reclamation 1993).

Rearing habitat has not been identified as a limiting factor in splittail population abundance, but as with spawning, a lack of sufficient seasonally flooded vegetation may be limiting population abundance and distribution (Young and Cech 1996). Rearing habitat for splittail encompasses the Delta, Suisun Bay, Suisun Marsh, the lower Napa River, the lower Petaluma River, and other parts of the San Francisco Bay (Moyle 2002). In Suisun Marsh, splittail concentrate in the dead-end sloughs that have small streams feeding into them (Daniels and Moyle 1983; Moyle 2002). As splittail grow, salinity tolerance increases (Young and Cech 1996). Salinity is not a limiting factor as splittail is able to tolerate salinity concentrations as high as 29 ppt (Moyle 2002).

Migration Habitat Conditions

The Sacramento, Feather, American, and Mokelumne Rivers and the Delta provide a migration pathway between freshwater and ocean habitats for adult and juvenile steelhead and all runs of chinook salmon. The Trinity River provides a migration pathway to coho salmon, chinook salmon, and steelhead.

Migration habitat conditions include streamflows that provide suitable water velocities and depths that provide successful passage. Flow in the Sacramento, Feather, American, Mokelumne Rivers and in the Delta provide the necessary depth, velocity, and water temperature. However, within the Delta, the Delta channel pathways affect migration of juvenile chinook salmon. Juvenile chinook salmon survival is lower for fish migrating through the central Delta (i.e., diverted into the Delta Cross Channel and Georgiana Slough) than for fish continuing down the Sacramento River (Newman and Rice 1997).

Larval and early juvenile delta smelt are transported by currents that flow downstream into the upper end of the mixing zone of estuary where incoming saltwater mixes with out-flowing freshwater (Moyle et al. 1992). Reduced flow may adversely affect transport of larvae and juveniles to rearing habitat.

Adult splittail gradually move upstream during the winter and spring months to spawn. Year class success of splittail is positively correlated with wet years, high Delta outflow, and floodplain inundation (Sommer et al. 1997; Moyle 2002). Low flow impedes access to floodplain areas to spawn.

Water Temperature

Fish species have different responses to water temperature conditions depending upon their physiological adaptations. Chinook salmon, coho salmon, and steelhead have evolved under conditions in which water temperatures are fairly cool. Delta smelt and splittail can tolerate warmer temperatures. In addition to species-specific thresholds, different life stages have different water temperature requirements. Eggs and larval fish are the most sensitive to warm water temperature.

Unsuitable water temperatures for adult chinook salmon, steelhead and coho salmon during upstream migration lead to delayed migration and potential lower reproduction. Elevated summer water temperature in holding areas cause mortality of spring-run chinook salmon (U.S. Fish and Wildlife Service 1996). Warm water temperature and low dissolved oxygen also result in an increase of egg and fry mortality. USFWS (1996) cited elevated water temperatures as limiting factors for fall- and late fall–run chinook salmon.

Juvenile salmonid survival, growth, and vulnerability to disease is affected by water temperature. In addition, water temperature affects prey species abundance and predator occurrence and activity. Juvenile salmonids alter their behavior depending on water temperature, including movement to take advantage of local water temperature refugia (e.g., movement into stratified pools, shaded habitat, and subsurface flow) and to improve feeding efficiency (e.g., movement into riffles).

Water temperature in Central Valley rivers frequently exceeds the tolerance of chinook salmon and steelhead life stages. Based on a literature review, conditions supporting adult chinook salmon migration are assumed to deteriorate as temperature warms between 54ºF and 70ºF (Hallock 1970 as cited in McCullough 1999). For chinook salmon eggs and larvae, survival during incubation is assumed to decline with increasing temperature between 54ºF and 61ºF. (Myrick and Cech 2001; Seymour 1956 cited in Alderice and Velsen 1978). For juvenile chinook salmon, survival is assumed to decline as temperature warms from 64ºF to 75ºF (Myrick and Cech 2001; Rich 1987). Relative to rearing, chinook salmon require cooler temperatures to complete the parr-smolt transformation and to maximize their saltwater survival. Successful smolt transformation is assumed to deteriorate at temperatures ranging from 63ºF to 73ºF (Marine 1997 as cited in Myrick and Cech 2001, Baker et al. 1995).

For steelhead, successful adult migration and holding is assumed to deteriorate as water temperature warms between 52ºF and 70ºF. Adult steelhead appear to be much more sensitive to thermal extremes than are juveniles (National Marine Fisheries Service 1996a; McCullough 1999). Conditions supporting steelhead spawning and incubation are assumed to deteriorate as temperature warms between 52ºF and 59ºF (Myrick and Cech 2001). Juvenile rearing success is assumed to deteriorate at water temperatures ranging from 63ºF to 77ºF (Raleigh et al. 1984; Myrick and Cech 2001). Relative to rearing, smolt transformation requires cooler temperatures and successful transformation occurs at temperatures ranging from 43ºF to 50ºF. Juvenile steelhead, however, have been captured at Chipps Island in June and July at water temperatures exceeding 68ºF (Nobriega and Cadrett 2001). Juvenile chinook salmon have also been observed to migrate at water temperatures warmer than expected based on laboratory experimental results (Baker et al. 1995).

Delta smelt and splittail populations are adapted to water temperature conditions in the Delta. Delta smelt may spawn at temperatures as high as 72ºF (U.S. Fish and Wildlife Service 1996) and can rear and migrate at temperatures as warm as 82ºF (Swanson and Cech 1995). Splittail may withstand temperatures as warm as 91ºF and prefer a temperature range between 66ºF and 75ºF (Young and Cech 1996).

Contaminants

In the Sacramento and San Joaquin River basins, industrial and municipal discharge and agricultural runoff introduce contaminants into rivers and streams that ultimately flow into the Delta. Organophosphate insecticides, such as carbofuran, chlorpyrifos, and diazinon, are present throughout the Central Valley and are dispersed in agricultural and urban runoff. These contaminants enter rivers in winter runoff and enter the estuary in concentrations that can be toxic to invertebrates. Because they accumulate in living organisms, they may become toxic to fish species especially those life stages that remain in the system year-round and spend considerable time during the early stages of development such as chinook salmon, steelhead, splittail, and delta smelt.

Predation

Nonnative species cause substantial predation mortality on native species. Studies at Clifton Court Forebay estimated predator-related mortality of hatchery-reared fall-run chinook salmon from about 60% to over 95%. Although the predation contribution to mortality is uncertain, the estimated mortality suggests that striped bass and other predatory fish, primarily nonnative, pose a threat to juvenile chinook salmon moving downstream, especially where the stream channel has been altered from natural conditions (California Department of Water Resources 1995). Turbulence after passing over dams and other structures may disorient juvenile chinook salmon and steelhead, increasing their vulnerability to predators. Predators such as striped bass, largemouth bass, and catfish also prey on delta smelt and splittail (U.S. Fish and Wildlife Service 1996). However, the extent that these predators may affect delta smelt and splittail populations is unknown.

Food

Food availability and type affect survival of fish species. Species such as threadfin shad and wakasagi may affect delta smelt survival through competition for food. Introduction of nonnative food organisms may also have an effect on delta smelt and other species survival. Nonnative zooplankton species are more difficult for small smelt and striped bass to capture, increasing the likelihood of larval starvation (Moyle et al. 2002). Splittail feed on opossum shrimp which in turn feed on native copepods that have shown reduced abundance, potentially attributable to the introduction of nonnative zooplankton and the Asiatic clam *Potamorcorbula amurensis*. In addition, flow affects the abundance of food in the Delta and Suisun Bay. In general, higher flows result in higher productivity, including the higher input of nutrients from channel margin and floodplain inundation and higher production resulting when low salinity occurs in the shallows of Suisun Bay. Higher productivity increases the availability of prey organisms for delta smelt and other fish species.

Entrainment

All fish species are entrained to varying degrees by the SWP and CVP Delta export facilities and other diversions in the Delta and Central Valley rivers. Fish entrainment and subsequent mortality is a function of the size of the diversion, the location of the diversion, the behavior of the fish, and other factors, such as fish screens, presence of predatory species, and water temperature. Low approach velocities are assumed to minimize stress and protect fish from entrainment.

The CVP and SWP fish facilities indicate entrainment of adult delta smelt during spawning migration from December through April (California Department of Water Resources and U.S. Bureau of Reclamation 1993). Juveniles are entrained primarily from April through June. Young-of-year splittail are entrained between April and August when fish are moving downstream into the estuary (Cech et al. 1979 as cited in Moyle 2002). Juvenile chinook salmon are entrained in all months, but primarily from November through June when juveniles are migrating downstream.

Environmental Consequences

Methods

The assessment of effects considers the occurrence and potential occurrence of species and life stages relative to the magnitude, timing, frequency, and duration of project activities, including construction of the diversion and conveyance facilities and water supply operations. Species habitat attributes potentially affected by construction activities include spawning habitat area, rearing habitat area, migration habitat conditions, contaminants, and predation. Construction effects are evaluated qualitatively, although the area of channel bank and bottom disturbed by construction is quantified.

Species habitat attributes potentially affected by water supply operations include spawning habitat area, rearing habitat area, migration habitat conditions, water temperature, food, and entrainment in diversions. The assessment of water supply operations effects is based on simulation of reservoir storage, river and Delta flow, diversions and exports, and water temperature. Under the proposed alternatives, reservoir operations, river flow, diversions and Delta exports were simulated by the CALSIM Water Resources Simulation Model and the EBMUDSIM Model (i.e., Mokelumne River system) for water years 1922 through 1993. The simulation is described in Chapter 3, "Hydrology, Water Supply, and Power" The simulation models and methods applied to assess the species response to simulated changes in flow and water temperature are discussed below.

Spawning Area and Rearing Area: Response to Changes in Flow

The assessment of changes in river flow on salmonid spawning and rearing habitat is qualitative. Relative to the base case, a meaningful change in habitat is assumed to occur when the change in flow equals or exceeds approximately 10%. The 10% criterion is based on the assumption that changes in flow less than 10% are generally not within the accuracy of flow measurements and will not result in measurable changes to fish habitat area.

Assessment of flow effects on spawning habitat is based on the estimated spawning habitat area provided by flows during the spawning and incubation period. Relationships between streamflow and spawning habitat area have been developed from existing instream flow studies (Jones & Stokes Associates 1994). Instream flow studies have indicated that spawning and rearing habitat for chinook salmon is most sensitive to changes in lower flows (California Department of Fish and Game 1991; U.S. Fish and Wildlife Service 1985). Spawning habitat peaks at about 1,500 to 2,000 cfs on the American River. Flow reductions, when flow is less than about 1,000 cfs can substantially reduce spawning habitat area. For flows higher than 1,000 cfs, changes in flow have little effect on habitat area. A similar relationship exists for the Mokelumne, although the applicable flow is about 300 to 400 cfs (California Department of Fish and Game 1991). Habitat area peaks at about 5,500 cfs in the Sacramento River and at about 500 to 2500 cfs in the Feather River. Habitat area declines with flows below and above the peak flows for habitat. Flows greater than the flow needed to provide the maximum habitat area are assumed to have minimal effect and are not included in the assessment. Although flow-habitat relationships are different for steelhead and chinook salmon because of differences in substrate, depth, and velocity preferences, the relationships for chinook salmon are used in the analysis for both species. Relationships for steelhead were available only for the Mokelumne River (California Department of Fish and Game 1991). For the Mokelumne River, the change in habitat area with change in flow is similar for the two species.

Spawning habitat area is the minimum area that is provided by flow during the month of spawning and during subsequent months of incubation. Steelhead fry are assumed to emerge from the redd after 2 months of incubation, and chinook salmon are assumed to emerge from the redd after 3 months of incubation. Therefore, flows during two consecutive months are considered in the calculation of spawning and incubation habitat for steelhead and flows during three consecutive months are considered in the calculation for chinook salmon. The assumed occurrence of spawning each month is based on Table 5-3.

Rearing habitat area tends to reach maximum abundance at very low flows that inundate most of the river channel area. Rearing habitat area declines as flow increases primarily in response to increased average velocity. The reduction in habitat area with increasing flow is caused by the preference of low velocity areas by juvenile chinook salmon and steelhead fry. The relationship may be misleading because the flow-habitat relationship may not adequately reflect local habitat conditions (i.e., availability of low velocity) or the importance of flow-related habitat quality elements (e.g., water temperature conditions or cover and prey availability). This is especially true under overbank conditions. Given the uncertainty of flow-habitat relationships for rearing, the analysis of potential effects on rearing relies on the assessment of changes to low-flow conditions (e.g., flows for critical and dry year types). A change in flow of 10% or greater is considered in relation to the magnitude of the base flow. A 10% change in a flow of low magnitude (i.e., a flow that is less than the 25th percentile) is assumed to affect rearing habitat. Increased low magnitude flow is assumed to be beneficial and reduced low magnitude flow is assumed to be detrimental. The assumed occurrence of rearing each month is based on Table 5-3.

For delta smelt and striped bass, the area and quality of estuarine rearing habitat is assumed to be dependent on the downstream location of approximately 2 ppt salinity (Moyle et al. 1992). The condition where 2-ppt salinity is located in the Delta is assumed to provide less habitat area and lower quality than when 2-ppt salinity is located farther downstream in Suisun Bay. The parameter X2 (i.e., the distance in kilometers of the 2-ppt isohaline from the Golden Gate Bridge) is assumed to indicate the location of delta smelt rearing habitat. X2 is calculated from simulated net Delta outflow and is part of the output of Delta flow simulations (see Chapter 3, "Hydrology, Water Supply, and Power"). For X2 values less than 80 km (i.e., downstream of Collinsville), a lower X2 is assumed to reflect an increase in rearing habitat area and a higher X2 is assumed to reflect a reduction in habitat area. When X2 is greater than 80 km, change in X2 location is assumed to have little effect on habitat area.

For splittail, reduced floodflows are assumed to reduce spawning and rearing habitat area (Sommer et al. 1997). Floodflows are assumed to be any flow in excess of 30,000 cfs for the Sacramento River at Freeport.

Habitat Migration Conditions

Flows that occur in Central Valley rivers generally support migration of adult and juvenile chinook salmon and steelhead. From October through May, assessment of the effects on rearing and spawning habitat discussed above are assumed to indicate potential effects on migration habitat conditions in the rivers. During June through September, water temperature is a controlling factor affecting migration. Changes in flows that would substantially affect depth and velocity would also result in warmer water temperature. The assessment of water temperature conditions for adult migration will indicate potential changes in depth that could affect migration.

The Delta channel pathway affects migration habitat for steelhead and chinook salmon within the Delta. Juvenile chinook salmon survival is lower for fish migrating through the central Delta (i.e., diverted into the Delta Cross Channel and Georgiana Slough) than for fish continuing down the Sacramento River (Newman and Rice 1997). Juvenile chinook salmon are assumed to move in proportion to flow; therefore an increase in the proportion of flow diverted off the Sacramento River through the Delta Cross Channel and Georgiana Slough would be expected to increase mortality of juvenile chinook salmon. Steelhead are assumed to be similarly affected. The proportion of Sacramento River flow diverted into the Delta Cross Channel and Georgiana Slough is based on the simulated flow for the Sacramento River at Freeport and for the Delta Cross Channel and Georgiana Slough.

Reduced net Delta flow toward the Bay is assumed to adversely affect migration habitat for larval and early juvenile delta smelt and striped bass, slowing transport to estuarine rearing habitat and increasing vulnerability to entrainment in diversions (U.S. Fish and Wildlife Service 1996). Increased net flow is assumed to have an opposite and beneficial effect.

For splittail, reduced floodflows are assumed to adversely affect migration habitat (Sommer et al. 1997). Floodflows are assumed to be any flow in excess of 30,000 cfs for the Sacramento River at Freeport.

Water Temperature

Water temperature for the Trinity, Sacramento, Feather, and American Rivers was simulated by Reclamation's temperature model. The model simulates monthly temperature conditions in CVP and SWP reservoirs and at locations downstream from the discharge points, providing estimates of both longitudinal and monthly temperature. Model inputs include initial storage and temperature conditions, simulated reservoir storage, simulated model segment inflow, simulated model segment outflow, evaporation, solar radiation, and average air temperature. Release temperatures from reservoirs are computed for each outlet level of the dam. River temperatures are computed for each month at river locations represented by specific model segments. River temperatures are based on the quantity and temperature of the simulated reservoir release, normal climactic conditions, and tributary accretions. During warmer months (i.e., March through October), reservoir releases warm with distance downstream.

Temperature conditions were not simulated for the San Joaquin River; however, simulated changes in flow were small and effects on water temperature would be too small to predict. Water temperature was not simulated for the Mokelumne River, but the change in reservoir storage and river flow provided an indication of the potential change in water temperature. Whenever Pardee Reservoir volume exceeds 100,000 af, EBMUD currently manages Pardee and Camanche Reservoirs to maintain stratification with a minimum of 28,000 af of hypolimnetic volume in Camanche Reservoir through October (Mokelumne Joint Settlement Agreement). Reduction in Pardee Reservoir storage below 100,000 af is assumed to be detrimental to management of water temperature conditions.

The water temperature assessment consisted of simulated monthly water temperature effects for selected locations and all life stages of chinook salmon, steelhead, and coho salmon. Simulated monthly water temperature indicates the potential direction of effect when considered relative to species water temperature requirements. As water temperature increases toward the extremes of the tolerance range of a fish, biological responses, such as impaired growth and risk of disease and predation, are more likely to occur (Myrick and Cech 2001; Sullivan et al. 2000). Acceptable water temperatures identified in the available literature for chinook salmon and steelhead life stages fall within a relatively broad range (See the discussion above under Factors That Affect Abundance of Fish Species—Water Temperature). Conclusive studies of the thermal requirements completed for chinook salmon and steelhead in Central Valley streams are limited (Myrick and Cech 2001), but for the purposes of this impact assessment, survival indices are generally based on experimental tolerance studies reported in the literature, a use recommended by EPA and Armour (cited in Sullivan et al. 2000, Armour 1991).

Temperature survival indices were estimated for chinook salmon and steelhead life stages, including adult migration, spawning and incubation, rearing, and smolt migration (Table 5-4). The temperature survival indices are estimated from curves fitted to available data. The temperature survival relationships are similar to relationships used in previous studies of Central Valley chinook salmon and steelhead (e.g., Shasta Dam temperature control alternatives [U.S. Fish and Wildlife Service 1990]). The survival indices applied in this assessment support the comparison of alternatives and should not be considered as specific management recommendations or targets for water temperature management in Central Valley rivers.

Table 5-4. Temperature Survival Indices for Chinook Salmon and Steelhead

	Chinook Salmon				Steelhead			
Water Temperature (°F)	Adult Migration	Spawning/ Incubation	Juvenile Rearing	Smolt Migration	Adult Migration	Spawning/ Incubation[1]	Juvenile Rearing	Smolt Migration[2,]
50	100%	100%	100%	100%	100%	100%	100%	100%
51	100%	100%	100%	100%	100%	100%	100%	100%
52	100%	100%	100%	100%	100%	100%	100%	100%
53	100%	100%	100%	100%	100%	100%	100%	100%
54	100%	100%	100%	100%	100%	98%	100%	100%
55	100%	99%	100%	100%	100%	91%	100%	100%
56	100%	96%	100%	100%	99%	80%	100%	100%
57	100%	90%	100%	100%	98%	63%	100%	100%
58	99%	82%	100%	100%	96%	37%	100%	100%
59	97%	69%	100%	100%	94%	0%	100%	100%
60	94%	52%	100%	100%	90%	0%	100%	100%
61	91%	29%	100%	100%	87%	0%	100%	100%
62	87%	0%	100%	100%	82%	0%	100%	100%
63	81%	0%	100%	100%	76%	0%	100%	100%
64	74%	0%	100%	100%	69%	0%	100%	100%
65	66%	0%	100%	99%	61%	0%	100%	99%
66	57%	0%	97%	96%	52%	0%	100%	96%
67	46%	0%	93%	92%	42%	0%	98%	92%
68	33%	0%	87%	87%	29%	0%	95%	87%
69	18%	0%	77%	79%	16%	0%	90%	79%
70	0%	0%	65%	69%	0%	0%	83%	69%
71	0%	0%	48%	57%	0%	0%	73%	57%
72	0%	0%	27%	42%	0%	0%	61%	42%
73	0%	0%	0%	23%	0%	0%	45%	23%
74	0%	0%	0%	0%	0%	0%	25%	0%
75	0%	0%	0%	0%	0%	0%	0%	0%

[1] The temperature criteria used to develop the indices result in a need for cooler water temperatures than are identified for steelhead in the American River (City-County Office of Metropolitan Water Planning 1995). The need for cooler water temperatures is based on values in available literature (Myrick and Cech 2001).

[2] Survival indices for chinook salmon smolt migration are assumed to apply to steelhead; indices for adult migration, juvenile rearing, and juvenile migration of chinook salmon are assumed to apply to coho salmon.

Note: The survival indices in this table support the comparison of alternatives and should not be considered as specific management recommendations or targets for water temperature management in Central Valley rivers.

Entrainment

Increased diversions are assumed to increase entrainment of fish species encountering the diversion. The analysis is qualitative. For the Freeport intake facility and other river diversions, the entrainment effect is assumed to be related to the proportion of river flow diverted. For Delta exports, the entrainment effect is assumed to be related to the volume of exports. Fish screens are assumed to minimize entrainment losses for all species life stages, with the exception of delta smelt larvae.

Significance Criteria

Numerous environmental documents have been published over the past 10 years that have addressed potential impacts on Central Valley and coastal fish species. A review of significance criteria used in those previous documents was undertaken to determine appropriate significance thresholds for this EIR/EIS. Examples of the documents reviewed include, among others:

- Programmatic EIS for the Central Valley Project Improvement Act,
- Programmatic EIS for the CALFED Bay-Delta Program,
- Los Vaqueros Reservoir EIR/EIS,
- Delta Wetlands EIR/EIS, and
- Trinity River Restoration Program EIS.

Based on a review of these documents, as well as review of the potential impacts of the FRWP alternatives analyzed in this EIR/EIS, the significance criteria below were determined to be appropriate thresholds for this analysis.

Assessment species are selected based on listing under the Endangered Species Act, listing in environmental management plans (e.g., local environmental plans and state resource agency plans), and ecological, economic, or social importance. Impacts are considered significant if project actions potentially reduce the abundance and distribution of the identified important fish species. Significant impacts may occur if the project alternatives would result in:

- substantial interference with the movement of any resident or migratory fish species;
- substantial long- or short-term loss of habitat quality or quantity;
- substantial effect on rare or endangered species or habitat of the species; and
- substantial effect on fish communities or species protected by applicable environmental plans and goals.

Determination of significance requires that:

- environmental conditions are measurably changed by the project,
- the change in environmental conditions adversely affects a species or its habitat,
- the change in environmental conditions is permanent or ongoing or affects a substantial proportion of the species population, and
- the species population abundance is likely reduced, including short-term reduction.

Qualitative and quantitative relationships between environmental conditions and life stage survival are the basis of the impact assessment. Cause and effect relationships are identified for assessment species, including the relationship between environmental conditions and habitat, and the effects of changes in habitat on survival. Determination of significance requires qualitative or quantitative assessment of the population sensitivity to changes in survival of specific life stages.

Less-than-Significant Impacts

The impacts are presented by alternative, and are further divided into construction- and operation-related impacts. Construction-related impacts are those effects that occur during construction activities and the on-going effects of the physical element (e.g., the effects of pilings, riprap, or barriers). Operation-related impacts are those effects that result from operation of existing and proposed water supply project components, including reservoirs and export and diversion facilities (e.g., the effects of changes in reservoir storage, flow, and diversion). The assessment of construction and water supply operations effects are presented separately because effects of water supply operations affect a greater area, extending to upstream reservoirs and potentially into the Klamath-Trinity watershed. The broad geographic extent of operation-related effects is related to changes in CVP and SWP water supply operations in response to EBMUD facility operations on the Mokelumne River and diversion from the Sacramento River by EBMUD and SCWA, depending on the alternative. Flow may be affected in the Trinity, Sacramento, Feather, American, and Mokelumne Rivers and in the Delta. Storage may be affected in Trinity, Shasta, Oroville, Folsom, Pardee, and Camanche reservoirs. In addition, changes in flow may result in changes to exports from the Delta by the CVP and SWP.

Alternative 1

Construction-Related Impacts

Alternative 1 does not include any construction activities. Fish habitat is the same as under existing conditions.

Operation-Related Impacts

Alternative 1 does not include any changes to water supply operations, including changes to reservoir operations and diversions. Effects of flow and diversions on fish habitat conditions in the Trinity, Sacramento, Feather, American, Mokelumne and San Joaquin Rivers and the Delta will be the same as under existing water supply operations criteria. Effects of reservoir storage on fish habitat in Trinity, Shasta, Oroville, Folsom, Pardee, and Camanche Reservoirs would also be the same as under existing water supply operations criteria.

Alternatives 2–5

Construction-Related Impacts

Construction activities under Alternatives 2–5 potentially affect environmental conditions in the Sacramento and Mokelumne Rivers and in perennial and ephemeral drainages in Sacramento and San Joaquin Counties (Table 5-5). Impacts to fish species potentially result from changes in spawning habitat area, rearing habitat area, migration habitat conditions, contaminants, predation, and direct injury. Construction activities, however, would have no effect on coho salmon because coho salmon do not occur in the Central Valley.

The Sacramento River channel and bank would be affected by construction of the facilities that would divert water from the Sacramento River near Freeport. Construction of fish screens, pumps, and pipelines would disturb the existing channel bottom and bank over an area about 200 feet long and 100 feet wide. A permanent structure 100–125 feet long, 30–40 feet wide, and about 70 feet high would be added to the Sacramento River channel. The structure would permanently change existing substrates and local hydraulic conditions.

Construction would require between 2 and 3 years and would include construction of a sheet-pile cofferdam. Construction of the cofferdam and other site preparation activities (i.e., dredging) would disturb several hundred feet of channel bank and contiguous channel bottom. Excavation and construction of the intake facility would occur within the cofferdam, following pumping to dry the interior.

Conveyance and water treatment facilities would be constructed outside of the Sacramento River levees. Conveyance facilities would cross tributaries to the

Sacramento River and the Delta, potentially disturbing streambanks and channels. With the exception of the Mokelumne River crossing, the conveyance pipeline would cross ephemeral and urban streams that do not support listed fish species (e.g., Morrison Creek and Dry Creek). Construction effects would be primarily within the pipeline footprint, although contaminants and sediment could be carried by runoff into streams and the Delta. The pipeline may be tunneled beneath the water channel at stream crossings to avoid disruption of flow and disturbance of bottom sediments. Tunneling is currently planned for the Mokelumne River crossing.

Spawning Habitat Area

Construction of the intake facility near Freeport would not affect spawning habitat for chinook salmon and steelhead because both species spawn well upstream from the intake facility construction site. Construction of the intake facility could adversely affect spawning habitat of delta smelt, splittail, and other species (e.g., smallmouth bass, green sunfish, and channel catfish). Delta smelt spawning has a low probability of occurring near the intake facility location. Most delta smelt spawn in Delta channels closer to Rio Vista and farther south in the Delta (see Figure 5-1). The existing bank is riprapped, unlikely to support splittail spawning because splittail spawn over flooded vegetation. Substrates similar to those at the proposed intake facility (i.e., riprap bank and sand-mud channel bottom) are extensive upstream and downstream of the intake location.

The pipeline would cross Morrison Creek, Dry Creek, and other small, mostly ephemeral, streams. If fish occur, the species are likely dominated by nonnative sunfish, catfish, and minnow species, including green sunfish, brown bullhead, and carp. Stream crossings would cause a temporary disturbance during construction, disrupting little if any spawning activity. In the Mokelumne River, the pipeline will be tunneled under the stream channel, avoiding any adverse effects on environmental conditions that support spawning habitat in the river.

Construction would have a less-than-significant impact on any fish species population because an inconsequential proportion of any species' spawning habitat would be affected and subsequent effects on abundance are unlikely. The amount of spawning habitat affected by construction for any species is very small relative to the spawning distribution of the affected species. Effects on spawning habitat for listed species are unlikely because of unsuitable existing substrates within the construction footprints.

Rearing Habitat Area

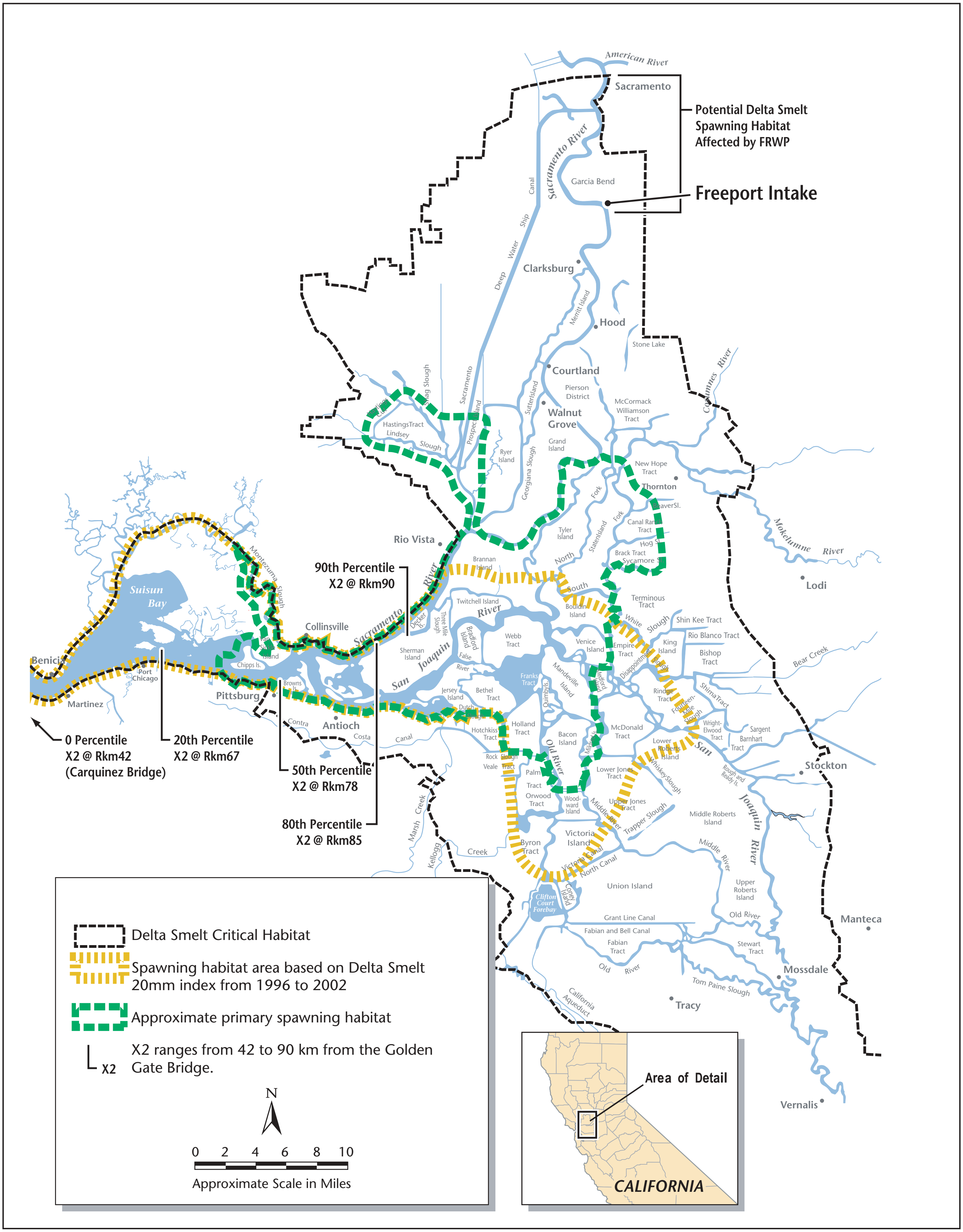
Construction of the intake facility near Freeport would not likely affect rearing habitat for steelhead and delta smelt. Steelhead rear in river reaches upstream of the intake facility location and would briefly pass the proposed intake location during juvenile and adult migration. Juvenile and adult delta smelt rear in the Delta downstream of the proposed intake location. Construction of the intake facility could adversely affect rearing habitat for chinook salmon, splittail, and other species, but the effects would be minimal. Rearing habitat within the footprint of the intake facility is very limited and of poor quality (i.e., riprapped bank) for species that prefer vegetated banks. Riprapped bank and sand-mud

Table 5-5. Potential Project Actions, Impact Mechanisms, and Affected Aquatic Environmental Conditions for Alternatives 2, 3, 4, 5, and 6

Alternative	Project Actions	Impact Mechanisms Associated with Implementing Project Actions	Affected Environmental Conditions
2, 3, 4, 5, and 6	Construct an intake structure, pumping facility, and fish screen facility on the Sacramento River near Freeport	Grade channel bank and channel bottom Place rock, concrete structure and other materials on the channel bank and bottom (e.g., rip-rap, pilings, fish screen) Potential accidental spill of petroleum products Grade and physically impact riparian area	Substrate: remove, disturb, or replace channel bottom and channel bank substrates Cover: Remove or disturb aquatic and riparian vegetation Physical injury: removal of organisms during grading or crushing organisms with placement of riprap and other materials Contaminants: petroleum products, concrete and other building materials Contaminants: suspended sediment from construction activities Channel dimensions: the presence of the facility will change the channel dimensions and affect hydraulics Predator effectiveness: the presence of the facility adds structure to the channel, potentially creating feeding areas for predator species and potentially creating hydraulic conditions that disorient prey.
2, 3, 4, 5, and 6	Construct pipelines connecting the intake structure to distribution points. The proposed route would cross several permanent and ephemeral streams, including the Morrison Creek. The proposed route crosses Dry Creek and the Mokelumne River for Alternatives 2, 3, 4, and 5. Alternative 6 would not include construction of pipelines to the Folsom South Canal or across Dry Creek and the Mokelumne River.	Remove and disturb channel bottom and channel bank substrate and vegetation (i.e., aquatic and riparian) Potential accidental spill of contaminants	Substrate: removes or disturbs channel bottom substrate Cover: removes or disturbs aquatic vegetation and may remove riparian vegetation Contaminants: petroleum products, concrete and other building materials Contaminants: suspended sediment

Alternative	Project Actions	Impact Mechanisms Associated with Implementing Project Actions	Affected Environmental Conditions
6	Construct a new dam and saddle dams to replace the existing Pardee Dam; construct a new powerhouse	Grade channel bank and channel bottom Blast within and near the channel Place rock, concrete structure and other materials on the channel bank and bottom (e.g., rock, concrete) Potential accidental spill of petroleum products Grade and physically impact riparian and upland areas	Substrate: remove, disturb, or replace channel bottom and channel bank substrates Cover: Remove or disturb aquatic and riparian vegetation Direct injury: crushing organisms with placement of rock, concrete, and other materials; physical injury by sound pressure waves during blasting Contaminants: petroleum products, concrete and other building materials Contaminants: suspended sediment from construction activities
6	Relocate State Route 49, Stony Creek Road, utilities, and existing Pardee Reservoir recreation areas	Grade channel bank Place rock, concrete structure and other materials on the channel bank and bottom (e.g., rip-rap, pilings) Potential accidental spill of petroleum products Grade and physically impact riparian and upland areas	Substrate: remove, disturb, or replace channel bank substrates Cover: Remove or disturb riparian vegetation Contaminants: petroleum products, concrete and other building materials Contaminants: suspended sediment from construction activities
6	Breach the existing Pardee Dam.	Break and blast a notch in the dam and blast the plug in the low level tunnel	Substrate: replace channel bottom and channel bank substrates Direct injury: crushing organisms with placement of broken concrete and other materials; physical injury by sound pressure waves during blasting Contaminants: petroleum products, concrete and other building materials Contaminants: suspended sediment from blasting and demolition activities

Alternative	Project Actions	Impact Mechanisms Associated with Implementing Project Actions	Affected Environmental Conditions
2, 3, 4, 5, and 6	Change in water supply project operations, potentially affecting Trinity, Shasta, Oroville, Folsom, and Pardee and Camanche reservoirs; Trinity, Sacramento, Feather, American, and Mokelumne Rivers; the Delta and San Francisco Bay/Estuary	Change in upstream reservoir operations Change in Delta exports New diversion on the Sacramento River	Reservoir surface area and shallow water area: operations may change the seasonal stage of reservoirs; change in rate-of-change for stage Flow depth and velocity: operations may change the seasonal releases from reservoirs and export operations, altering river and delta channel flow Substrate: could be affected depending on the magnitude of river flow change Cover: could be affected depending on the magnitude of river flow change Water temperature: operations may affect reservoir storage and river flow, subsequently affecting water temperature Outside nutrient input: could be affected depending on the magnitude of river flow change Net flow direction: depending on Delta inflow and export changes Salinity: depending on Delta outflow changes Diversion volume: change in Delta exports and new diversion near Freeport



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Jones & Stokes

Figure 5-1
Delta Smelt in the Sacramento-San Joaquin Delta

channel bottom is extensive upstream and downstream of the intake location and construction of the intake would affect a very small proportion of similar substrates.

The pipeline would cross Morrison Creek, Dry Creek, and other small, mostly ephemeral, streams. If fish occur, the species are likely dominated by nonnative sunfish, catfish, and minnow species, including green sunfish, brown bullhead, and carp. Stream crossings would cause a temporary disturbance during construction, disrupting little if any rearing activity over a relatively short period of time. In the Mokelumne River, the pipeline will be tunneled under the stream channel, avoiding any adverse effects on environmental conditions that support rearing habitat in the river.

The amount of rearing habitat affected by construction for any species is small and effects on rearing habitat for listed species are unlikely because of unsuitable existing substrates within the construction footprints. Construction would have a less-than-significant impact on any fish species population because a small proportion of any species' rearing habitat would be affected and subsequent effects on abundance are unlikely.

Migration Habitat Conditions

Construction of the intake facility near Freeport would affect a small proportion of the channel cross section and would not alter depth and velocity conditions that support migration and movement of fish through the unaffected part of the channel cross section. The construction area will be isolated with sheet piles, avoiding disturbance of fish passing the construction area. The pipeline crossings could temporarily create conditions that block fish movement, but Morrison Creek, Dry Creek, and other small, mostly ephemeral, streams do not support anadromous species that require continuity to habitat required for spawning and rearing life stages. In addition, stream crossings may cause a temporary disturbance during construction, disrupting little if any depth and velocity conditions that support movement of fish species. In the Mokelumne River, the pipeline will be tunneled under the stream channel, avoiding any adverse effects on environmental conditions that support movement and migration of fish species in the river.

Construction would have a less-than-significant impact on the movement of any fish species because passage conditions are maintained in anadromous species habitat.

Contaminants

Contaminants accidentally introduced during construction activities to the Sacramento River, Mokelumne River, and small streams could adversely affect fish species and their habitat. Environmental commitments, including an erosion and sediment control plan, storm water pollution prevention plan, hazardous materials management plan, hydrologic simulation modeling and scour analysis, spoils disposal plan, and environmental training, will be developed and implemented before and during construction activities (Chapter 2, "Project Description"). The environmental commitments would eliminate the likelihood of any substantial contaminant input. Contaminants would have a less-than-significant adverse impact on any fish species because the potential for increased contaminant input following implementation of environmental commitments is small.

Predation

Construction of fish screens, intake bays, and pumps would add permanent structure and cover to the Sacramento River channel near Freeport. The presence of natural or artificial cover (e.g., pilings, piers, trees, or aquatic plants) in rivers is known to attract relatively high concentrations of fish (Johnson and Stein 1979). Cover can disrupt flow patterns and provide fish with refuge from elevated water velocity (Shirvell 1990). Food may also be more abundant in areas with cover (Johnson et al. 1988). The addition of structure has the potential to increase the density of predator species and predation on fish moving around and past the structure.

Juvenile chinook salmon and other fish species are known to be vulnerable to predators at locations such as Red Bluff Diversion Dam (RBDD), Clifton Court Forebay, and release sites for fish salvaged from the SWP and CVP facilities (Hall 1980; Pickard et al. 1982, U.S. Bureau of Reclamation 1983). These facilities and release sites create relatively high concentrations of juvenile salmonids and other fish species that may be substantially disoriented by turbulence and handling associated with diversion, flow constriction, bypasses, and salvage. Concentrations of disoriented fish increase prey availability and create predator habitat. Juvenile steelhead may be similarly vulnerable.

Predation associated with the addition of the intake facility and fish screens to the river channel could cause a small, and likely negligible, increase in mortality of the fish moving past the structure in the Sacramento River. Design elements, which are required by the various resource agencies, will minimize and avoid adverse effects related to scour and erosion and minimize turbulence that could disorient fish and increase vulnerability to predation.

The intake would also not substantially increase the concentration of fish life stages that may be prey for predator species near the intake facility. As indicated in the following section on diversions, the maximum percentage of Sacramento River flow diverted in any month of any year is small. The concentration of fish, given the relatively small proportion of flow removed, would not be substantially altered relative to the existing condition. In addition, the sweeping velocities past the fish screen would be consistent with existing flow velocity in the Sacramento River. The transition zones between various elements of the intake facility (e.g., sheet piles and riprap) could provide low-velocity holding areas for predatory fish (Vogel pers. comm.). Predatory fish holding near the intake facility could prey on vulnerable species.

The additional predator habitat created by the intake facility and fish screen would have a less-than-significant adverse impact on any fish species because the increase in potential predator habitat is small relative to habitat in adjacent areas, and disorientation and concentration of juvenile fish would be minimal given the size and design of the diversion and fish screen facilities.

Direct Injury

Construction of the intake facility near Freeport would include placement of sheet piles and riprap and could directly injure fish present in the Sacramento River. Direct injury associated with construction would have a less-than-significant adverse impact on any fish species because the number of fish injured is likely small given that:

- the area of construction activity is small relative to the size of the river at Freeport,
- existing rearing habitat consists of riprap and sand-mud channel bottom that provides suitable habitat for a limited number of species,
- inwater construction would occur over a relatively short period (i.e., 2–3 years), and
- most fish would move away from construction activity.

Construction of the pipeline crossing of Morrison Creek could also injure fish. The species affected are likely dominated by nonnative sunfish, catfish, and minnow species that would be minimally affected by inwater construction that would affect a relatively small area over a short period of time. In the Mokelumne River, the pipeline will be tunneled under the stream channel, avoiding any direct injury to fish and other aquatic species.

Operation-Related Impacts

Water supply operations for the FRWP would include diversions under existing contracts with Reclamation and other water sources. In addition, diversions could affect operation of CVP and SWP reservoirs. Operation of the CVP and SWP Delta export facilities may also be affected. Consequently, changes in flow and diversions may affect fish and fish habitat in reaches of the Trinity, Sacramento, Feather, American, Mokelumne, and San Joaquin Rivers and in the Delta and Suisun Bay. Simulated flow and water temperature conditions are evaluated.

The simulated flow volume for 1922–1993 in the Sacramento, Feather, and American Rivers is nearly identical for Alternative 1 and Alternatives 2–5 (i.e., the volume of water flowing down the rivers to Freeport is unchanged). Only the pattern of flow changes, with reduction in flow for some months and years, and increases for other months and years (Figure 5-2). (Note: Points that fall off of the 45° line in the figures for flow indicate an increase (above the line) or a decrease (below the line) relative to the No Action.) The simulated change in flow pattern in response to FRWP demand causes a relatively small change in the timing and magnitude of downstream demands. The resulting change in simulated release pattern and storage is in response to implementation and interaction of operations rules within CALSIM II for the CVP and SWP facilities.

As shown in Figure 5-2, the simulated change in flow for any given month is nearly always very small, and flow changes that exceed 10% are infrequent. Specific effects on spawning and rearing habitat for chinook salmon and steelhead are discussed in following sections.

Simulated flow in the Trinity and San Joaquin Rivers is similar for Alternative 1 and Alternatives 2–5, with small and infrequent changes in month to month volume (Figure 5-3). In the Mokelumne River, flow is reduced by 10% or more during a few months, but flow is generally higher, sometimes substantially higher, under Alternatives 2–5 than under Alternative 1 (Figure 5-4). The generally higher flows result from higher water release requirements for fish in response to an increase in the number of water years classified as wetter when compared to Alternative 1. The water release requirements for fish for October–March increase in at least 13 water years, reflecting the increased occurrence of below-normal and above-normal year-types from 46 years under Alternative 1 to 54 years under Alternatives 2–5 (i.e., out of the 74-year simulation) (Chapter 3, "Hydrology, Water Supply, and Power"). Higher water releases for fish are also required during the April–September period, although the frequency is somewhat less.

As indicated above, the flow volume simulated for 1922–1993 in the Sacramento River upstream of the intake facility is similar for Alternative 1 and Alternatives 2–5 (Figure 5-2). The change in the pattern of Sacramento River flow affects the pattern of Delta inflow and outflow.

Although the intake facility removes water from the Sacramento River at Freeport and Delta inflow from the Sacramento River is reduced, changes in Delta inflow reflect the combined effect of FRWP diversions and upstream reservoir operations. Sacramento River inflow to the Delta affects the proportion of Sacramento River flow diverted into the Delta Cross Channel and Georgiana Slough. The change in Sacramento River flow is small and the proportion of Sacramento River flow diverted is similar for Alternative 1 and Alternatives 2–5 (Figure 5-5). The percentage change in the proportion of Sacramento River flow diverted into the DCC and Georgiana Slough is substantially less than 1% during almost all months (i.e., the proportion for the 90^{th} and 10^{th} percentiles).

Although Delta outflow is also slightly reduced under Alternatives 2–5 for some simulated months, the changes in outflow are small and consistent with existing salinity criteria. The change in Delta outflow affects the downstream extent of freshwater and the estuarine salinity distribution. The parameter X2 (i.e., the distance in kilometers of the 2-ppt isohaline from the Golden Gate Bridge) is an indicator of potential effects of Delta outflow changes on salinity distribution. Comparison of X2 for Alternative 1 and Alternatives 2–5 indicates minimal change in salinity distribution (Figure 5-6). The average change is 0.02 km (approximately 80 ft.), and both positive (upstream) and negative (downstream) changes occur in the simulations.

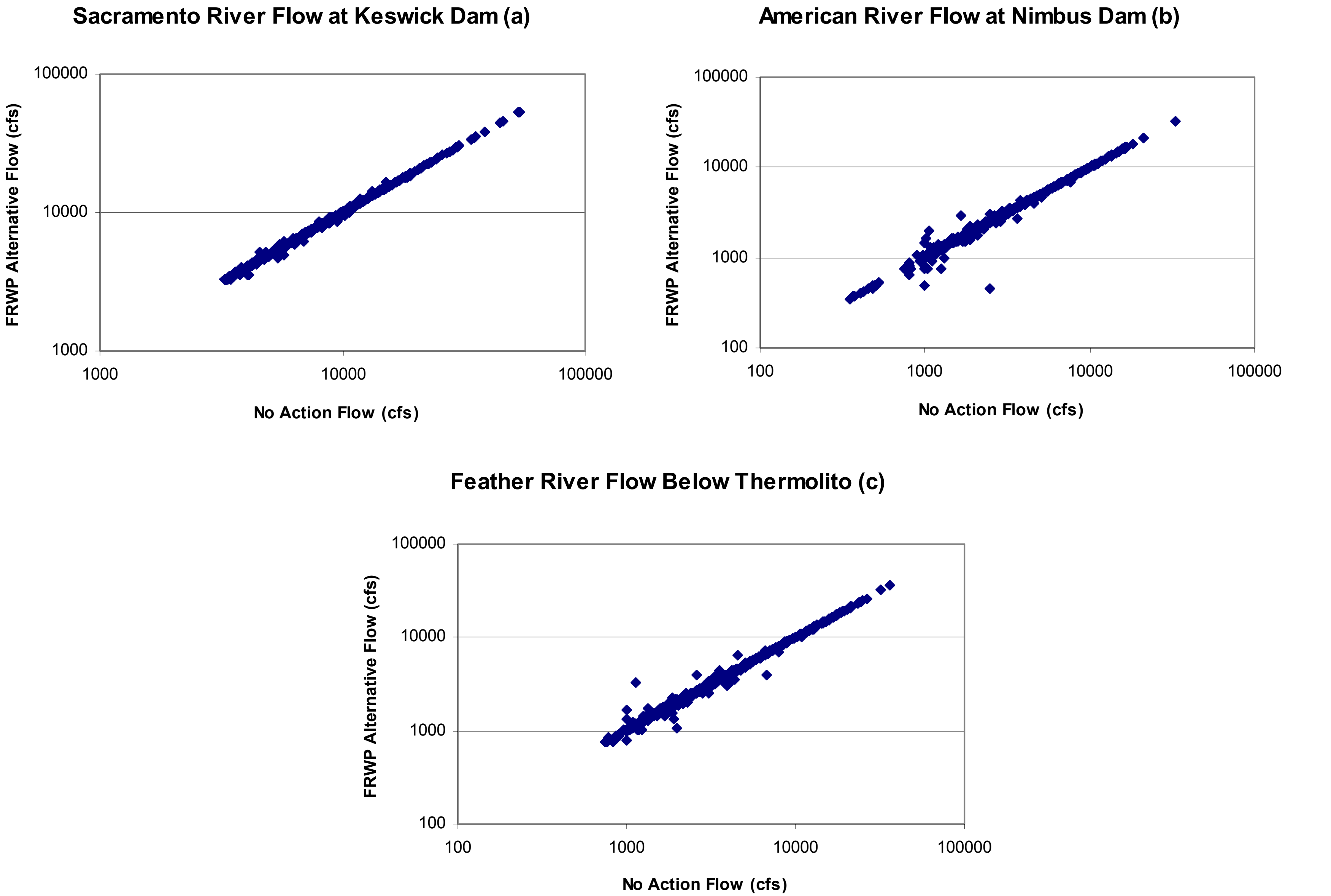
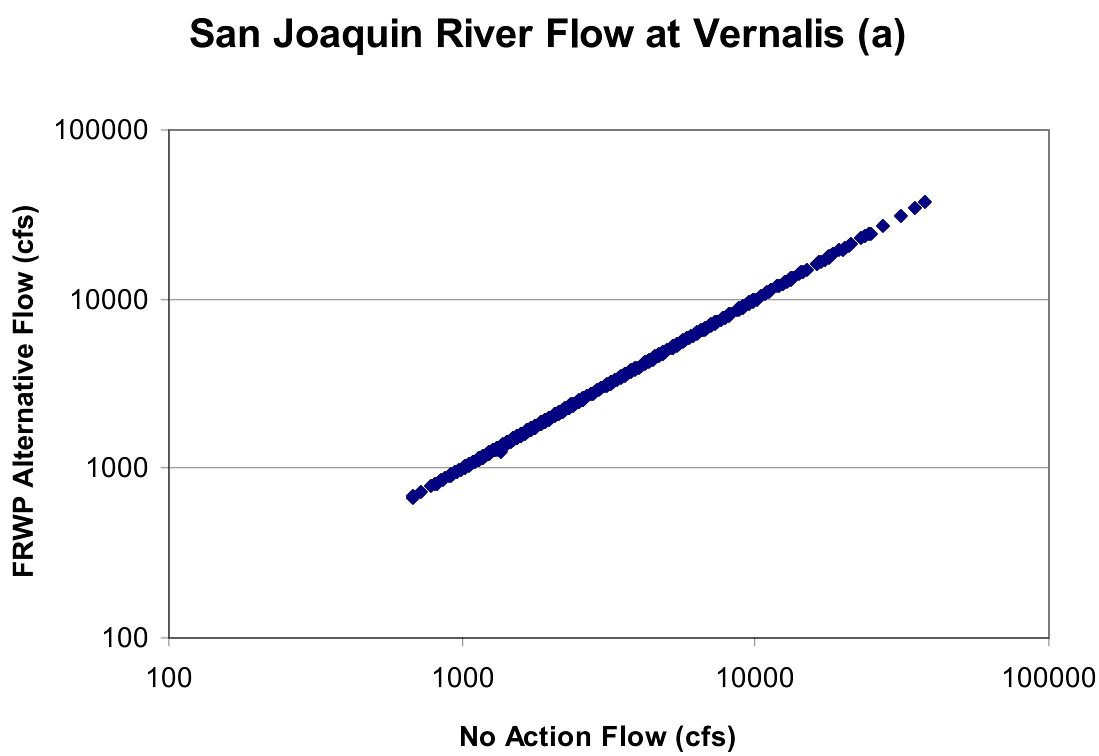


Figure 5-2
Comparison of Sacramento River, American River, and Feather River Flows under the FRWP Alternative and No Action, 1922 – 1993 Simulation (2001 Operations).



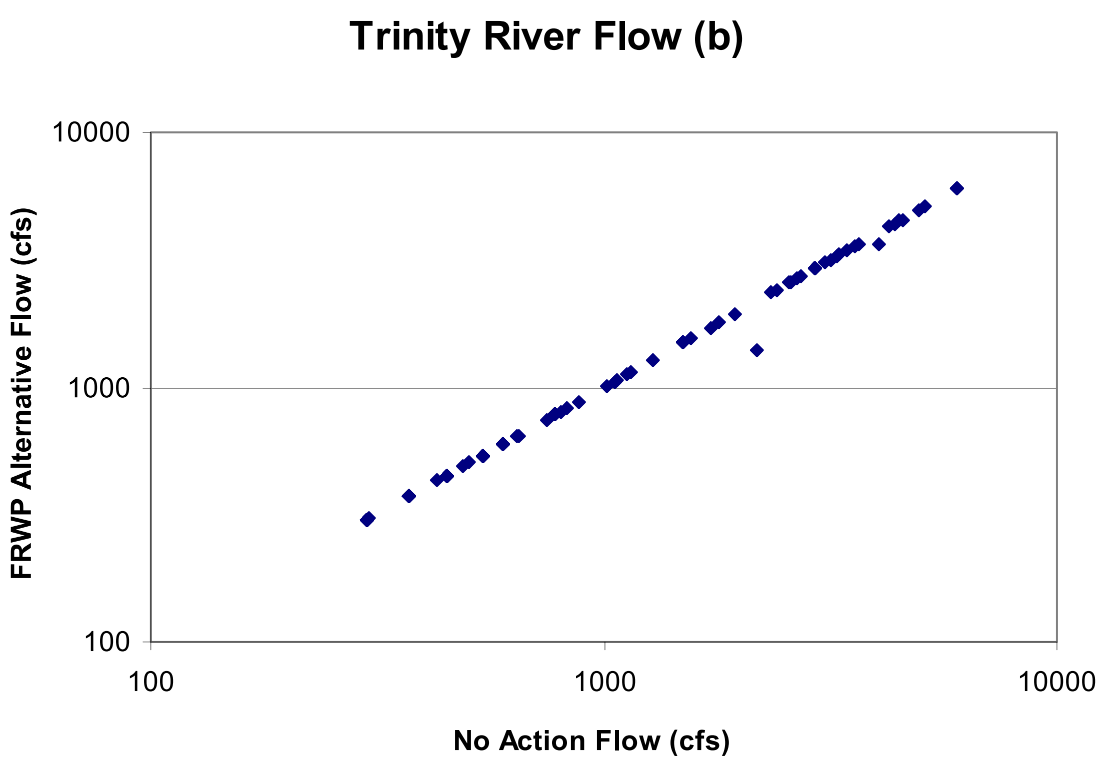


Figure 5-3
Comparison of San Joaquin River (a) and Trinity River Flows (b) under the FRWP Alternative and No Action, 1922 – 1993 Simulation (2001 Operations).

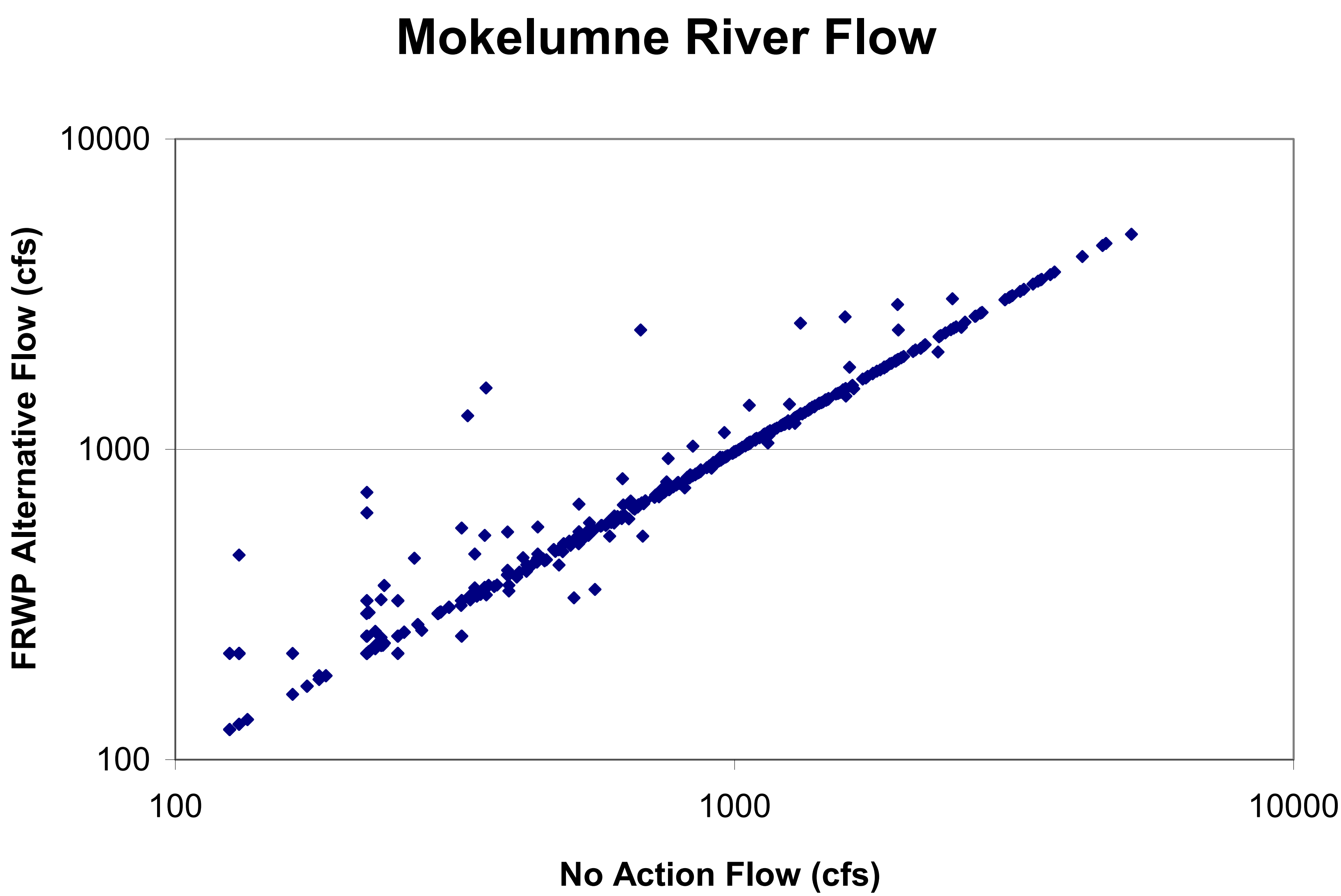


Figure 5-4
Comparison of Mokelumne River Flow under the FRWP Alternative and No Action, 1922 – 1993 Simulation (2001 Operations).

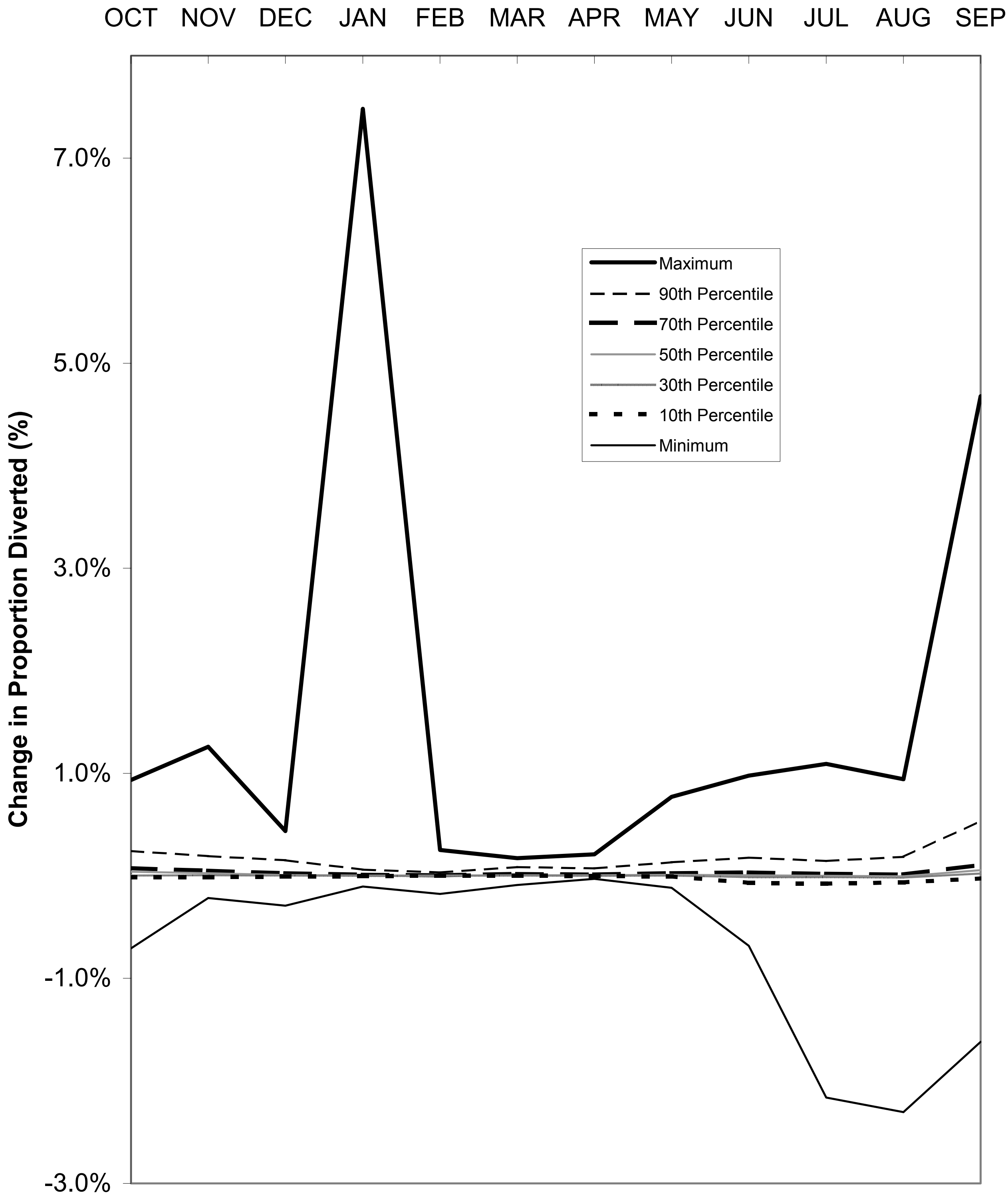


Figure 5-5
Change in the Proportion of Sacramento River Flow Diverted into the Delta Cross Channel & Georgiana Slough under the FRWP Alternative Relative to No Action, 1922 – 1993 Simulation (2001 Operations).

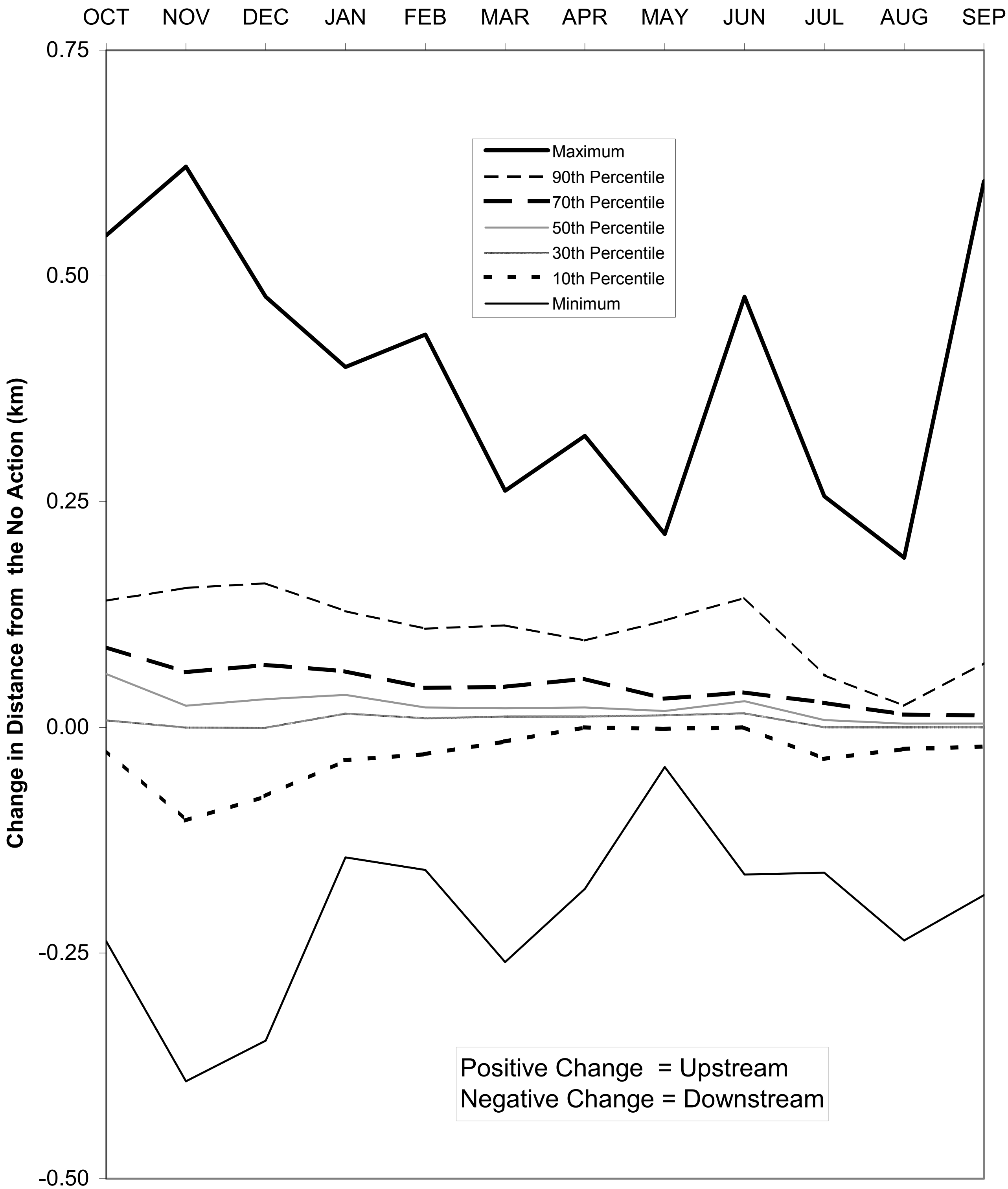


Figure 5-6
Change in X2 under the FRWP Alternative Relative to No Action, 1922 – 1993 Simulation (2001 Operations).

Spawning Habitat Area

Coho salmon spawn primarily in tributaries of the Klamath and Trinity Rivers. Spawning habitat affected by Trinity River flow is minimal because flow under Alternatives 2–5 is nearly identical to flow under Alternative 1 (Figure 5-3). Spawning habitat area would not be affected.

Steelhead and fall-/late fall–run chinook salmon spawn in the cool reaches of the Sacramento, Feather, American, and Mokelumne Rivers downstream of the terminal reservoirs. Steelhead eggs may be present from December through June (Table 5-3). The spawning and egg incubation period for fall-/late fall–run chinook salmon extends from October through May in the Sacramento River and October through February in the Feather, American, and Mokelumne Rivers. Winter-run chinook salmon spawn in the Sacramento River, generally above RBDD, and spring-run chinook salmon spawn in the cool reaches of the Sacramento and Feather Rivers. The spawning and egg incubation period for winter-run chinook salmon extends from April through September. The spawning and egg incubation period for spring-run chinook salmon extends from August through December.

The infrequent and relatively small flow changes in the Sacramento, Feather, American, and Mokelumne Rivers attributable to water supplied under Alternatives 2–5 have minimal effect on spawning habitat area (Table 5-6). The pattern of flows over consecutive months under Alternatives 2–5 supports spawning habitat for steelhead and chinook salmon that is consistent with habitat area in the Sacramento, Feather, and American Rivers for Alternative 1.

Table 5-6. Frequency of Occurrence for the Base Percentage (top) and Change in Percentage (bottom) of Spawning Habitat Area for Steelhead and Chinook Salmon in the Sacramento, Feather, American, and Mokelumne Rivers under Alternatives 2–5, 1922–1993 Simulation (2001 Operations)

	Sacramento River					Feather River		American River		Mokelumne River	
Base Percentage Area	Fall-Run Chinook Salmon	Late Fall–Run Chinook Salmon	Winter-Run Chinook Salmon	Spring-Run Chinook Salmon	Steelhead	Fall-Run Chinook Salmon	Steelhead	Fall-Run Chinook Salmon	Steelhead	Fall-Run Chinook Salmon	Steelhead
<+100%	200	171	89	195	265	210	322	147	268	117	232
<+90%	0	0	0	0	0	0	0	19	27	69	92
<+80%	0	0	0	0	0	0	0	4	3	0	0
<+70%	0	0	0	0	0	0	0	25	20	0	0
<+60%	0	0	0	0	0	0	0	0	0	36	46
<+50%	0	0	0	0	0	0	0	12	12	0	0
<+40%	0	0	0	0	0	0	0	5	0	0	0
<+30%	0	0	0	0	0	0	0	1	4	0	0
<+20%	0	0	0	0	0	0	0	0	0	0	0
<+10%	0	0	0	0	0	0	0	0	0	0	0
0%	0	0	0	0	0	0	0	0	0	0	0

	Sacramento River					Feather River		American River		Mokelumne River	
Change in Percentage Area	Fall-Run Chinook Salmon	Late Fall–Run Chinook Salmon	Winter-Run Chinook Salmon	Spring-Run Chinook Salmon	Steelhead	Fall-Run Chinook Salmon	Steelhead	Fall-Run Chinook Salmon	Steelhead	Fall-Run Chinook Salmon	Steelhead
<+100%	0	0	0	0	0	0	0	0	0	0	0
<+90%	0	0	0	0	0	0	0	0	0	0	0
<+80%	0	0	0	0	0	0	0	0	0	0	0
<+70%	0	0	0	0	0	0	0	0	0	0	0
<+60%	0	0	0	0	0	0	0	0	0	0	0
<+50%	0	0	0	0	0	0	0	0	0	0	1
<+40%	0	0	0	0	0	0	0	0	0	0	0
<+30%	0	0	0	0	0	0	0	0	0	12	16
<+20%	0	0	0	0	0	0	0	4	3	6	10
<+10%	0	0	0	0	0	0	0	2	2	2	0
0%	200	171	87	195	264	209	322	203	325	198	341
>-10%	0	0	0	0	0	0	0	0	1	1	0
>-20%	0	0	0	0	0	0	0	0	0	3	2
>-30%	0	0	0	0	0	0	0	3	2	0	0
>-40%	0	0	0	0	0	0	0	0	0	0	0
>-50%	0	0	0	0	0	0	0	1	1	0	0
>-60%	0	0	0	0	0	0	0	0	0	0	0
>-70%	0	0	0	0	0	0	0	0	0	0	0
>-80%	0	0	0	0	0	0	0	0	0	0	0
>-90%	0	0	0	0	0	0	0	0	0	0	0
>=-100%	0	0	0	0	0	0	0	0	0	0	0

In the Mokelumne River, reduction in flow reduced simulated spawning habitat for steelhead and fall-run chinook salmon for a few months (Table 5-6), but increased spawning habitat for both species would occur during substantially more months. The generally higher flows result from higher water release requirements for fish in response to an increase in the number of water years classified as wetter when compared to Alternative 1. As indicated previously, the water release requirements for fish for October–March increase in at least 13 water years, reflecting the increased occurrence of below-normal and above-normal year-types from 46 years under Alternative 1 to 54 years under Alternatives 2–5 (i.e., out of the 74-year simulation) (Chapter 3, "Hydrology, Water Supply, and Power"). The relatively small and infrequent change in spawning habitat is not expected to affect population abundance of chinook salmon and steelhead.

Delta smelt spawn in tidal freshwater areas. The small changes in Delta outflow, and subsequent small effects on X2 would not substantially affect the area and distribution of spawning habitat (Figure 5-6).

Splittail spawn over flooded vegetation. Although river flows would be affected by implementation of the FRWP, the affected flows are generally within the range of managed releases. The magnitude, timing, frequency, and duration of floodflows would not measurably change. Spawning habitat area available to splittail would not be affected by water supply operations under Alternatives 2–5.

Based on the effects described above, changes in flow would have no effect or a less-than-significant impact on spawning habitat for fish species in the Trinity, Sacramento, Feather, and American Rivers and in the Delta. Flow increases in the Mokelumne River may, overall, be beneficial.

Rearing Habitat Area

Juvenile coho salmon rear in the Trinity River year-round. Trinity River flow under Alternatives 2–5 is nearly identical to flow under Alternative 1 (Figure 5-3). Rearing habitat area would not be affected by changes in flow.

Central Valley steelhead rear year-round in the cool upstream reaches of the Sacramento, Feather, American, and Mokelumne Rivers. Juvenile chinook salmon may also be present year-round in Central Valley rivers, depending on the run (Table 5-3), but generally rear in river habitat for 2 to 8 months.

The flow volume simulated for 1922–1993 in the Sacramento, Feather, and American Rivers is nearly identical for Alternative 1 and Alternatives 2–5 (i.e., the volume of water flowing down the rivers to Freeport is unchanged) (Figure 5-2). Only the pattern of flow changes slightly, with reduction in flow for some months and years and increases for other months and years. Based on the analysis of changes in low-flow conditions, very few changes in rearing habitat are expected for the Sacramento, Feather, and American Rivers (Table 5-7).

Table 5-7. Frequency of Occurrence of the Percentage Change in Flow that Could Affect Rearing Habitat Area for Steelhead and Chinook Salmon in the Sacramento, Feather, American, and Mokelumne Rivers under Alternatives 2–5, 1922–1993 Simulation (2001 Operations)

	Sacramento River					Feather River		American River		Mokelumne River	
Percentage Change in Flow	Fall-Run Chinook Salmon	Late Fall–Run Chinook Salmon	Winter-Run Chinook Salmon	Spring-Run Chinook Salmon	Steelhead	Fall-Run Chinook Salmon	Steelhead	Fall-Run Chinook Salmon	Steelhead	Fall-Run Chinook Salmon	Steelhead
<+100%	0	0	0	0	0	0	0	0	0	0	0
<+90%	0	0	0	0	0	0	0	0	0	0	0
<+80%	0	0	0	0	0	0	0	0	0	0	0
<+70%	0	0	0	0	0	0	0	0	0	0	0
<+60%	0	0	0	0	0	0	0	0	0	0	0
<+50%	0	0	0	0	0	0	0	0	0	0	0

Percentage Change in Flow	Sacramento River					Feather River		American River		Mokelumne River	
	Fall-Run Chinook Salmon	Late Fall–Run Chinook Salmon	Winter-Run Chinook Salmon	Spring-Run Chinook Salmon	Steelhead	Fall-Run Chinook Salmon	Steelhead	Fall-Run Chinook Salmon	Steelhead	Fall-Run Chinook Salmon	Steelhead
<+40%	0	0	0	0	0	0	0	0	0	0	0
<+30%	0	0	0	0	0	0	0	0	0	0	0
<+20%	0	0	0	0	0	0	0	0	0	0	0
<+10%	0	0	0	0	0	0	0	0	0	0	0
0%	438	582	728	510	874	434	871	432	862	444	886
>-10%	0	0	0	0	0	0	0	0	0	0	0
>-20%	0	2	2	1	2	2	3	4	7	0	2
>-30%	0	0	0	0	0	1	1	1	4	0	0
>-40%	0	0	0	0	0	0	0	0	0	0	0
>-50%	0	0	0	0	0	1	1	1	1	0	0
>-60%	0	0	0	0	0	0	0	0	1	0	0
>-70%	0	0	0	0	0	0	0	0	0	0	0
>-80%	0	0	0	0	0	0	0	0	0	0	0
>-90%	0	0	0	0	0	0	0	0	1	0	0
>=-100%	0	0	0	0	0	0	0	0	0	0	0

Although flows in the Mokelumne River are generally higher under Alternatives 2–5 than under Alternative 1 (Figure 5-4), the change in rearing habitat area for steelhead and chinook salmon is minimal (Table 5-7). Steelhead and chinook salmon might benefit from other factors that correspond to increased flow (e.g., water temperature) in the Mokelumne River but would not be expected to respond to changes in habitat area.

Delta smelt rear in estuarine areas close to 2 ppt salinity (i.e., X2). During most months, implementation of the FRWP causes a slight upstream shift in X2 relative to Alternative 1 (i.e., average of less than 0.1 km) (Figure 5-6). The simulated slight upstream shift in X2 would be expected to have a minimal adverse effect on rearing habitat area for delta smelt.

As indicated above for splittail spawning, the magnitude, timing, frequency, and duration of floodflows would not measurably change under Alternatives 2–5and spawning habitat area available to splittail would not be affected relative to Alternative 1.

Based on the effects described above, changes in flow would have a less-than-significant adverse impact or beneficial effect on rearing habitat for fish species in the Trinity, Sacramento, Feather, American, and Mokelumne Rivers and in the Delta.

Migration Habitat Conditions

Juvenile coho salmon rear in the Trinity River year-round. Trinity River flow under Alternatives 2–5 is nearly identical to flow under Alternative 1 (Figure 5-3). Migration habitat conditions would not be affected by changes in flow.

The Sacramento, Feather, American, and Mokelumne Rivers provide a migration pathway between freshwater and ocean habitats for steelhead and chinook salmon. Flows that occur in Central Valley rivers generally support migration of adult and juvenile chinook salmon and steelhead. The flow volume simulated for 1922–1993 in the Sacramento, Feather, and American Rivers is nearly identical for Alternative 1 and Alternatives 2–5 (i.e., the volume of water flowing down the rivers to Freeport is unchanged) (Figure 5-2). Migration of adult and juvenile chinook salmon would be minimally affected by operations under Alternatives 2–5. Juvenile chinook salmon survival is lower for fish migrating through the central Delta than for fish continuing down the Sacramento River (Newman and Rice 1997). Juvenile chinook salmon are assumed to move in proportion to flow; therefore, an increase in the proportion of flow diverted off the Sacramento River through the Delta Cross Channel and Georgiana Slough would be expected to increase mortality of migrating juvenile chinook salmon. Steelhead are assumed to be similarly affected. Alternatives 2–5 would have a less-than-significant impact on survival of steelhead and chinook salmon migrating through the Delta because the proportion of flow diverted off the Sacramento River at the Delta Cross Channel and Georgiana Slough under Alternatives 2–5 would be the nearly the same as the proportion of flow diverted under Alternative 1 (Figure 5-5).

Reduced net Delta flow toward the bay is assumed to adversely affect migration habitat for larval and early juvenile delta smelt, slowing transport to estuarine rearing habitat and increasing vulnerability to entrainment in diversions (U.S. Fish and Wildlife Service 1996). Relative to Alternative 1, Alternatives 2–5 would have a less-than-significant impact on transport of delta smelt larvae and early juveniles because the change in Delta outflow under Alternatives 2–5 is relatively small (generally less than 1%) (Figure 5-7). The small change in outflow indicates a corresponding small change in net channel flows. In general, net downstream flow on the Sacramento River side of the Delta is reduced slightly and net downstream flow on the Mokelumne and San Joaquin side of the Delta would increase slightly (i.e., in response to lower exports and increased Mokelumne River flow).

Splittail spawn primarily during flood events and movement of adults and young-of-year juveniles to downstream habitat is potentially dependent on receding floodflow. Although river flow would be affected by implementation of Alternatives 2–5, the affected flows are generally within the range of managed releases. Migration habitat conditions would not be affected by change in water supply operations attributable to Alternatives 2–5 because the magnitude, timing, frequency, and duration of floodflow would not measurably change.

Based on the effects described above, changes in flow would have no effect or a less-than-significant impact on spawning habitat for fish species in the Trinity, Sacramento, Feather, American, and Mokelumne Rivers and in the Delta.

Water Temperature

Change in reservoir storage and river flow potentially affects water temperature in the Trinity, Sacramento, Feather, American, and Mokelumne Rivers. Water temperature in river reaches immediately downstream of the primary reservoirs, including Trinity, Shasta, Oroville, Folsom, and Camanche, are the most sensitive to effects of operations. These reaches support coho salmon (Trinity River only), chinook salmon, and steelhead, species with life stages that can be adversely affected by temperature conditions in Central Valley rivers and the Trinity River.

Simulated water temperature for the Trinity River is nearly the same for Alternative 1 and Alternatives 2–5 (Figure 5-8). (Note: Points that fall off of the 45° line in the figures for water temperature indicate warming (above the line) or cooling (below the line) relative to the No Action Alternative.) Additional information on temperature modeling is included in Section 5 of the Modeling Technical Appendix (Volume 3) of this EIR/EIS. The simulated changes in water temperature are caused by simulated changes in export of Trinity River water to the Sacramento River. The total water volume exported to the Sacramento River is nearly the same under Alternative 1 and Alternatives 2–5. However, the monthly volume of Trinity River exports under Alternatives 2–5 varies from the volume exported under Alternative 1. Water exported to the Sacramento River is released from Trinity Lake to Lewiston Reservoir. Lewiston Reservoir discharges flow to the Trinity River and exports flow to the Sacramento River. When Trinity Lake releases are low during warmer months, water traversing Lewiston Reservoir warms considerably prior to release to the Trinity River. Under Alternatives 2–5, the warming of water temperature in some months coincides with reduced export of Trinity River water and the cooling coincides with increased export.

Increased water temperature in the Trinity River during the fall months could have an adverse effect on coho salmon and other salmonids. Survival indices were assigned to the water temperature simulated for each month of occurrence for adult migration, juvenile rearing, and smolt migration life stages of coho salmon in the Trinity River (Table 5-8). Egg incubation is not affected because incubation occurs during the winter months. For juvenile rearing and smolt migration, the water temperature survival indices are nearly the same for Alternatives 2–5 and Alternative 1. Water temperature conditions for most months are optimal (i.e., an index of 1). For adult migration, declines in the survival indices exceed increases. The change in the suitability indices that is attributable to implementation of the FRWP is less than 0.1. Given that the suitability index during most months of adult migration is 1.0, the slightly warmer water temperature conditions with the FRWP would have a less-than-significant adverse effect on adult migration.

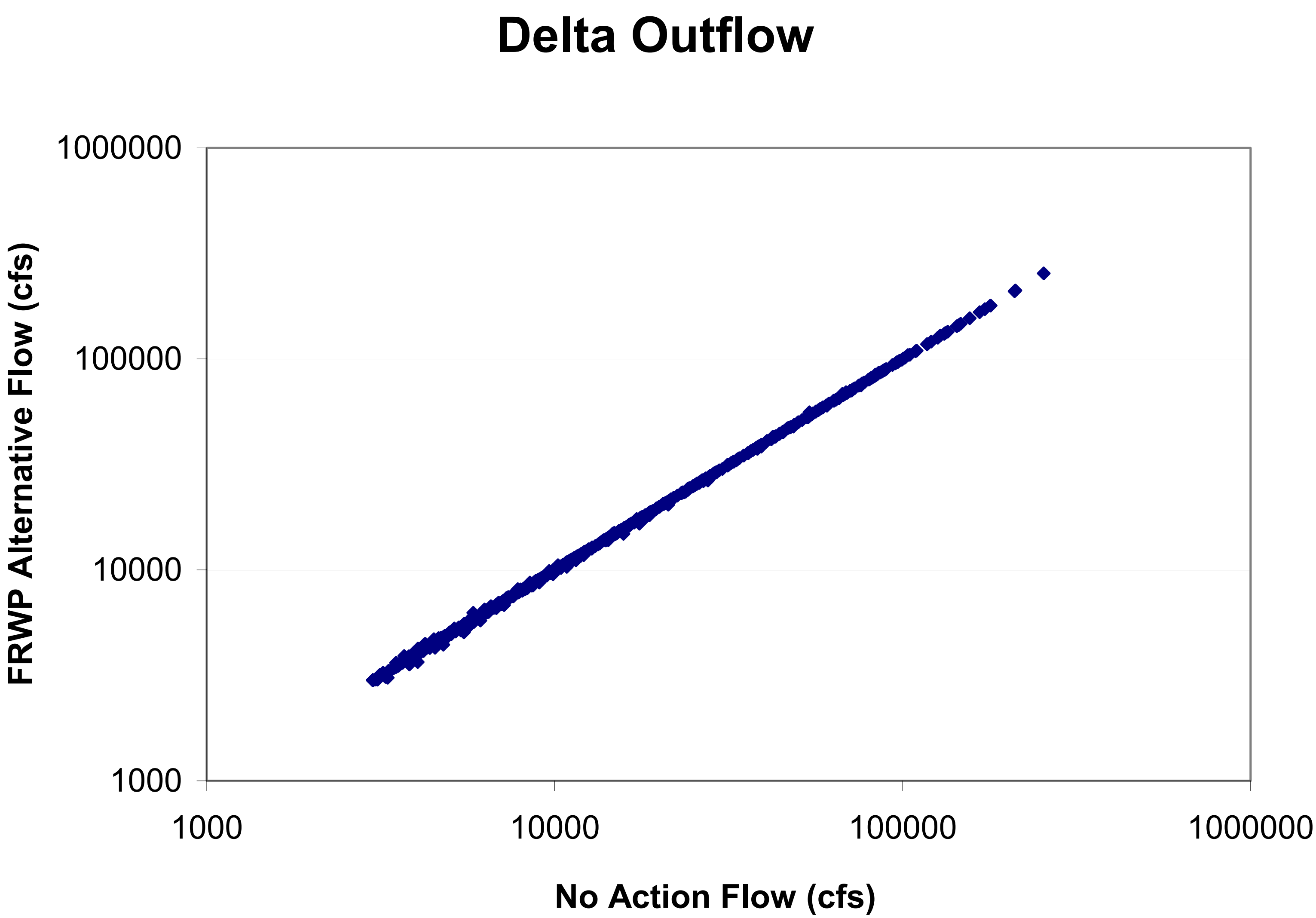


Figure 5-7
Comparison of Delta Outflow under the FRWP Alternative and No Action, 1922 – 1993 Simulation (2001 Operations).

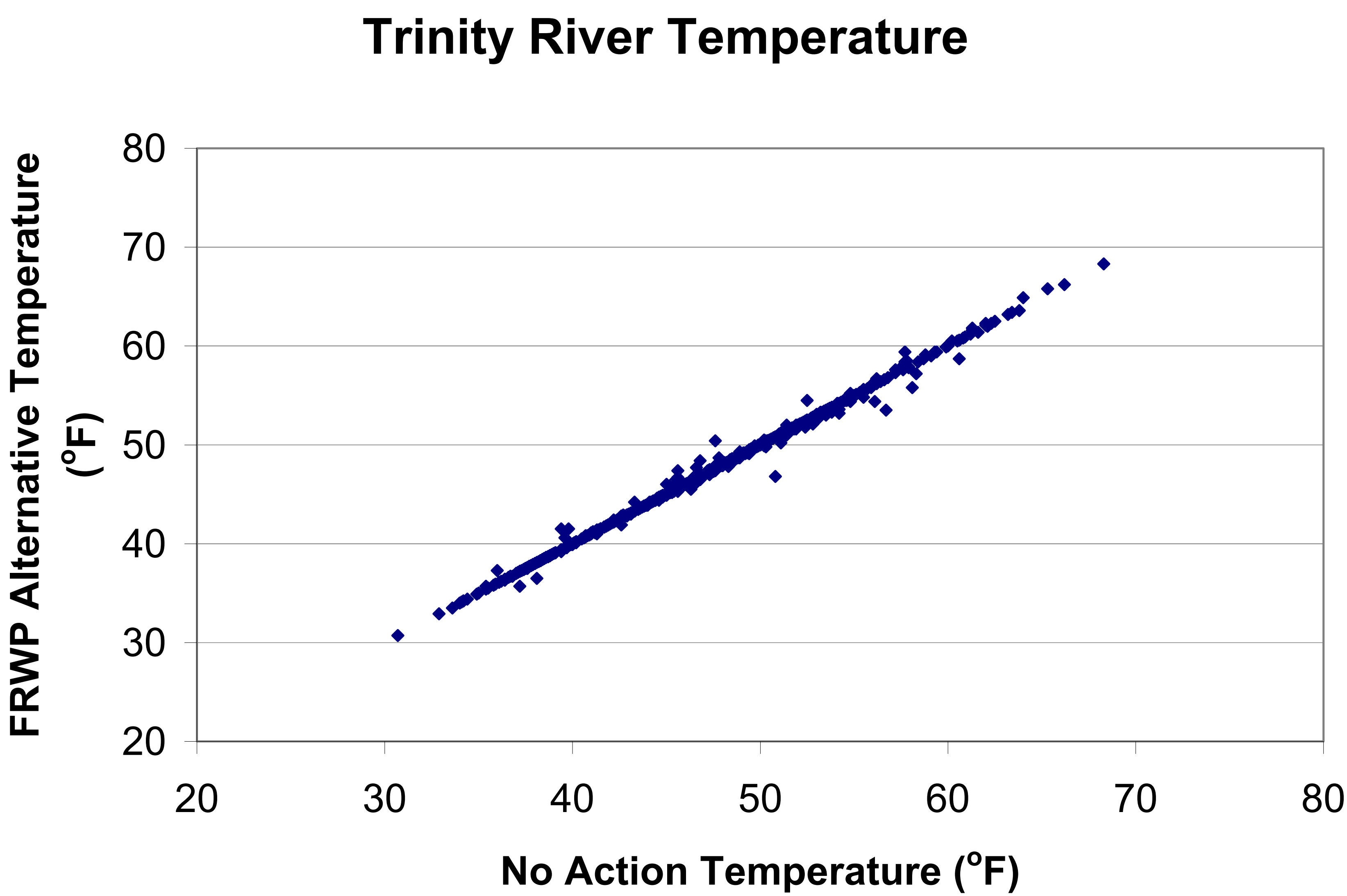


Figure 5-8
Comparison of Water Temperature for the Trinity River under the FRWP Alternative and No Action, 1922 – 1993 Simulation (2001 Operations).

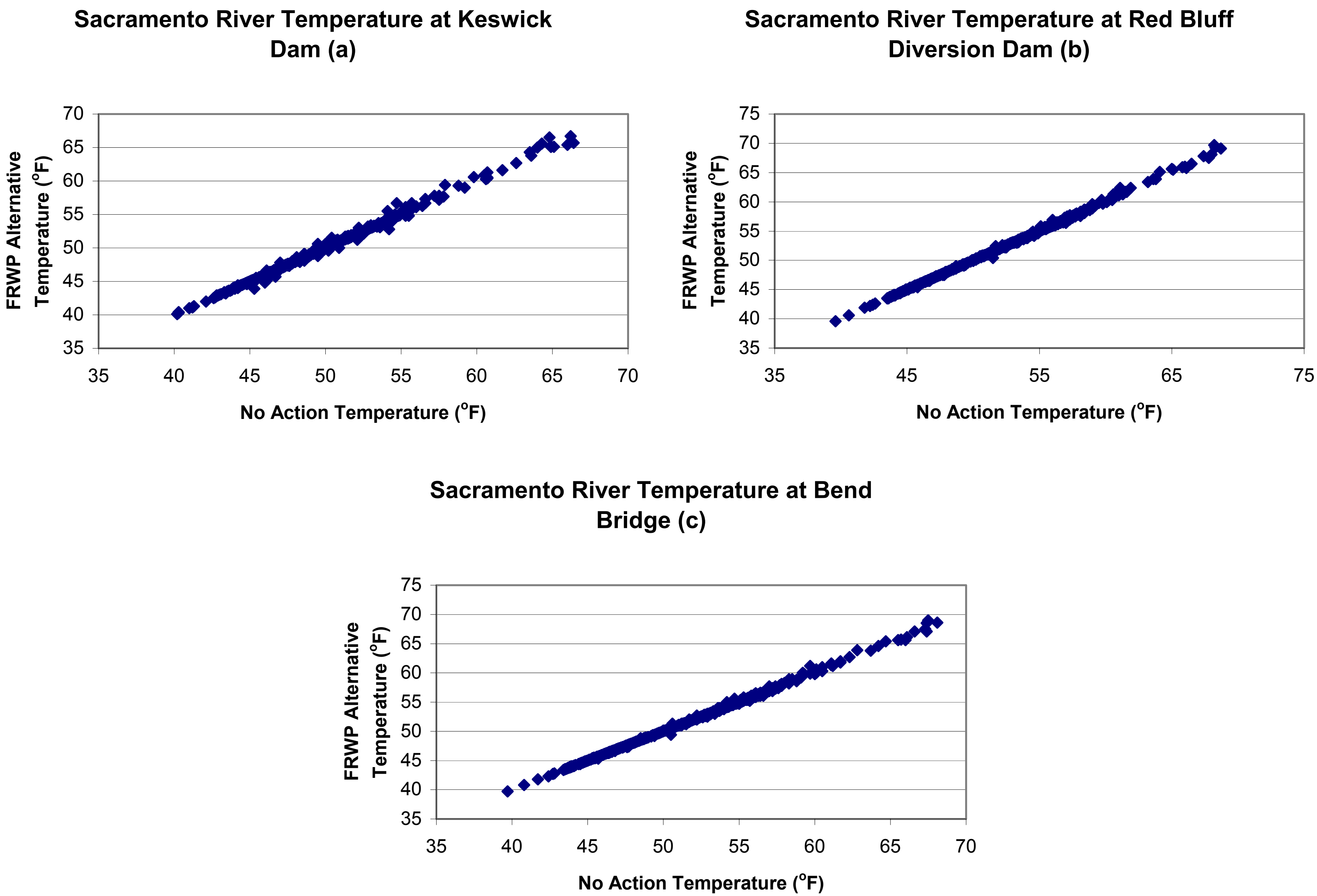


Figure 5-9
Comparison of Water Temperature for the Sacramento River, at Keswick, Red Bluff Diversion Dam, and Bend Bridge, under the FRWP Alternative and No Action, 1922 – 1993 Simulation (2001 Operations).

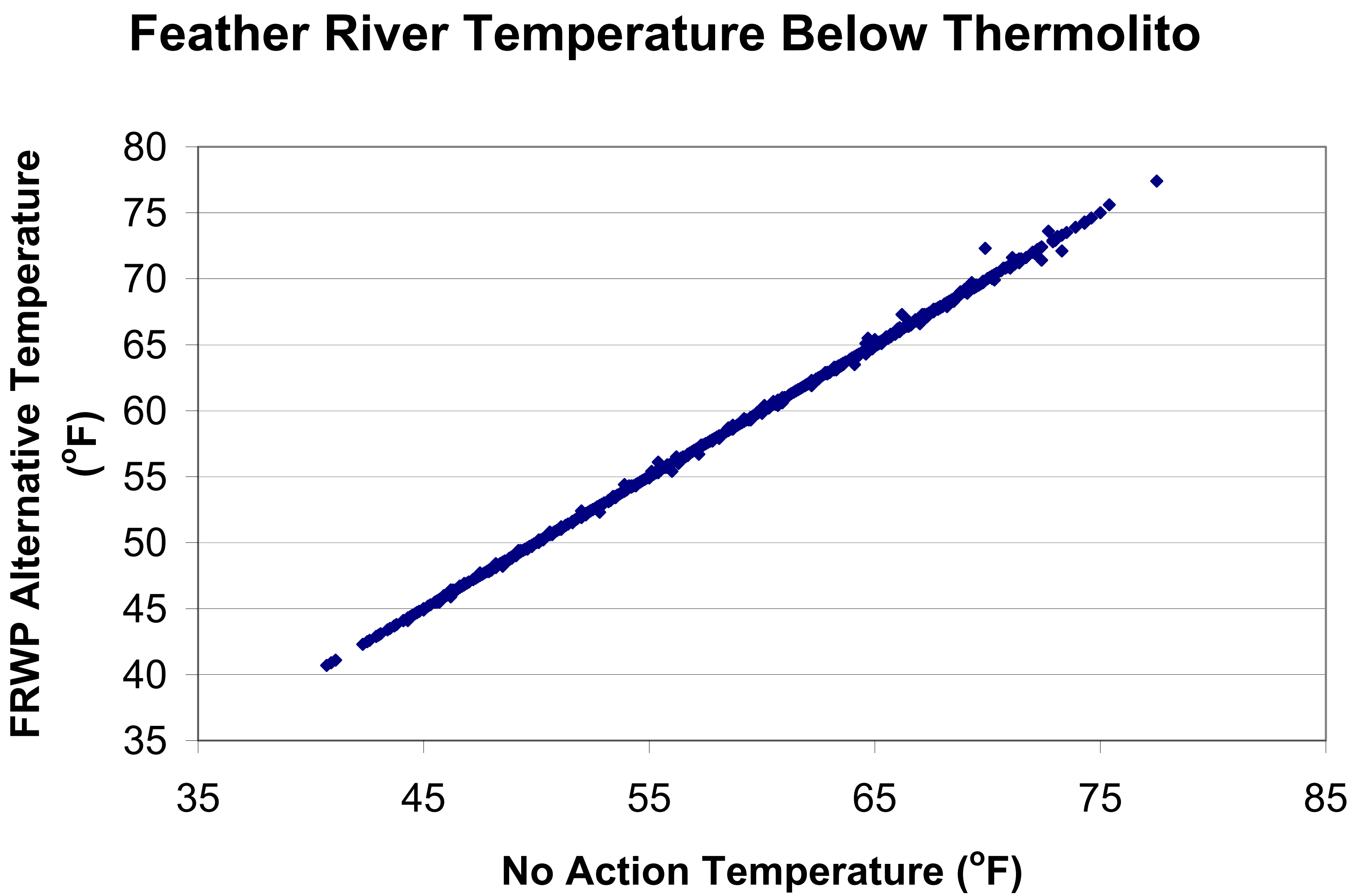


Figure 5-10
Comparison of Water Temperature for the Feather River, below Thermolito, under the FRWP Alternative and No Action, 1922 – 1993 Simulation (2001 Operations).

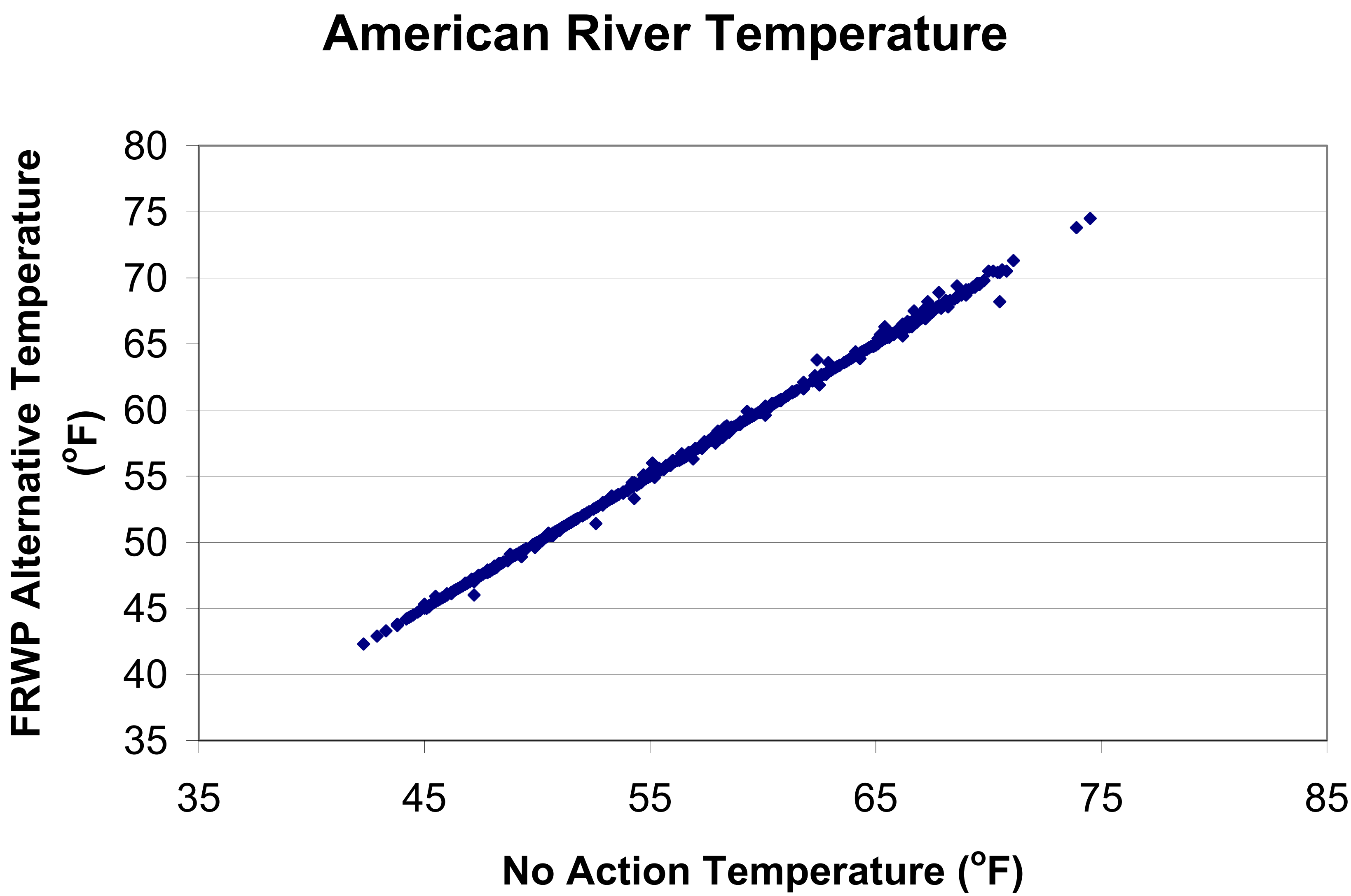


Figure 5-11
Comparison of Water Temperature for the American River, at Sunrise, under the FRWP Alternative and No Action, 1922 – 1993 Simulation (2001 Operations).

Table 5-8. Frequency of Occurrence of the Water Temperature Suitability Index for Coho Salmon Life Stages (Based on Suitability for Chinook Salmon) in the Trinity River at Lewiston under the Base Case (top) and Frequency of Occurrence of the Change in Water Temperature Suitability Index under Alternatives 2–5 (bottom), 1922–1993 Simulation (2001 Operations)

	Coho Salmon			
Base Index	Adult Migration	Spawning/Incubation	Juvenile Rearing	Smolt Migration
1	278	NA	863	216
0.9	5		1	0
0.8	3		0	0
0.7	1		0	0
0.6	0		0	0
0.5	0		0	0
0.4	0		0	0
0.3	1		0	0
0.2	0		0	0
0.1	0		0	0
0	0		0	0

Change in	Coho Salmon			
the Index	Adult Migration	Spawning/Incubation	Juvenile Rearing	Smolt Migration
<+1.0	0	NA	0	0
<+0.9	0		0	0
<+0.8	0		0	0
<+0.7	0		0	0
<+0.6	0		0	0
<+0.5	0		0	0
<+0.4	0		0	0
<+0.3	0		0	0
<+0.2	0		0	0
<+0.1	3		1	0
0	280		863	216
>-0.1	5		0	0
>-0.2	0		0	0
>-0.3	0		0	0
>-0.4	0		0	0
>-0.5	0		0	0
>-0.6	0		0	0
>-0.7	0		0	0
>-0.8	0		0	0
>-0.9	0		0	0
>=-1.0	0		0	0

Water temperatures in the Sacramento, Feather, and American Rivers are similar under Alternatives 2–5 and Alternative 1 (Figures 5-9 through 5-11). The change in water temperature attributable to the FRWP is almost always less than 1°F (0.56°C). Further indication of minimal water temperature change is the frequency that water temperature criteria (i.e., as identified in the CVP-OCAP Biological Opinion, NOAA Fisheries, 1993) are exceeded for Bend Bridge and Jelly's Ferry. Under Alternative 1 and Alternatives 2–5, the criteria were exceeded during 48 months at Jelly's Ferry and during 47 months at Bend Bridge. The months of exceedance are the same with and without changes in operations attributable to Alternatives 2–5. Although changes in water temperature are small, the potential effect of water temperature on steelhead and chinook salmon life stages warrants further consideration. Survival indices were assigned to the water temperature for each month of occurrence of each life stage for chinook salmon (i.e., winter-, spring-, and fall-/late fall–runs) and steelhead in the Sacramento, Feather, and American Rivers (Tables 5-9 through 5-13).

Table 5-9. Frequency of Occurrence of the Water Temperature Suitability Index for Chinook Salmon and Steelhead Life Stages in the Sacramento River at Keswick Dam under the Base Case (top) and Frequency of Occurrence of the Change in Water Temperature Suitability Index under Alternatives 2–5 (bottom), 1922–1993 Simulation (2001 Operations)

	Fall-/Late Fall–Run Chinook Salmon				Winter-Run Chinook Salmon				Spring-Run Chinook Salmon				Steelhead			
Base Index	Adult Migration	Spawning/ Incubation	Juvenile Rearing	Smolt Migration	Adult Migration	Spawning/ Incubation	Juvenile Rearing	Smolt Migration	Adult Migration	Spawning/ Incubation	Juvenile Rearing	Smolt Migration	Adult Migration	Spawning/ Incubation	Juvenile Rearing	Smolt Migration
1	556	558	864	648	576	415	720	504	492	326	864	576	487	497	864	432
0.9	7	5	0	0	0	3	0	0	1	7	0	0	7	6	0	0
0.8	4	3	0	0	0	2	0	0	2	5	0	0	3	0	0	0
0.7	6	0	0	0	0	0	0	0	6	0	0	0	4	1	0	0
0.6	3	2	0	0	0	0	0	0	3	2	0	0	2	0	0	0
0.5	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
0.4	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0
0.3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0.2	0	4	0	0	0	1	0	0	0	5	0	0	0	0	0	0
0.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	3	0	0	0	11	0	0	0	14	0	0	0	0	0	0

	Fall-/Late Fall–Run Chinook Salmon				Winter-Run Chinook Salmon				Spring-Run Chinook Salmon				Steelhead			
Change in the Index	Adult Migration	Spawning/ Incubation	Juvenile Rearing	Smolt Migration	Adult Migration	Spawning/ Incubation	Juvenile Rearing	Smolt Migration	Adult Migration	Spawning/ Incubation	Juvenile Rearing	Smolt Migration	Adult Migration	Spawning/ Incubation	Juvenile Rearing	Smolt Migration
<+1.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
<+0.9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
<+0.8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

	Fall-/Late Fall–Run Chinook Salmon				Winter-Run Chinook Salmon				Spring-Run Chinook Salmon				Steelhead			
Change in the Index	Adult Migration	Spawning/ Incubation	Juvenile Rearing	Smolt Migration	Adult Migration	Spawning/ Incubation	Juvenile Rearing	Smolt Migration	Adult Migration	Spawning/ Incubation	Juvenile Rearing	Smolt Migration	Adult Migration	Spawning/ Incubation	Juvenile Rearing	Smolt Migration
<+0.7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
<+0.6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
<+0.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
<+0.4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
<+0.3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
<+0.2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
<+0.1	3	8	2	0	1	0	2	0	4	6	2	0	3	2	0	0
0	559	560	861	648	574	423	717	504	490	339	861	576	493	501	864	432
>-0.1	12	6	1	0	1	7	1	0	8	11	1	0	8	1	0	0
>-0.2	2	1	0	0	0	1	0	0	2	2	0	0	0	0	0	0
>-0.3	0	1	0	0	0	1	0	0	0	2	0	0	0	0	0	0
>-0.4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
>-0.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
>-0.6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
>-0.7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
>-0.8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
>-0.9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
>=-1.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 5-10. Frequency of Occurrence of the Water Temperature Suitability Index for Chinook Salmon and Steelhead Life Stages in the Sacramento River at Bend Bridge under the Base Case (top) and Frequency of Occurrence of the Change in Water Temperature Suitability Index under Alternatives 2–5 (bottom), 1922–1993 Simulation (2001 Operations)

	Fall-/Late Fall–Run Chinook Salmon				Winter-Run Chinook Salmon				Spring-Run Chinook Salmon				Steelhead			
Base Index	Adult Migration	Spawning/ Incubation	Juvenile Rearing	Smolt Migration	Adult Migration	Spawning/ Incubation	Juvenile Rearing	Smolt Migration	Adult Migration	Spawning/ Incubation	Juvenile Rearing	Smolt Migration	Adult Migration	Spawning/ Incubation	Juvenile Rearing	Smolt Migration
1	548	528	863	648	576	290	719	504	484	266	863	576	481	378	863	432
0.9	14	35	1	0	0	102	1	0	7	55	1	0	13	90	1	0
0.8	3	2	0	0	0	13	0	0	2	8	0	0	2	20	0	0
0.7	2	0	0	0	0	3	0	0	2	1	0	0	2	11	0	0
0.6	3	3	0	0	0	4	0	0	3	4	0	0	4	2	0	0
0.5	4	0	0	0	0	3	0	0	4	1	0	0	1	1	0	0
0.4	2	1	0	0	0	0	0	0	2	1	0	0	1	0	0	0
0.3	0	1	0	0	0	1	0	0	0	2	0	0	0	0	0	0
0.2	0	2	0	0	0	0	0	0	0	2	0	0	0	1	0	0
0.1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
0	0	4	0	0	0	16	0	0	0	20	0	0	0	0	0	0

Change in the Index	Fall-/Late Fall–Run Chinook Salmon				Winter-Run Chinook Salmon				Spring-Run Chinook Salmon				Steelhead			
	Adult Migration	Spawning/ Incubation	Juvenile Rearing	Smolt Migration	Adult Migration	Spawning/ Incubation	Juvenile Rearing	Smolt Migration	Adult Migration	Spawning/ Incubation	Juvenile Rearing	Smolt Migration	Adult Migration	Spawning/ Incubation	Juvenile Rearing	Smolt Migration
<+1.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
<+0.9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
<+0.8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
<+0.7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
<+0.6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
<+0.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
<+0.4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
<+0.3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
<+0.2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
<+0.1	2	8	0	0	1	7	0	0	3	8	0	0	2	10	0	0
0	557	560	861	648	575	405	717	504	487	335	861	576	494	487	860	432
>-0.1	15	7	3	0	0	15	3	0	12	13	3	0	8	6	4	0
>-0.2	1	1	0	0	0	4	0	0	1	4	0	0	0	1	0	0
>-0.3	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
>-0.4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
>-0.5	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
>-0.6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
>-0.7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
>-0.8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
>-0.9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
>=-1.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 5-11. Frequency of Occurrence of the Water Temperature Suitability Index for Chinook Salmon and Steelhead Life Stages in the Sacramento River at Red Bluff Diversion Dam under the Base Case (top) and Frequency of Occurrence of the Change in Water Temperature Suitability Index under Alternatives 2–5 (bottom), 1922–1993 Simulation (2001 Operations)

Base Index	Fall-Run Chinook Salmon			
	Adult Migration	Spawning/Incubation	Juvenile Rearing	Smolt Migration
1	541	493	859	648
0.9	19	55	5	0
0.8	4	15	0	0
0.7	2	1	0	0
0.6	4	2	0	0
0.5	1	1	0	0
0.4	2	1	0	0
0.3	3	2	0	0
0.2	0	1	0	0
0.1	0	1	0	0
0	0	4	0	0

Change in the Index	Fall-Run Chinook Salmon			
	Adult Migration	Spawning/Incubation	Juvenile Rearing	Smolt Migration
<+1.0	0	0	0	0
<+0.9	0	0	0	0
<+0.8	0	0	0	0
<+0.7	0	0	0	0
<+0.6	0	0	0	0
<+0.5	0	0	0	0
<+0.4	0	0	0	0
<+0.3	0	0	0	0
<+0.2	0	0	0	0
<+0.1	3	8	1	0
0	556	559	860	648
>-0.1	15	9	3	0
>-0.2	1	0	0	0
>-0.3	1	0	0	0
>-0.4	0	0	0	0
>-0.5	0	0	0	0
>-0.6	0	0	0	0
>-0.7	0	0	0	0
>-0.8	0	0	0	0
>-0.9	0	0	0	0
>=-1.0	0	0	0	0

Table 5-12. Frequency of Occurrence of the Water Temperature Suitability Index for Chinook Salmon and Steelhead Life Stages in the Feather River below Thermolito under the Base Case (top) and Frequency of Occurrence of the Change in Water Temperature Suitability Index under Alternatives 2–5 (bottom), 1922–1993 Simulation (2001 Operations)

	Fall-Run Chinook Salmon				Steelhead			
Base Index	Adult Migration	Spawning/ Incubation	Juvenile Rearing	Smolt Migration	Adult Migration	Spawning/ Incubation	Juvenile Rearing	Smolt Migration
1	320	364	740	602	370	271	736	386
0.9	45	37	61	36	59	27	82	36
0.8	18	25	27	6	19	12	21	6
0.7	29	17	11	2	19	9	14	2
0.6	25	20	9	2	25	8	5	2
0.5	29	8	6	0	8	9	3	0
0.4	14	9	3	0	3	2	1	0
0.3	15	12	1	0	0	4	1	0
0.2	13	12	3	0	0	6	0	0
0.1	10	7	0	0	0	3	0	0
0	58	65	3	0	1	153	1	0

Change in the Index	Fall-/Late Fall-Run Chinook Salmon				Steelhead			
	Adult Migration	Spawning/ Incubation	Juvenile Rearing	Smolt Migration	Adult Migration	Spawning/ Incubation	Juvenile Rearing	Smolt Migration
<+1.0	0	0	0	0	0	0	0	0
<+0.9	0	0	0	0	0	0	0	0
<+0.8	0	0	0	0	0	0	0	0
<+0.7	0	0	0	0	0	0	0	0
<+0.6	0	0	0	0	0	0	0	0
<+0.5	0	0	0	0	0	0	0	0
<+0.4	0	0	0	0	0	0	0	0
<+0.3	0	0	0	0	0	0	0	0
<+0.2	0	0	2	0	0	0	1	0
<+0.1	25	15	11	5	4	8	7	5
0	534	550	842	641	490	494	849	425
>-0.1	16	11	7	2	9	2	6	2
>-0.2	1	0	1	0	1	0	1	0
>-0.3	0	0	1	0	0	0	0	0
>-0.4	0	0	0	0	0	0	0	0
>-0.5	0	0	0	0	0	0	0	0
>-0.6	0	0	0	0	0	0	0	0
>-0.7	0	0	0	0	0	0	0	0
>-0.8	0	0	0	0	0	0	0	0
>-0.9	0	0	0	0	0	0	0	0
>=-1.0	0	0	0	0	0	0	0	0

Table 5-13. Frequency of Occurrence of the Water Temperature Suitability Index for Chinook Salmon and Steelhead Life Stages in the American River at Sunrise under the Base Case (top) and Frequency of Occurrence of the Change in Water Temperature Suitability Index under Alternatives 2–5 (bottom), 1922–1993 Simulation (2001 Operations)

	Chinook Salmon				Steelhead			
Base Index	Adult Migration	Spawning/ Incubation	Juvenile Rearing	Smolt Migration	Adult Migration	Spawning/ Incubation	Juvenile Rearing	Smolt Migration
1	334	332	805	617	380	276	801	403
0.9	14	62	49	24	37	30	56	22
0.8	4	46	7	7	5	8	5	7
0.7	50	22	1	0	27	9	0	0
0.6	76	13	0	0	30	6	1	0
0.5	42	14	0	0	11	10	1	0
0.4	22	9	0	0	8	2	0	0
0.3	11	10	1	0	3	6	0	0
0.2	7	5	1	0	0	2	0	0
0.1	6	4	0	0	1	3	0	0
0	10	59	0	0	2	152	0	0

Change in the Index	Chinook Salmon				Steelhead			
	Adult Migration	Spawning/ Incubation	Juvenile Rearing	Smolt Migration	Adult Migration	Spawning/ Incubation	Juvenile Rearing	Smolt Migration
<+1.0	0	0	0	0	0	0	0	0
<+0.9	0	0	0	0	0	0	0	0
<+0.8	0	0	0	0	0	0	0	0
<+0.7	0	0	0	0	0	0	0	0
<+0.6	0	0	0	0	0	0	0	0
<+0.5	0	0	0	0	0	0	0	0
<+0.4	0	0	0	0	0	0	0	0
<+0.3	1	0	0	0	0	0	0	0
<+0.2	0	1	1	0	0	1	0	0
<+0.1	37	11	5	3	8	3	3	3
0	513	544	850	640	482	494	852	427
>-0.1	22	19	8	5	12	5	9	2
>-0.2	3	1	0	0	2	1	0	0
>-0.3	0	0	0	0	0	0	0	0
>-0.4	0	0	0	0	0	0	0	0
>-0.5	0	0	0	0	0	0	0	0
>-0.6	0	0	0	0	0	0	0	0
>-0.7	0	0	0	0	0	0	0	0
>-0.8	0	0	0	0	0	0	0	0
>-0.9	0	0	0	0	0	0	0	0
>=-1.0	0	0	0	0	0	0	0	0

For all steelhead and chinook salmon life stages in the Sacramento River near Keswick, the water temperature suitability indices are similar for Alternatives 2–5 and Alternative 1 (Table 5-9). Suitability indices decline during a few months, but water temperature conditions are near optimal most of the time (i.e., an index of 1). The change in the indices for a few months could result in a small adverse effect on life stage success for steelhead and chinook salmon. Temperatures warm further downstream and the frequency of optimal suitability (i.e., an index of 1) declines, especially for spawning and incubation life stages of winter-run chinook salmon (Table 5-10). The effect of the FRWP, however, is similarly small. Suitability indices for fall-/late fall–run chinook salmon reflect continued warming downstream to RBDD (Table 5-11). Steelhead and chinook salmon spawning is not supported by water temperature conditions that occur during the summer and rearing conditions are less than optimal. Fall-/late fall–run timing, with spawning incubation in the fall and winter, facilitates use of habitat in this reach. The effect of the FRWP continues to be small.

Water temperature suitability indices for steelhead and chinook salmon life stages in the American and Feather Rivers are less than optimal for many months under Alternative 1 and Alternatives 2–5 (Tables 5-12 and 5-13). The change in the indices under Alternatives 2–5 would be small (i.e., less than 0.1) and infrequent. As indicated by the occurrence of both higher and lower indices relative to Alternative 1, no negative or positive effect is apparent over the period of life stage occurrence. Effects on survival of steelhead and chinook salmon life stages would likely be small.

Water temperature was not simulated for the Mokelumne River, but changes in flow and reservoir storage provide an indication of potential effects on water temperature. Change in the Mokelumne River flow relative to Alternative 1 is generally small or increasing (Figure 5-4). As discussed previously, the generally higher flows result from higher water release requirements for fish in response to an increase in the number of water years classified as wetter when compared to Alternative 1. Substantial increases in flow occur primarily between October and March, and a few substantial increases occur in every month. Substantial increases in flow during warmer months (i.e., April through October) have the potential to cool water temperature. Storage is also assumed to affect water temperature, especially during September and October when storage affects the ability to release cold water to the Mokelumne River. The combined Camanche and Pardee Reservoir storage during September and October is higher for the FRWP (Figure 5-12), indicating an increase in the coldwater pool. Under Alternative 1, Pardee Reservoir storage fell below 100,000 af during April through September in 3 years, indicating that water temperature management flexibility may be impaired during those years. Under Alternatives 2–5, Pardee Reservoir storage below 100,000 af is less frequent (i.e., 1 year), and water temperature management flexibility would be enhanced. In general, cooler water temperature could be expected more frequently in October because of the combined effect of increased reservoir storage and increased river flow. The cooler water temperature could have a small benefit to fall-run chinook salmon and steelhead.

Based on the changes in water temperature conditions and survival indices described above, the change in water temperature under Alternatives 2–5 would have a less-than-significant impact on adult migration, spawning, incubation,

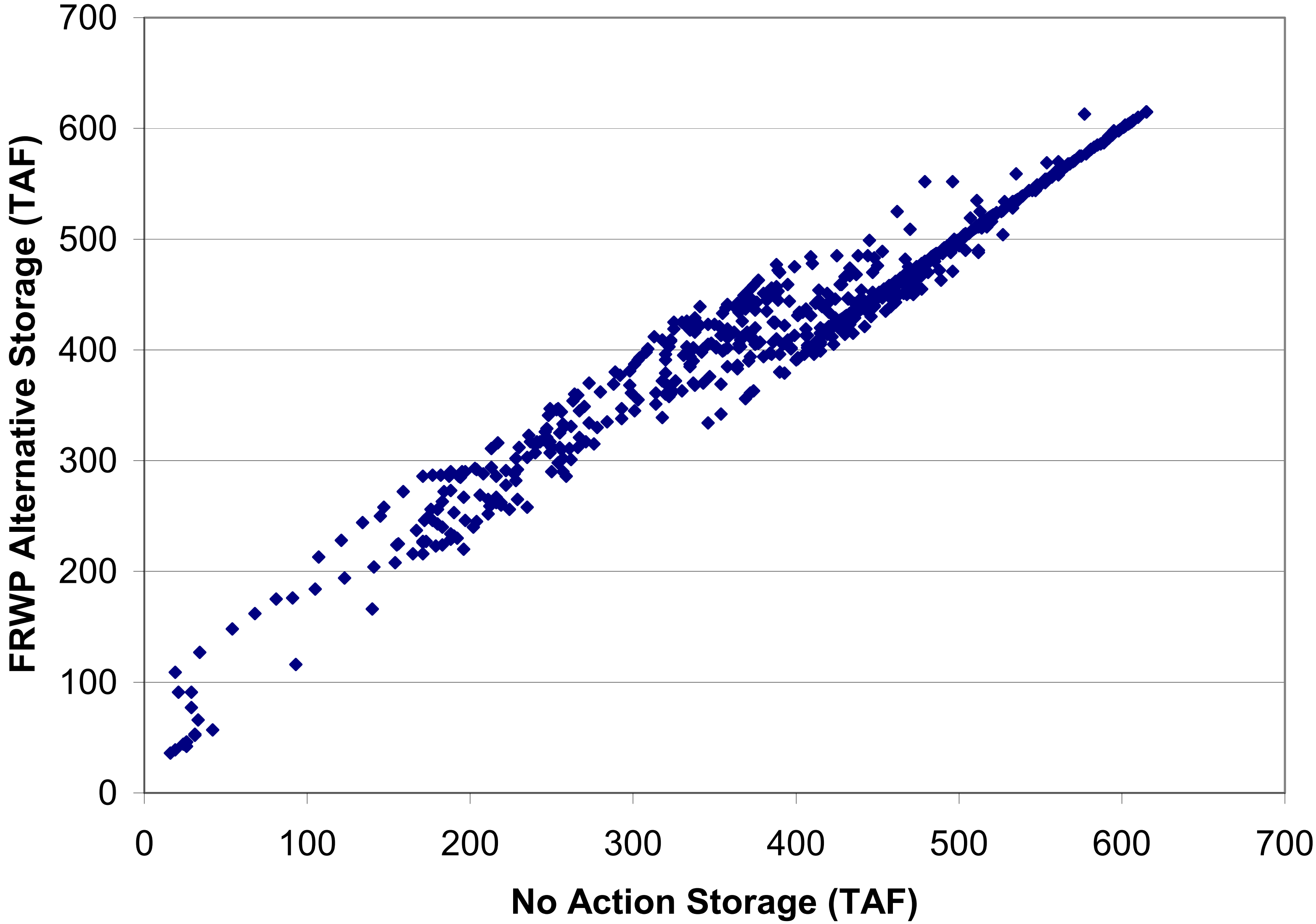


Figure 5-12
Comparison of the Combined Storage for Pardee and Camanche Reservoirs under the FRWP Alternative and No Action, 1922 – 1993 Simulation (2001 Operations).

rearing, and juvenile migration life stages of coho salmon (Trinity River only), chinook salmon, and steelhead in the Trinity, Sacramento, Feather, and American Rivers. In the Mokelumne River, water temperature would be expected to cool slightly, potentially providing some benefit to life stages of chinook salmon and steelhead.

Entrainment

Diversions from the Sacramento River under Alternatives 2–5 range from 0 to 286 cfs for the 1922–1993 simulation. The highest diversions occur in the summer months of drier years, although the highest proportion of Sacramento River flow diverted generally occur in April, May, and June (Figure 5-13). Median diversions range from 0 cfs in February to 128 cfs in June. The median proportion of flow diverted from the Sacramento River near Freeport is 0.2% and never exceeds 4.0% (Figure 5-13). During most months the proportion of the Sacramento River diverted is less than 1%.

Juvenile steelhead and chinook salmon, adult and juvenile delta smelt, splittail and juvenile and adult life stages of other species are unlikely to be entrained by the intake facility. The low potential for entrainment is partially attributable to the relatively small proportion of flow diverted from the Sacramento River. Based on field studies of pumps and siphons diverting a relatively small proportion of river flow (Hanson 2001), the proportion of fish entrained when passing a diversion is less than the proportion of flow diverted. In addition, the intake facility will include a fish exclusionary system designed to meet DFG, NOAA Fisheries, and USFWS criteria. Specific criteria on adequate screen area, maintenance features, and facility hydraulics are mandated for compliance. The screen face would be oriented parallel to the river flow and would extend into the river channel to allow adequate water depth at the screen (i.e., 10 feet minimum). The orientation allows sweeping flows across the screens, minimizing the overall screen length and exposure to the facility.

Fish eggs and larvae could be entrained. Delta smelt larvae have occurred in the vicinity of the diversion during February–May. Entrainment losses would be minimal given the apparent infrequent and low intensity spawning activity upstream of the intake. Eggs and larvae of other species, such as striped bass, pass the proposed diversion point during the spring months and could be entrained.

Based on the small proportion of Sacramento River flow diverted and the low approach velocity of the fish screen, entrainment of egg, larval, juvenile, and adult life stages would have a less-than-significant impact on populations of chinook salmon, steelhead, delta smelt, striped bass, and other species.

Entrainment of egg, larval, juvenile, and adult life stages in Delta exports would have a less-than-significant impact on populations of chinook salmon, steelhead, delta smelt, striped bass, and other species because the FRWP would result in less than 2% change in CVP and SWP exports during most months (Figure 5-14). The few substantial increases (December and July) and decreases (November, May, July, and September) in export would be expected to have minimal effect on fish populations. The increases occur primarily during months when presence of delta smelt, chinook salmon, and steelhead near the export facilities is relatively low.

Reservoir Species Habitat

Storage in Trinity, Shasta, Oroville, Folsom, Pardee, Camanche, and other Central Valley Reservoirs varies substantially from month to month, sometimes increasing or decreasing as much as 20% depending on inflows and downstream demands (see Chapter 2, "Hydrology, Water Supply, and Power"). The high variability in month-to-month and year-to-year storage provides relatively poor habitat for most fish species, especially sunfish and catfish. Falling surface elevation during the late spring and summer results in desiccation of spawning habitat and relatively barren rearing habitat. Average storage in any month under Alternatives 2–5 is reduced by less than 1% in Trinity, Shasta, Oroville, and Folsom Reservoirs, indicating relatively little change in reservoir conditions. The average combined storage for Camanche and Pardee reservoirs increases by about 10 % under Alternatives 2–5, potentially resulting in a slight benefit to reservoir species. Based on the small change in reservoir conditions and the existing relatively poor spawning and rearing habitat for many species, change in reservoir storage would have a less-than-significant impact on reservoir fishes.

Alternative 6

Construction-Related Impacts

Alternative 6 has construction effects on fish species similar to those described under Alternatives 2–5(Table 5-5). The intake facility under Alternative 6 would be smaller than the intake facility constructed under Alternatives 2–5 because only Sacramento County would divert water from the Sacramento River. Consequently, construction effects associated with the intake facility would be slightly less than effects described under Alternatives 2–5.

The pipeline would cross streams in Sacramento County and the effects of stream crossings would be the same as described under Alternatives 2–5 (Table 5-5). The pipeline, however, would not connect to the Folsom South Canal and would not continue south across Dry Creek and the Mokelumne River. Effects of the streamcrossing on Dry Creek and the Mokelumne that were identified under Alternatives 2–5 would not occur under Alternative 6.

Additional constructed elements under Alternative 6 include a new dam located just downstream of the existing Pardee Dam on the Mokelumne River (Table 5-5). In addition, SR 49 and other roads and utilities would be relocated and the existing Pardee Dam would be breached.

Spawning Habitat Area

Construction of the intake facility near Freeport and the conveyance pipeline would have similar but lesser effects on spawning habitat of delta smelt, splittail, and other species as described under Alternatives 2–5. Based on the discussion

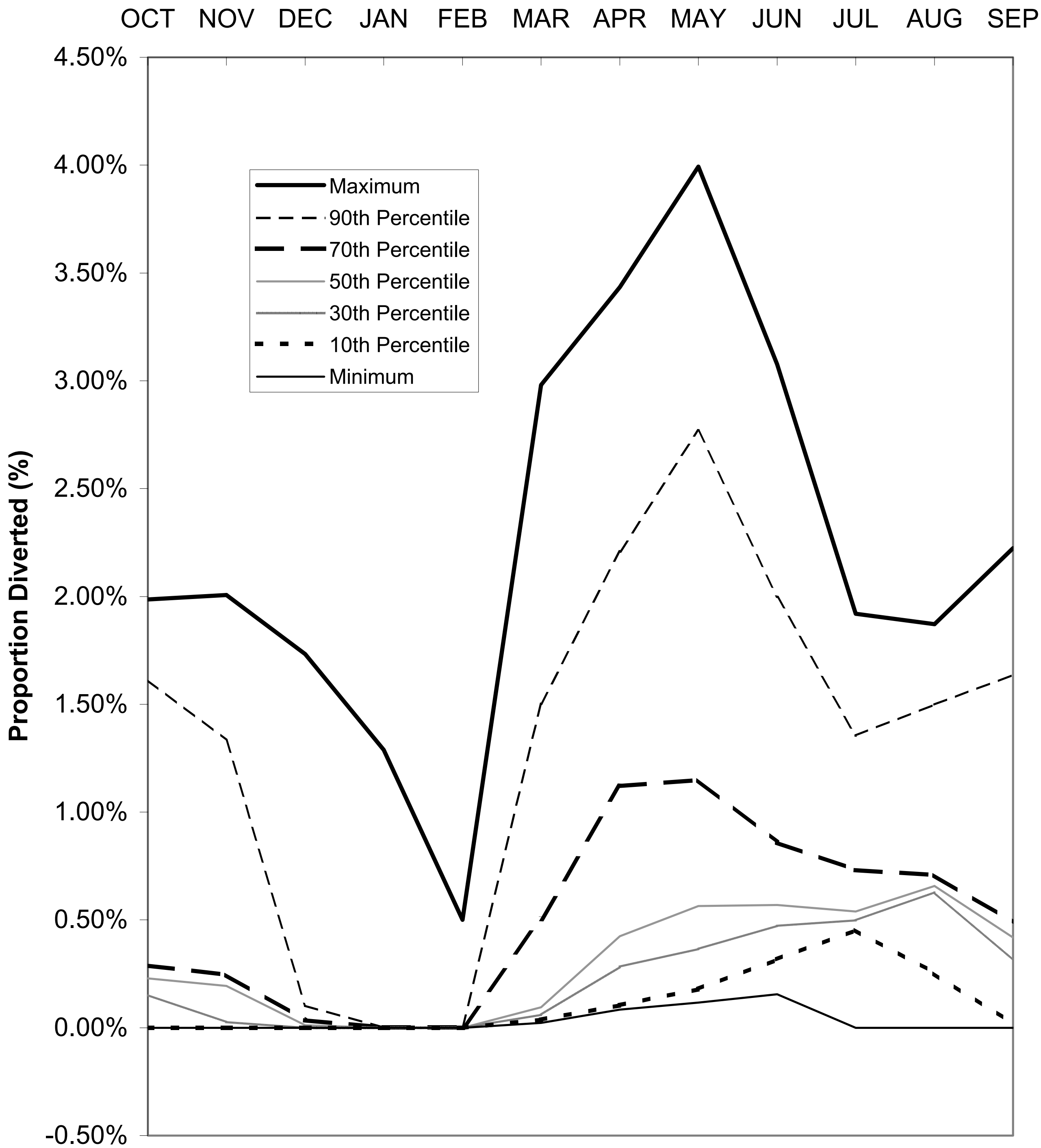


Figure 5-13
The Proportion of Sacramento River Flow Diverted at Freeport under the FRWP Alternative, 1922 – 1993 Simulation (2001 Operations).

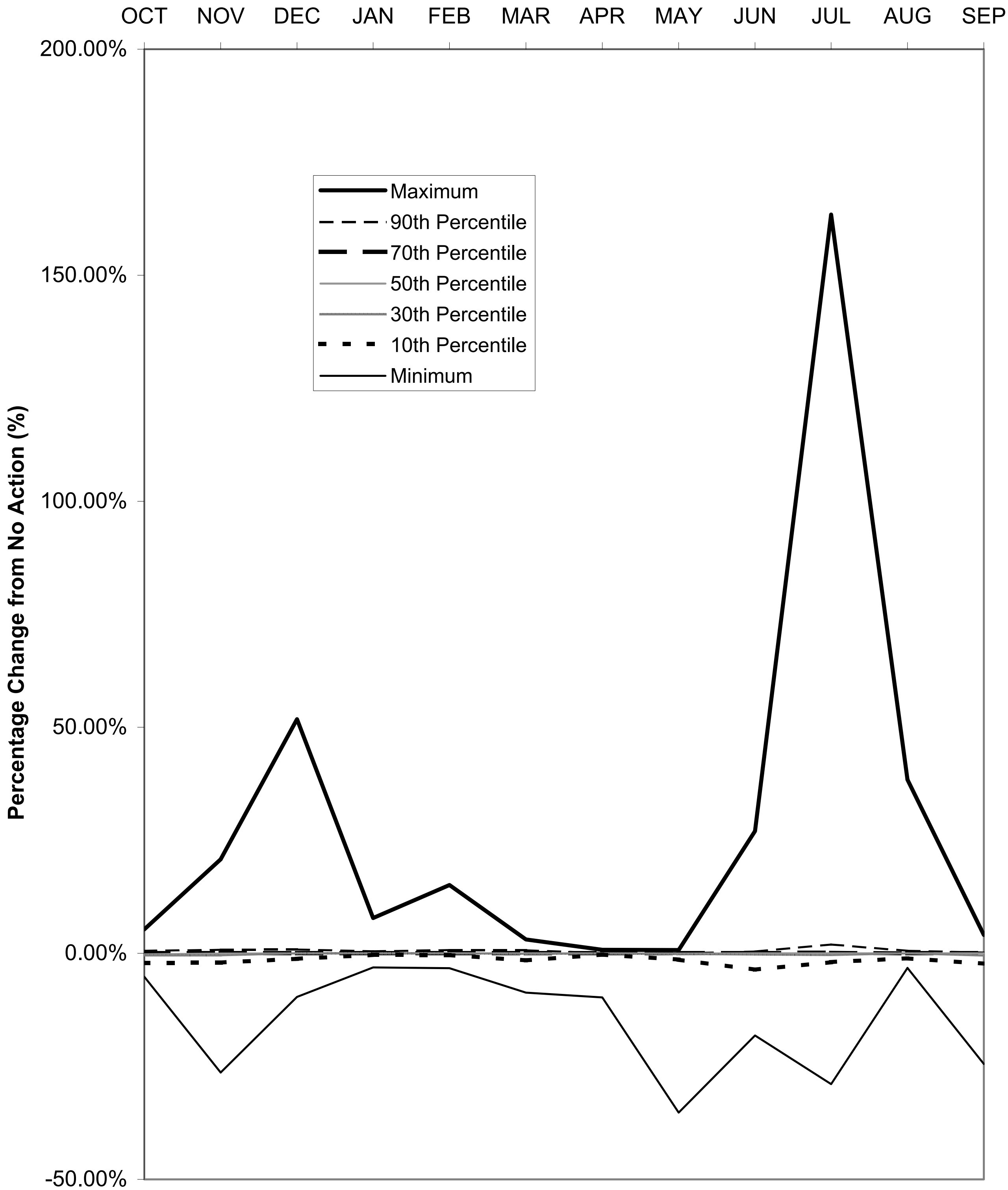


Figure 5-14
Percentage Change in Delta Exports under the FRWP Alternative Relative to No Action, 1922 – 1993 Simulation (2001 Operations).

under Alternatives 2–5, the impacts would be less than significant for all affected fish species.

The amount of spawning habitat affected by construction for any species is small, and effects on spawning habitat for listed species are unlikely because existing substrates within the construction footprints are generally unsuitable. Construction would affect a small proportion of any species' spawning habitat and would have a less-than-significant impact on any fish species population. Based on the species affected by construction in Pardee and Camanche Reservoirs and the relatively small proportion of the reservoir area affected, construction would have a less-than-significant impact on spawning habitat for reservoir species.

Rearing Habitat Area

Construction of the intake facility near Freeport and the conveyance pipeline would have similar but lesser effects on rearing habitat of chinook salmon, splittail, and other species as described under Alternatives 2–5. Based on the discussion in Alternatives 2–5, the impacts would be less than significant for all affected fish species.

Rearing habitat for fish species in Camanche and Pardee Reservoirs could be affected by construction of the new dam, relocation of roads, and breaching of the existing dam. The fishes affected would include primarily nonnative species that are common throughout the Central Valley. A small proportion of the habitat within Pardee and Camanche Reservoirs would be adversely affected by direct disturbance and sedimentation. Based on the species affected by construction in Pardee and Camanche Reservoirs and the relatively small proportion of the reservoir area affected, construction would have a less-than-significant impact on rearing habitat for reservoir species.

Migration Habitat Conditions

Construction of the intake facility near Freeport would have similar but less effect on migration habitat conditions for chinook salmon, delta smelt, splittail, and other species as described under Alternatives 2–5. Construction would have a less-than-significant impact on the movement of any fish species in the Sacramento River and the small streams crossed by the pipeline.

Contaminants

Contaminants accidentally introduced during construction activities to the Sacramento River, small streams, and Camanche and Pardee Reservoirs could adversely affect fish species and their habitat. Environmental commitments, including an erosion and sediment control plan, storm water pollution prevention plan, hazardous materials management plan, hydrologic simulation modeling and scour analysis, spoils disposal plan, and environmental training, will be developed and implemented before and during construction activities (see Chapter 2, "Project Description"). The environmental commitments would eliminate the likelihood of any substantial contaminant input and contaminants, therefore, would have a less-than-significant adverse impact on any fish species.

Predation

Construction of fish screens, pumps, and pipelines would add permanent structure and cover to the Sacramento River channel near Freeport. The facilities, however, would be smaller under Alternative 6 than under Alternatives 2–5 and would have a smaller effect on predation than described under Alternatives 2–5.

As described for Alternatives 2–5, the additional predator habitat created by the intake facility and fish screen is small relative to the river cross section and predator habitat in adjacent areas and would have a less-than-significant adverse impact on any fish species.

Direct Injury

Construction of the intake facility near Freeport would include placement of sheet piles and riprap and could directly injure fish present in the Sacramento River. The potential for injury of fish, however, would be less than the potential under Alternatives 2–5 because the intake facility would be smaller. The impact, therefore, would be less than significant.

Construction of the pipeline crossing of Morrison Creek could also injure fish. The impact would be less than significant because the species affected are likely dominated by nonnative sunfish, catfish, and minnow species that would be minimally affected by inwater construction that would affect a relatively small area over a short period of time.

Breaching of the existing Pardee Dam could injure and kill fish. In-water blasting associated with the breaching of the old dam could kill fish in the vicinity of the dam. Direct injury associated with construction and breaching of Pardee Dam would have a less-than-significant adverse impact on any fish species because the habitat area affected within Pardee and Camanche Reservoirs is relatively local and a small proportion of the total habitat. The fishes affected would primarily include nonnative species that are common throughout the Central Valley.

Operation-Related Impacts

Operations and effects on reservoir storage, flow, water temperature, and exports are similar to the effects described for Alternatives 2–5. For the Trinity, Sacramento, Feather, and American Rivers; Trinity, Shasta, Oroville, and Folsom Reservoirs; and the Delta, effects would be less than described under Alternatives 2–5. The smaller effect would occur because only Sacramento County would divert Sacramento River water and changes in CVP and SWP operations would be smaller (see Chapter 3, “Hydrology, Water Supply, and Power”). As described under Alternatives 2–5, operations under Alternative 6 would have less-than-significant impacts on fish species in the affected reservoirs, rivers, and in the Delta. Additional information on temperature and mortality modeling is included in Section 5 of the Modeling Technical Appendix (Volume 3) of this EIR/EIS.

Operations on the Mokelumne River under Alternative 6 would reduce flows during many months (Figure 5-15). However, operations under Alternative 6 assumed that the frequency of water-year types is the same as for Alternatives 2–5. Consequently, the number of years with fish flows that correspond to wetter year types increases relative to Alternative 1. As indicated previously, the water release requirements for fish for October–March increase in at least 13 water years, reflecting the increased occurrence of below-normal and above-normal year-types from 46 years under Alternative 1 to 54 years under the Alternatives 2–5 and would increase similarly under Alternative 6 (Chapter 3, "Hydrology, Water Supply, and Power"). The modeling assumption related to the frequency of water-year types may be renegotiated with the resource agencies. The timing of flow changes and the magnitude of flows affected result in maintenance or a slight increase in spawning habitat relative to the No Action Alternative (Table 5-14). Rearing habitat would be reduced during a few months, but relatively unchanged during most months (Table 5-15).

The combined storage in Pardee and Camanche reservoirs would increase (Figure 5-16). Under Alternative 1, Pardee Reservoir storage fell below 100,000 af during April through September in 3 years, indicating that water temperature management flexibility may be limited during those years. Under Alternative 6, Pardee Reservoir storage below 100,000 af is less frequent (i.e., at most 2 years), and water temperature management flexibility would be enhanced. The increased storage could result in cooler release temperatures and benefit chinook salmon and steelhead.

Based on the maintenance of spawning and rearing habitat for chinook salmon and steelhead, the potential for cooler discharge from Camanche Reservoir, and the minimal effect on flows during March through May, the increased reservoir storage and re-operation of Pardee and Camanche Reservoirs could provide some benefit to chinook salmon and steelhead in the Mokelumne River. Any adverse effects on splittail and other species would be minimal. These impacts would be less than significant.

Table 5-14. Frequency of Occurrence for the Base Percentage (top) and Change in Percentage (bottom) of Spawning Habitat Area for Steelhead and Chinook Salmon in the Sacramento, Feather, American, and Mokelumne Rivers under Alternative 6, 1922–1993 Simulation (2001 Operations)

	Sacramento River					Feather River		American River		Mokelumne River	
Base Percentage Area	Fall-Run Chinook Salmon	Late Fall–Run Chinook Salmon	Winter-Run Chinook Salmon	Spring-Run Chinook Salmon	Steelhead	Fall-Run Chinook Salmon	Steelhead	Fall-Run Chinook Salmon	Steelhead	Fall-Run Chinook Salmon	Steelhead
<+100%	200	171	89	195	265	210	322	147	268	117	232
<+90%	0	0	0	0	0	0	0	19	27	69	92
<+80%	0	0	0	0	0	0	0	4	3	0	0
<+70%	0	0	0	0	0	0	0	25	20	0	0
<+60%	0	0	0	0	0	0	0	0	0	36	46
<+50%	0	0	0	0	0	0	0	12	12	0	0
<+40%	0	0	0	0	0	0	0	5	0	0	0
<+30%	0	0	0	0	0	0	0	1	4	0	0
<+20%	0	0	0	0	0	0	0	0	0	0	0
<+10%	0	0	0	0	0	0	0	0	0	0	0
0%	0	0	0	0	0	0	0	0	0	0	0

	Sacramento River					Feather River		American River		Mokelumne River	
	Fall-Run Chinook Salmon	Late Fall–Run Chinook Salmon	Winter-Run Chinook Salmon	Spring-Run Chinook Salmon	Steelhead	Fall-Run Chinook Salmon	Steelhead	Fall-Run Chinook Salmon	Steelhead	Fall-Run Chinook Salmon	Steelhead
<+100%	0	0	0	0	0	0	0	0	0	0	0
<+90%	0	0	0	0	0	0	0	0	0	0	0
<+80%	0	0	0	0	0	0	0	0	0	0	0
<+70%	0	0	0	0	0	0	0	0	0	0	0
<+60%	0	0	0	0	0	0	0	0	0	0	0
<+50%	0	0	0	0	0	0	0	0	0	0	0
<+40%	0	0	0	0	0	0	0	0	0	0	0
<+30%	0	0	0	0	0	0	0	0	0	12	16
<+20%	0	0	0	0	0	0	0	0	0	9	11
<+10%	0	0	0	0	0	0	0	1	0	1	0
0%	200	171	89	194	265	209	322	211	331	196	332
>-10%	0	0	0	0	0	0	0	1	3	0	1
>-20%	0	0	0	0	0	0	0	0	0	4	8
>-30%	0	0	0	0	0	0	0	0	0	0	0
>-40%	0	0	0	0	0	0	0	0	0	0	0
>-50%	0	0	0	0	0	0	0	0	0	0	2
>-60%	0	0	0	0	0	0	0	0	0	0	0
>-70%	0	0	0	0	0	0	0	0	0	0	0
>-80%	0	0	0	0	0	0	0	0	0	0	0
>-90%	0	0	0	0	0	0	0	0	0	0	0
>=-100%	0	0	0	0	0	0	0	0	0	0	0

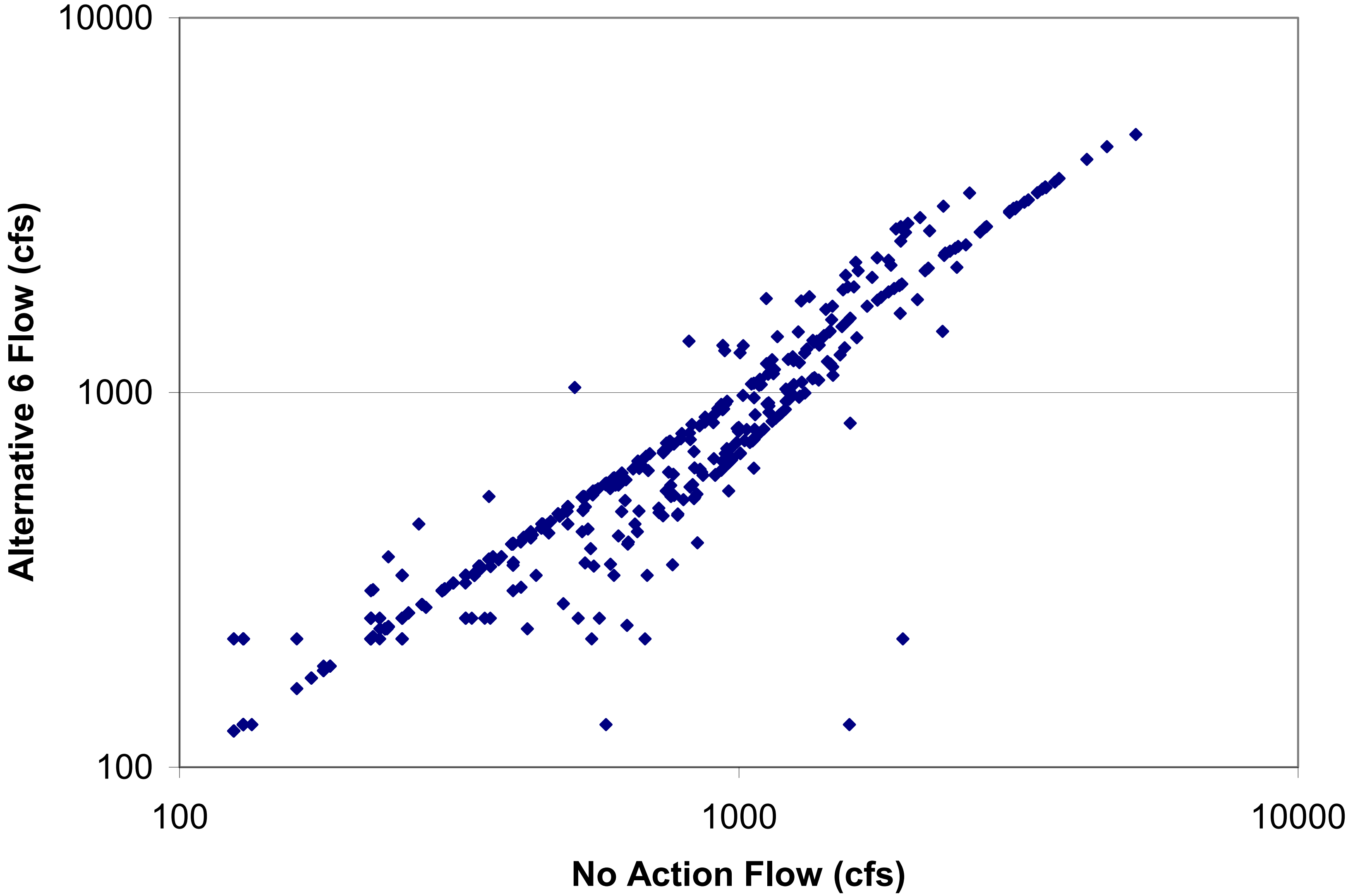


Figure 5-15
Comparison of Mokelumne River Flow (i.e., Camanche Reservoir Discharge) under Alternative 6 and No Action, 1922 – 1993 Simulation (2001 Operations).

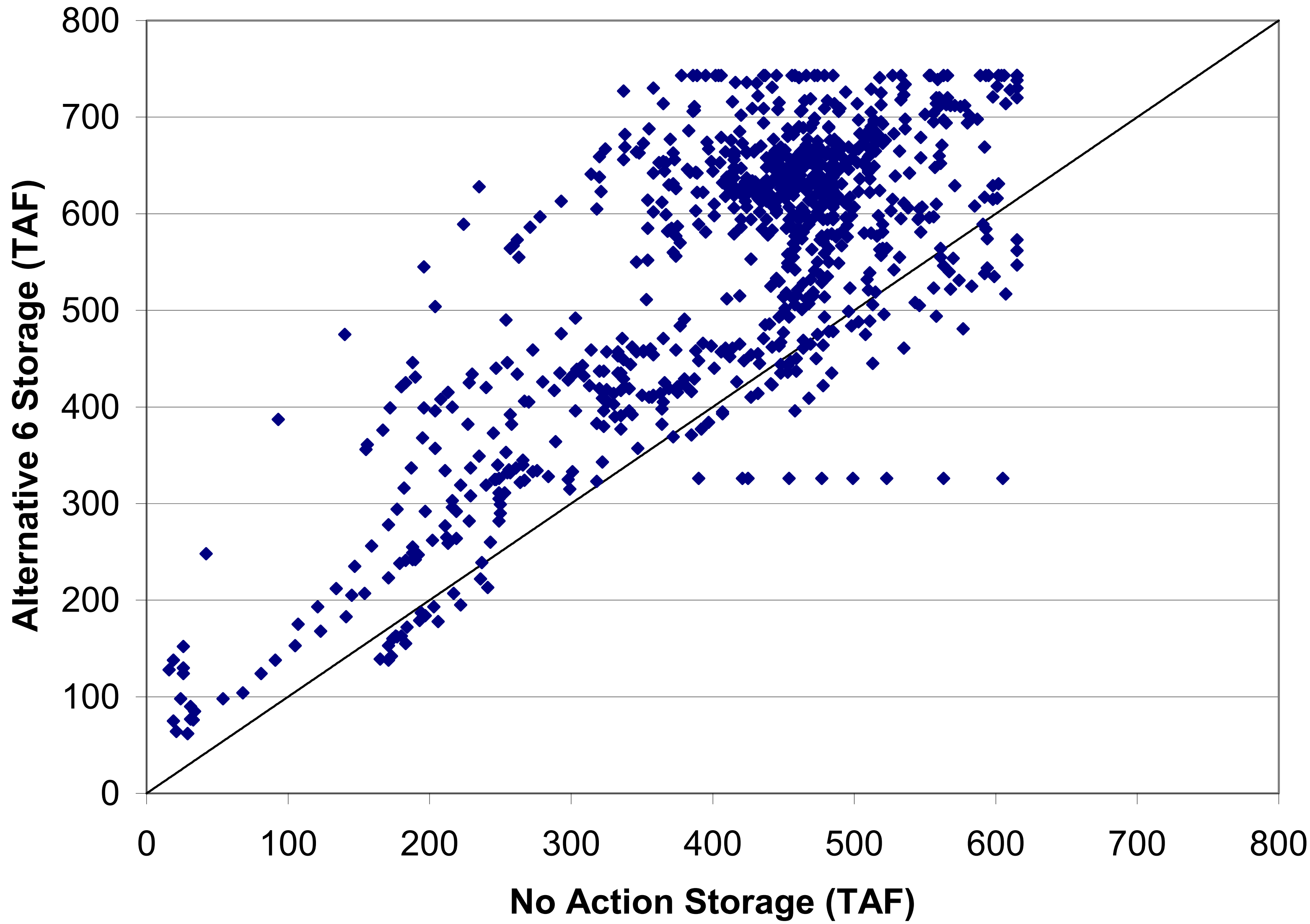


Figure 5-16
Comparison of the Combined Storage for Pardee and Camanche Reservoirs under Alternative 6 and No Action, 1922 – 1993 Simulation (2001 Operations).

Table 5-15. Frequency of Occurrence of the Percentage Change in Flow that Could Affect Rearing Habitat Area for Steelhead and Chinook Salmon in the Sacramento, Feather, American, and Mokelumne Rivers under Alternative 6, 1922–1993 Simulation (2001 Operations)

	Sacramento River					Feather River		American River		Mokelumne River	
Percentage Change in Flow	Fall-Run Chinook Salmon	Late Fall–Run Chinook Salmon	Winter-Run Chinook Salmon	Spring-Run Chinook Salmon	Steelhead	Fall-Run Chinook Salmon	Steelhead	Fall-Run Chinook Salmon	Steelhead	Fall-Run Chinook Salmon	Steelhead
<+100%	0	0	0	0	0	0	0	0	0	0	0
<+90%	0	0	0	0	0	0	0	0	0	0	0
<+80%	0	0	0	0	0	0	0	0	0	0	0
<+70%	0	0	0	0	0	0	0	0	0	0	0
<+60%	0	0	0	0	0	0	0	0	0	0	0
<+50%	0	0	0	0	0	0	0	0	0	0	0
<+40%	0	0	0	0	0	0	0	0	0	0	0
<+30%	0	0	0	0	0	0	0	0	0	0	0
<+20%	0	0	0	0	0	0	0	0	0	0	0
<+10%	0	0	0	0	0	0	0	0	0	0	0
0%	438	582	727	509	873	433	869	436	873	438	878
>-10%	0	0	0	0	0	0	0	0	0	0	0
>-20%	0	2	2	1	2	3	4	2	3	1	3
>-30%	0	0	1	1	1	0	1	0	0	0	0
>-40%	0	0	0	0	0	1	1	0	0	0	0
>-50%	0	0	0	0	0	0	0	0	0	0	1
>-60%	0	0	0	0	0	1	1	0	0	1	1
>-70%	0	0	0	0	0	0	0	0	0	1	2
>-80%	0	0	0	0	0	0	0	0	0	1	1
>-90%	0	0	0	0	0	0	0	0	0	1	1
>=-100%	0	0	0	0	0	0	0	0	0	1	1

Storage in Pardee and Camanche Reservoirs varies substantially from month to month, sometimes increasing or decreasing as much as 80% depending on inflows and downstream demands (see Chapter 2, "Hydrology, Water Supply, and Power"). The high variability in month-to-month and year-to-year storage provides relatively poor habitat for most fish species, especially sunfish and catfish. Falling surface elevation during the late spring and summer results in desiccation of spawning habitat and relatively barren rearing habitat. The average combined storage for Camanche and Pardee Reservoirs increases under Alternative 6, potentially resulting in a slight benefit to reservoir species. Based on the continued relatively poor spawning and rearing habitat for many species caused by continued month-to-month storage variation, change in reservoir storage could have a slight beneficial effect on reservoir fishes.

The operation of the enlarged Pardee Reservoir will inundate existing terrestrial areas around the perimeter. Periodic inundation associated with variation in storage will mobilize fine sediment. The sediment will move down slope and gradually settle out, reaching equilibrium over several years. The movement of sediment will adversely affect reservoir species that lay their eggs on reservoir substrates. However, existing operations and the associated high variability in month-to-month and year-to-year storage provides relatively poor habitat for most fish species. The variability in storage results in declining surface elevation that desiccates eggs and mobilizes fine sediment that may smother eggs and larvae in deeper water. The additional fine sediment that will be mobilized with the enlargement of the reservoir may increase the adverse effect in the short term, but the effect would likely have a less-than-significant adverse effect on long-term abundance of reservoir species.

In addition, reservoir species would be expected to benefit from the enlarged reservoir over the short term. Based on response of fish populations in other reservoirs, fish abundance increases dramatically during the first few years after filling a new reservoir. Inundation of terrestrial areas provides access to terrestrial prey and captures nutrients that increase abundance of invertebrates. The increased food base that would occur during initial operation of the enlarged Pardee Reservoir would be expected to increase the growth and abundance of fish species in the short term.

The sediment mobilized by reservoir enlargement remains primarily in the deeper areas of Pardee Reservoir. Any suspended sediment discharged downstream would be captured in Camanche Reservoir. Suspended sediment is unlikely to be carried downstream of Camanche into the Mokelumne River. The mobilization of sediment by enlargement of Pardee Reservoir would not adversely affect fish species in the Mokelumne River and the Delta.

Significant Impacts and Mitigation Measures

None of the project alternatives would result in significant construction-related or operation-related impacts on fish, and no mitigation measures are necessary.

Cumulative Impacts

Less-than-Significant Impacts

Cumulative impacts are related primarily to ongoing and future (year 2020) water supply operations, including operations by the CVP, SWP, SCWA, and EBMUD. Flow and fish habitat may be affected in the Trinity, Sacramento, Feather, American, and Mokelumne Rivers and in the Delta. Storage and fish habitat may be affected in Trinity, Shasta, Oroville, Folsom, Pardee, and Camanche Reservoirs. In addition, changes in flow may result in changes to exports from the Delta by the CVP and SWP, potentially affecting fish entrainment levels. Construction related effects are described earlier in this chapter and would not contribute to any cumulative significant effects relative to 2020 conditions. The

2020 operations effects are described in the following sections for Alternatives 1 through 6.

Alternative 1

The flow volume simulated for 1922–1993 in the Trinity, Sacramento, and Feather Rivers is similar for 2001 and 2020 operations (Figures 5-17 and 5-18). The pattern of flow changes, with reduction in flow for some months and years and increases for other months and years. The mix of increases and decreases would minimally affect storage and water temperature conditions. Based on the change in flow, fish habitat conditions in the Trinity may improve. Conditions in the Sacramento, and Feather Rivers under 2020 operations would be similar to fish habitat conditions under 2001 operations.

Flow and export conditions simulated for the Delta are also similar for 2001 and 2020 operations (Figures 5-19, 5-20, and 5-21). For most months, the proportion of flow entering the Delta Cross Channel and Georgiana Slough under 2020 operations is similar to the proportion under 2001 conditions (Figure 5-19). The migration pathway for chinook salmon and other species would be minimally affected.

The average and median shift in X2 over the 1922–1993 simulation is less than 0.1 km (Figure 5-20). During May, the shift in X2 for the 1922–1993 simulation is downstream, with an average change in downstream location of about 0.21 km and a median change of 0.11 km. During October and November, X2 would shift slightly (averaging about 0.3 km) upstream. Overall, fish habitat location and quantity, relative to salinity distribution (X2) under the No Action Alternative, would be similar for 2001 and 2020 operations.

Flows in the American and Mokelumne Rivers would be less under 2020 operations than under 2001 operations (Figures 5-18 and 5-22). The reduced flow could adversely affect fish habitat in both rivers. The 2020 simulations assume a greater demand than that assumed under 2001. The effects on flow, therefore, are related to projected growth.

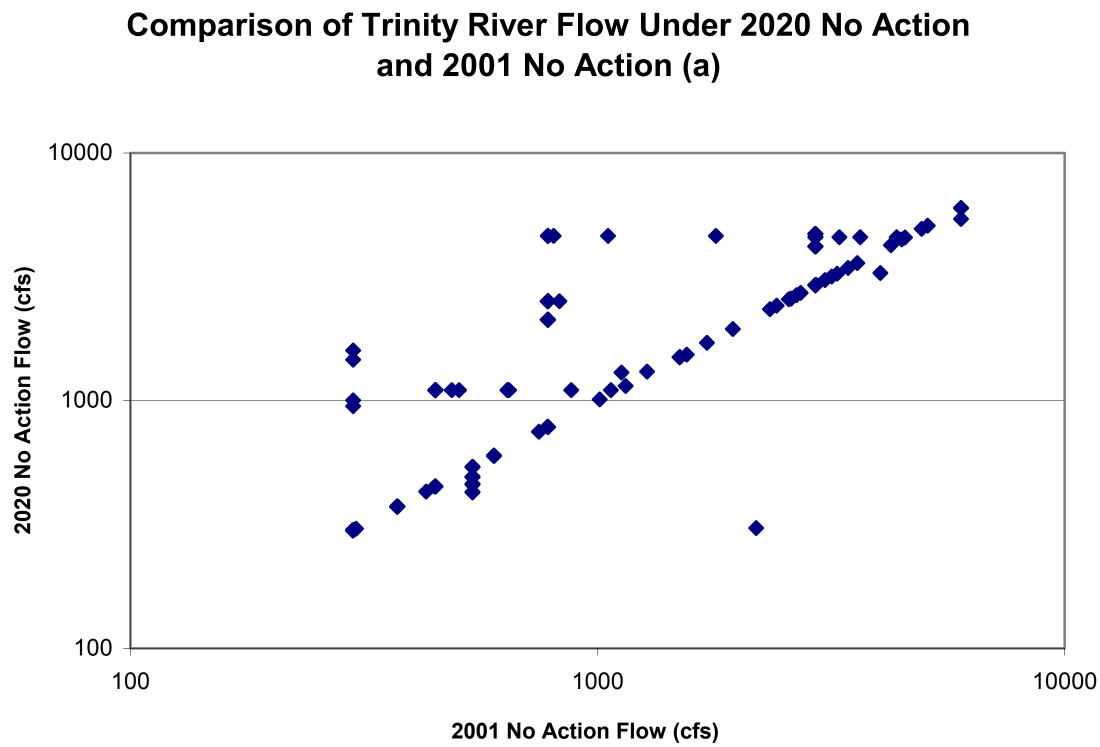
Spawning and Rearing Habitat Area

Simulated flows under 2020 operations are compared to simulated flows under 2001 operations for the American and Mokelumne Rivers (Figures 5-18 and 5-22). Flows under the 2020 operations would be reduced compared to flows under 2001 operations. The reduction in flow could adversely affect spawning and rearing habitat for chinook salmon and steelhead in both rivers. Inundated floodplain provides spawning habitat for splittail and rearing habitat for juvenile splittail and chinook salmon. In the Mokelumne River, the reduction in high February flow could adversely affect the frequency and duration of overbank and floodplain inundation. The reduced inundation could reduce continuity with spawning and rearing habitat for splittail and rearing habitat for juvenile chinook salmon. Flows during March and April, however, would be less affected by 2020 operations and continue to support similar levels of floodplain inundation. The adverse effect on splittail and juvenile chinook salmon access to spawning and rearing habitat would likely be minimal.

Water Temperature

Change in reservoir storage and river flow potentially affects water temperature in the American and Mokelumne Rivers. Water temperature in river reaches immediately downstream of the primary reservoirs, including Folsom and Camanche, are the most sensitive to effects of operations. These reaches support chinook salmon and steelhead, species with life stages that can be adversely affected by temperature conditions.

Water temperature in the American River is slightly warmer under 2020 operations than under 2001 operations (Figure 5-23). The warming of water temperature attributable to 2020 operations is almost always less than 1°F. However, the potential effect of water temperature on steelhead and chinook salmon life stages warrants further consideration. Survival indices were assigned to the water temperature for each month of occurrence of each life stage for chinook salmon and steelhead in the American River (Table 5-16).



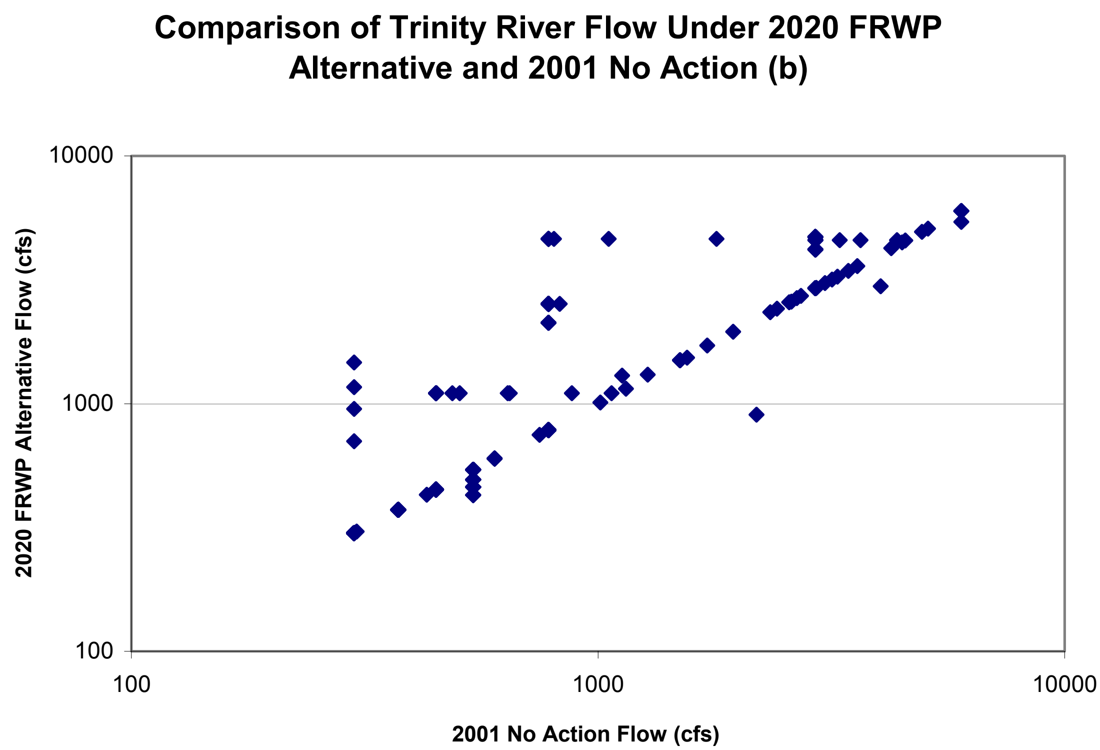


Figure 5-17
Trinity River Flows under 2020 No Action Operations (a) and 2020 FRWP Alternative Operations (b) Compared to Flows under 2001 No Action Operations, 1922 – 1993 Simulation.

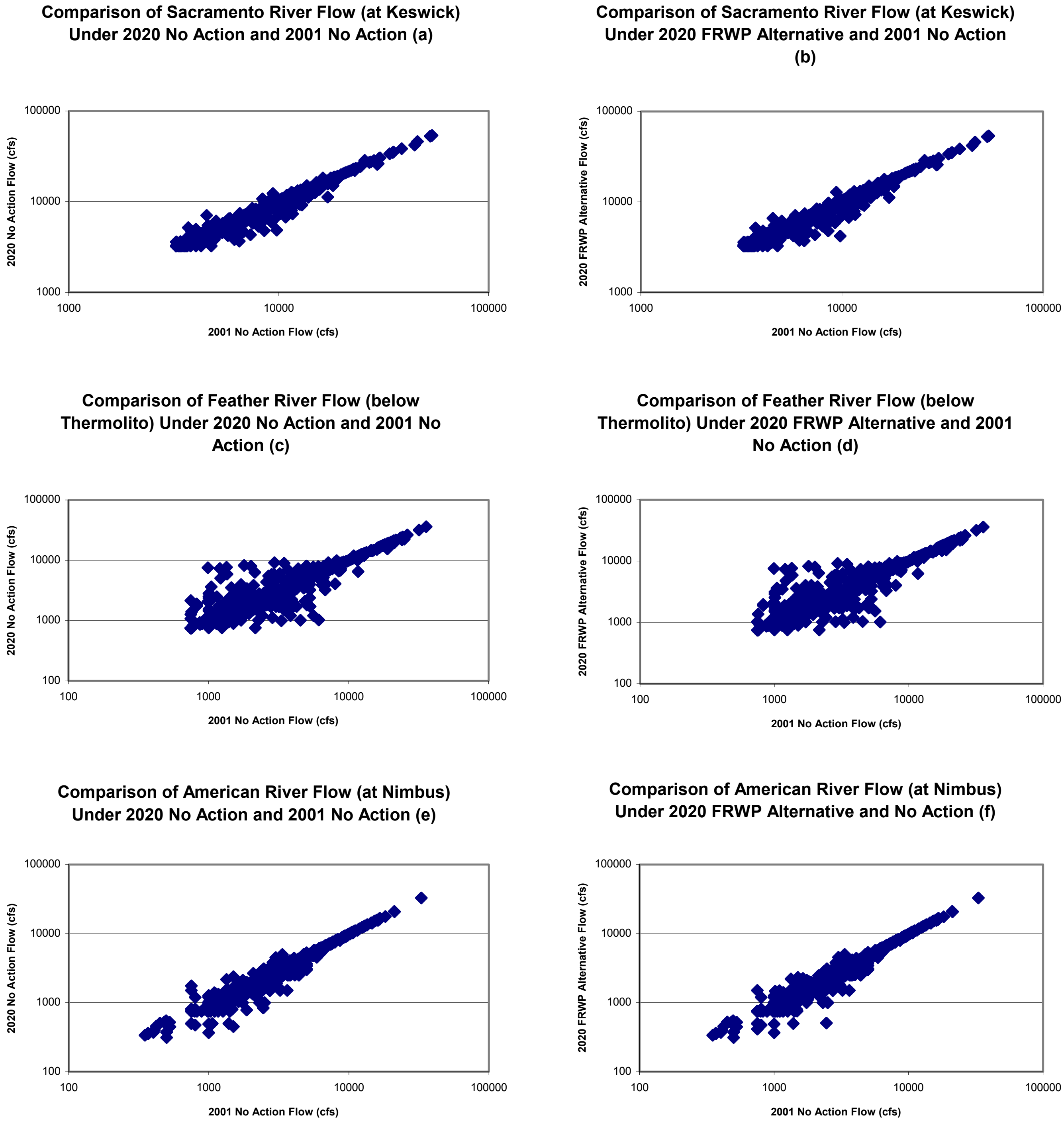
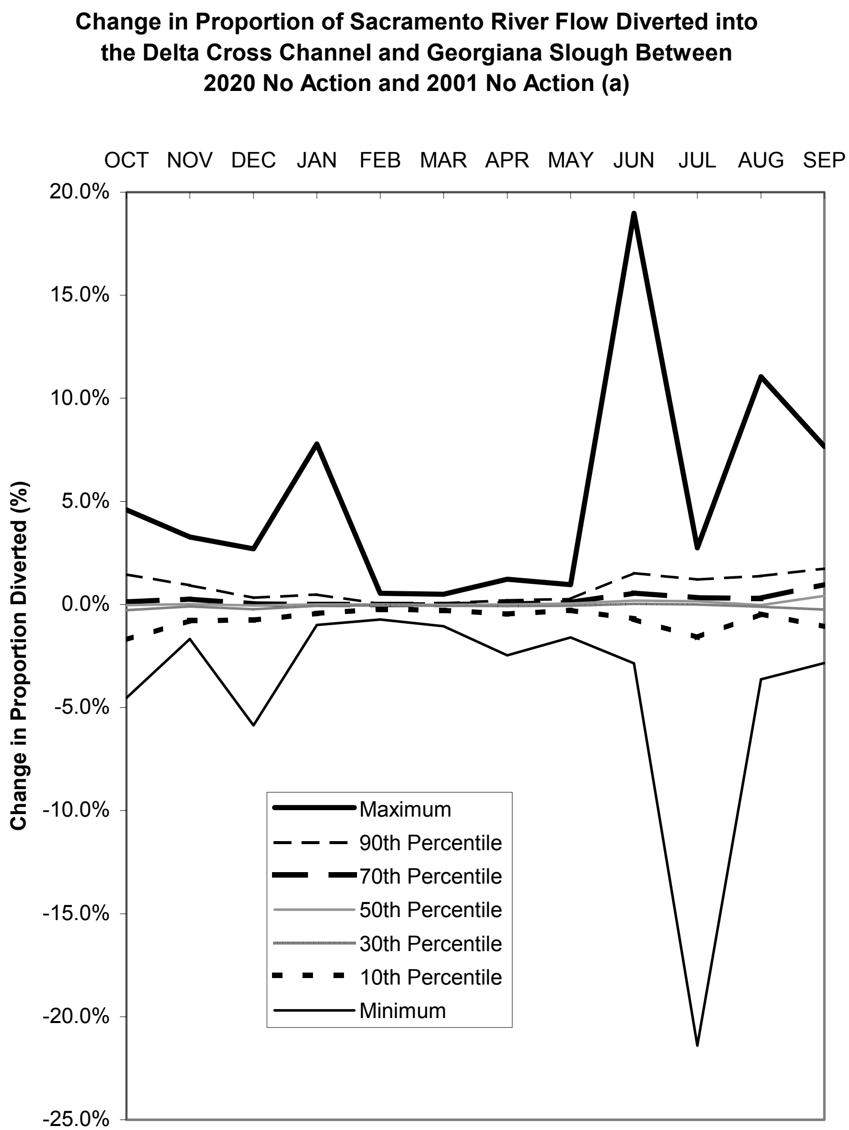


Figure 5-18
Sacramento River, American River, and Feather River Flows under 2020 No Action Operations and 2020 FRWP Alternative Operations Compared to Flows under 2001 No Action Operations, 1922 – 1993 Simulation.



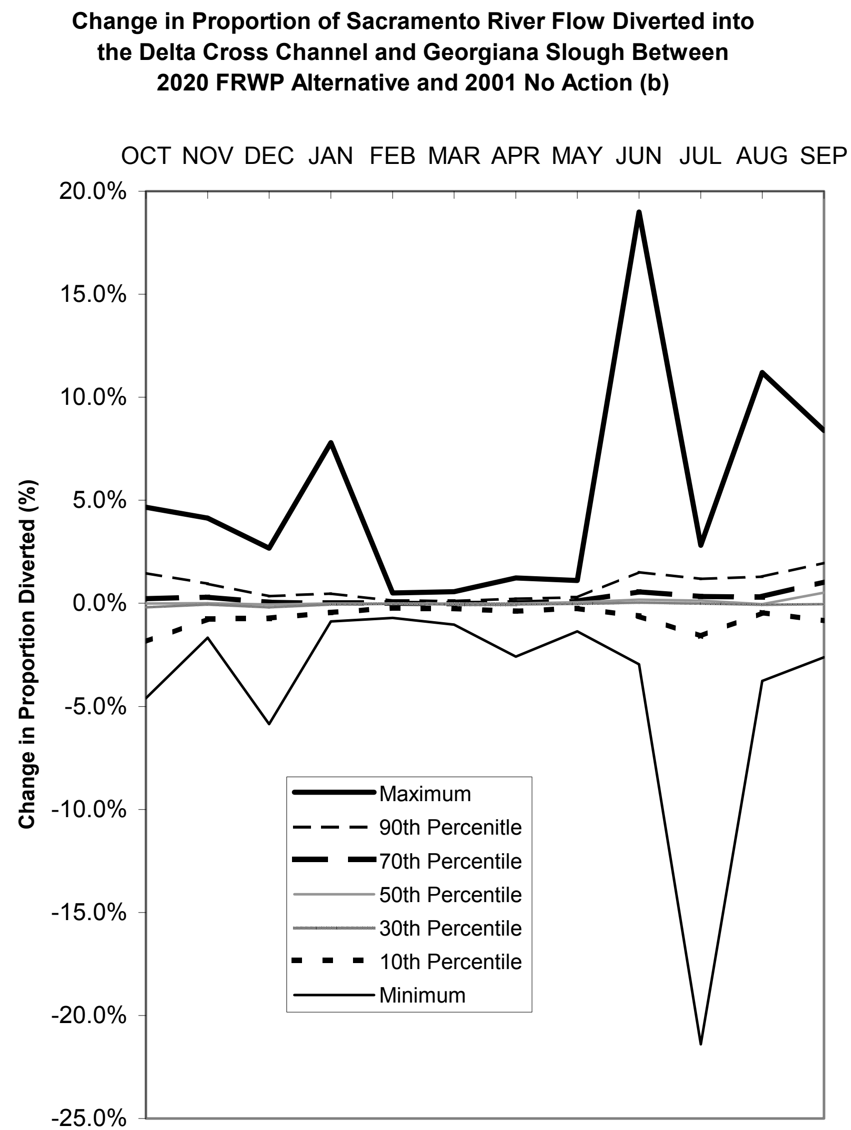


Figure 5-19
Change in the Proportion of Sacramento River Flow Diverted into the Delta Cross Channel & Georgiana Slough under 2020 No Action Operations (a) and 2020 FRWP Alternative Operations (b) Relative to 2001 No Action Operations, 1922 – 1993 Simulation.

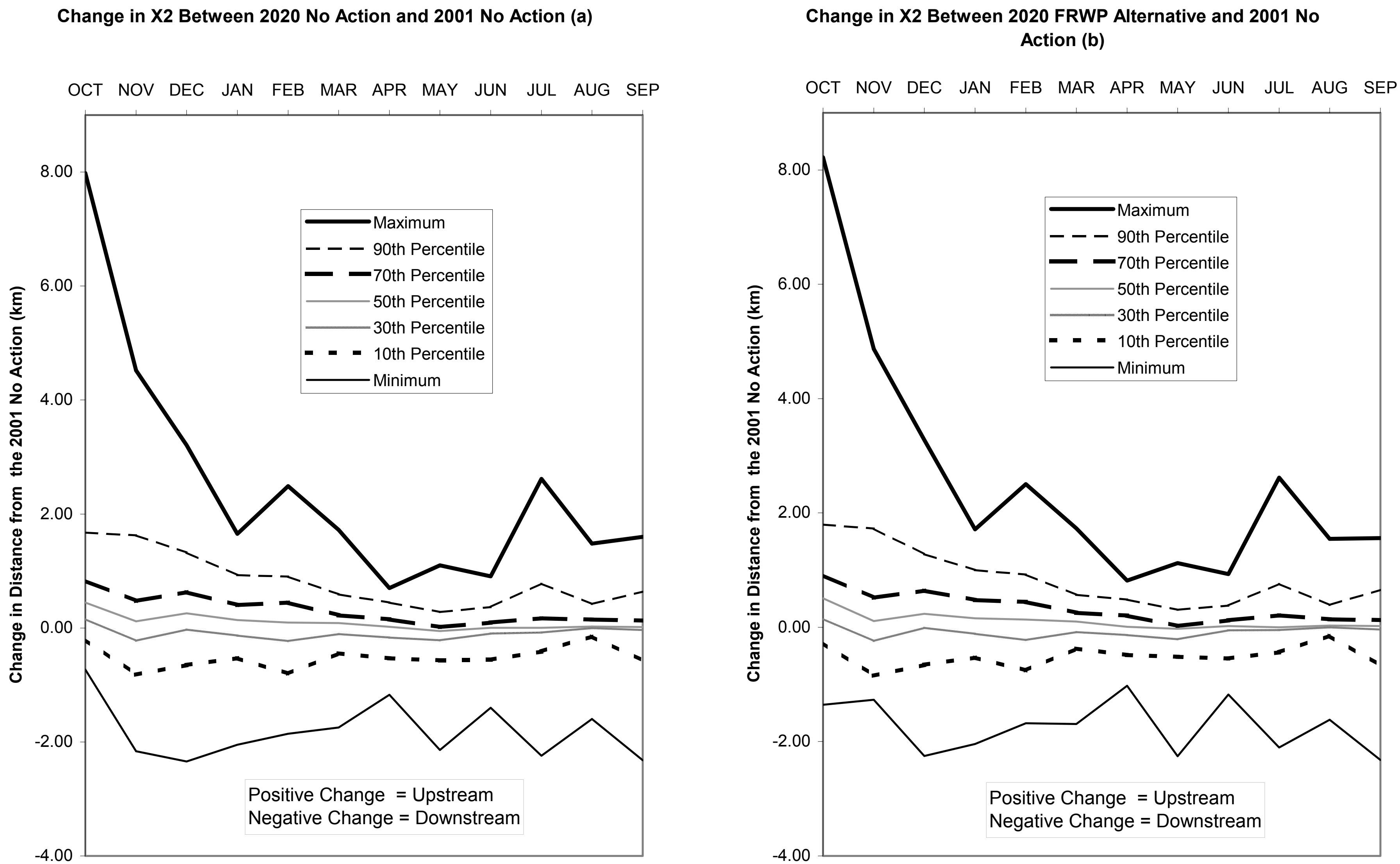


Figure 5-20
Change in X2 under 2020 No Action Operations (a) and 2020 FRWP Alternative Operations (b) Relative to 2001 No Action Operations, 1922 – 1993 Simulation

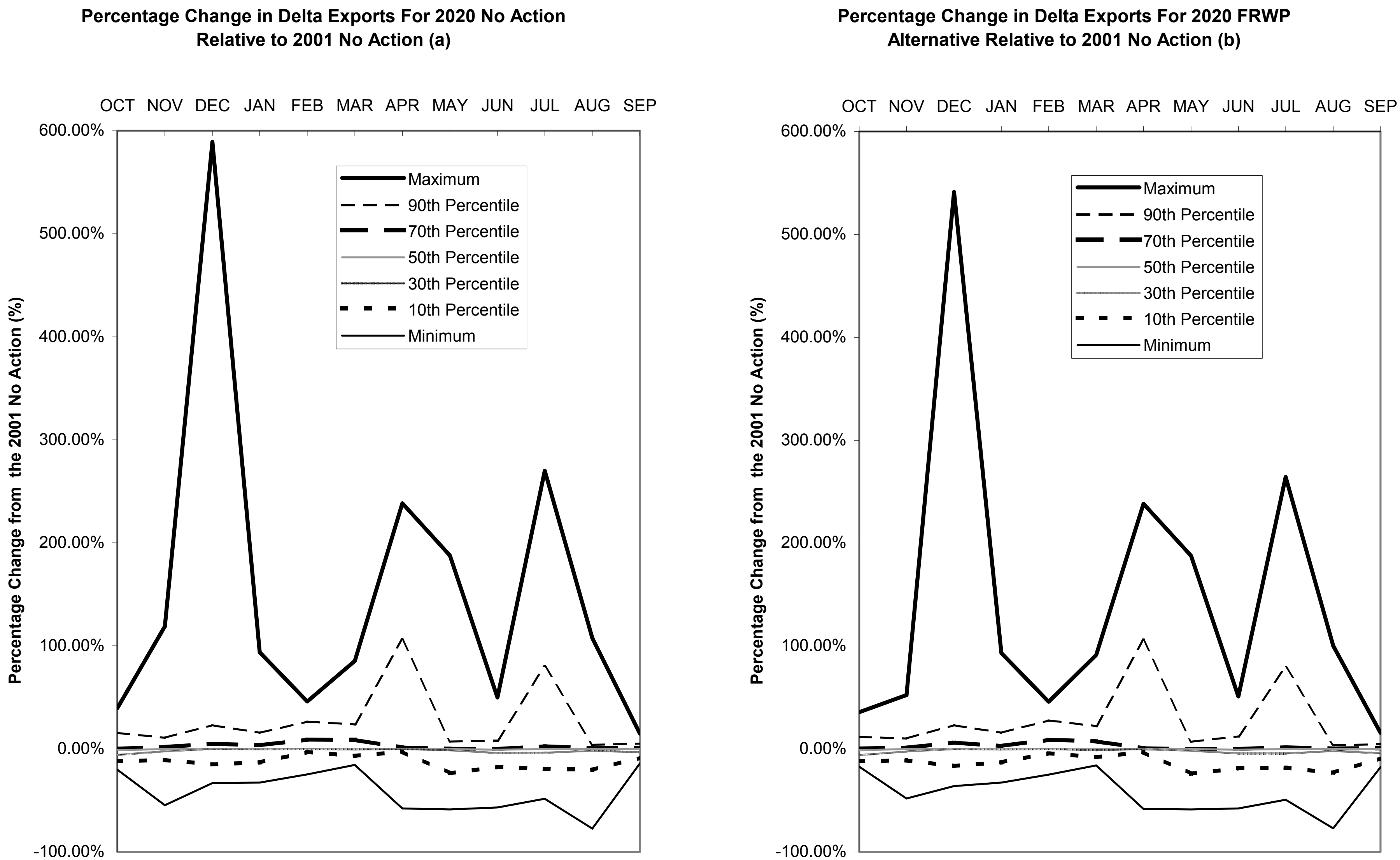
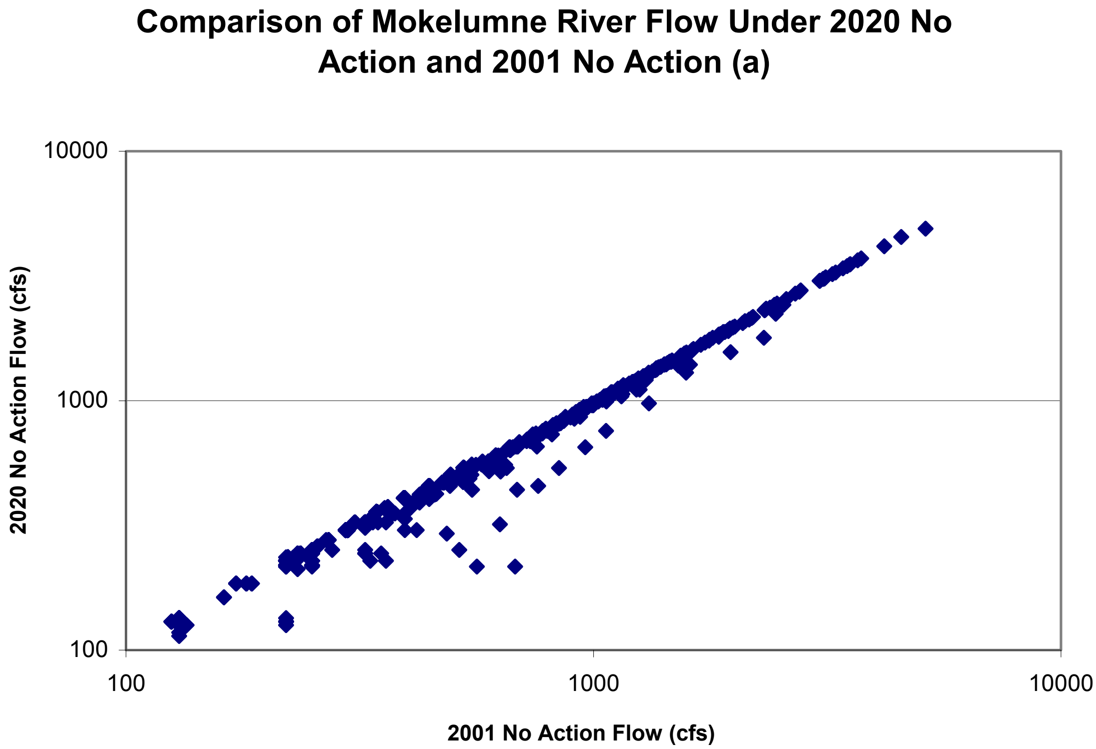


Figure 5-21
Percentage Change in Delta Exports under 2020 No Action Operations (a) and 2020 FRWP Alternative Operations (b) Relative to 2001 No Action Operations, 1922 – 1993 Simulation



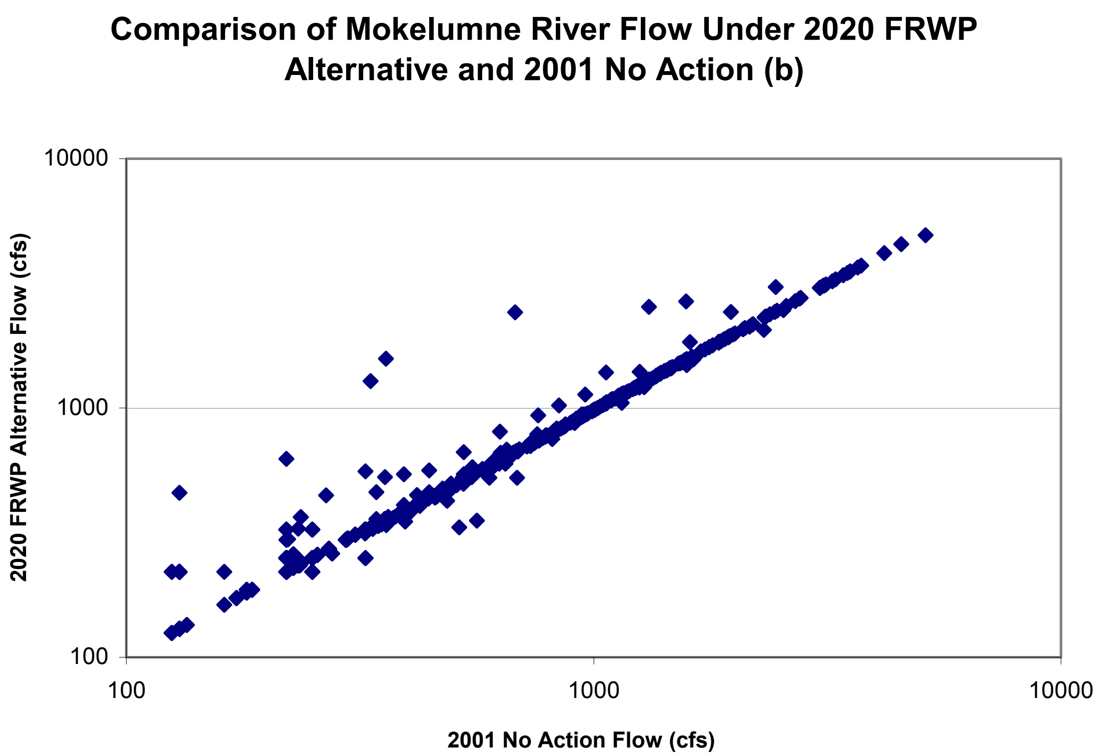
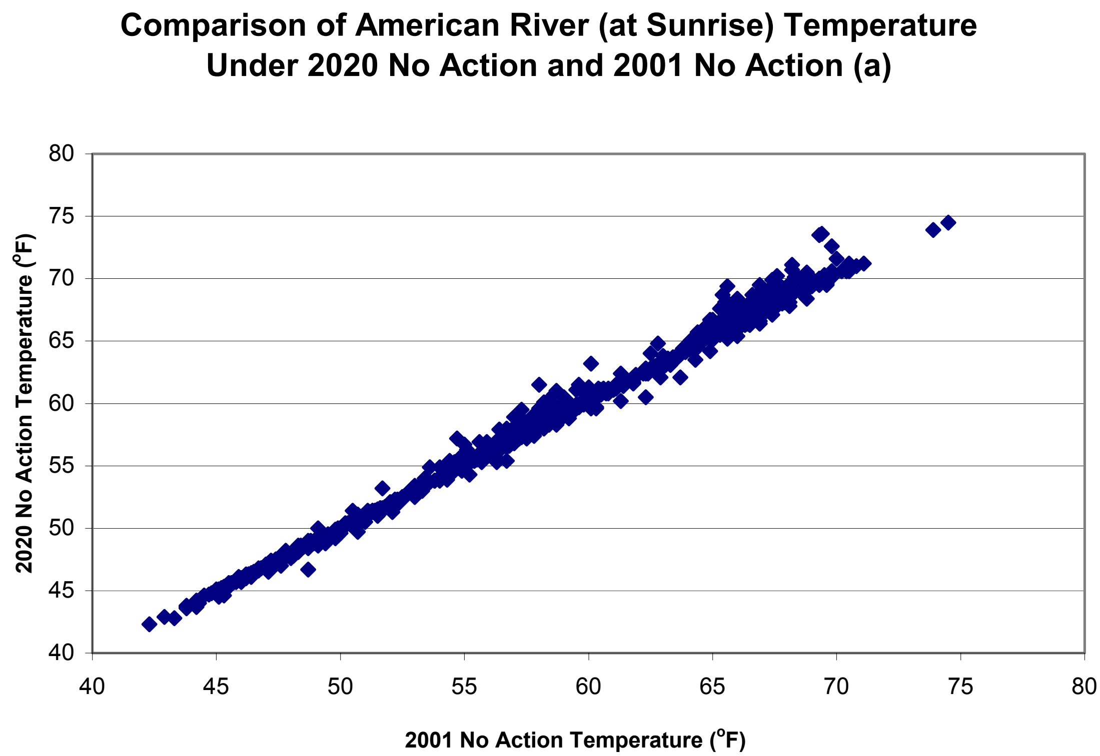


Figure 5-22
Mokelumne River Flow under 2020 No Action Operations (a) and 2020 FRWP Alternative Operations (b) Compared to Flow under 2001 No Action Operations, 1922 – 1993 Simulation.



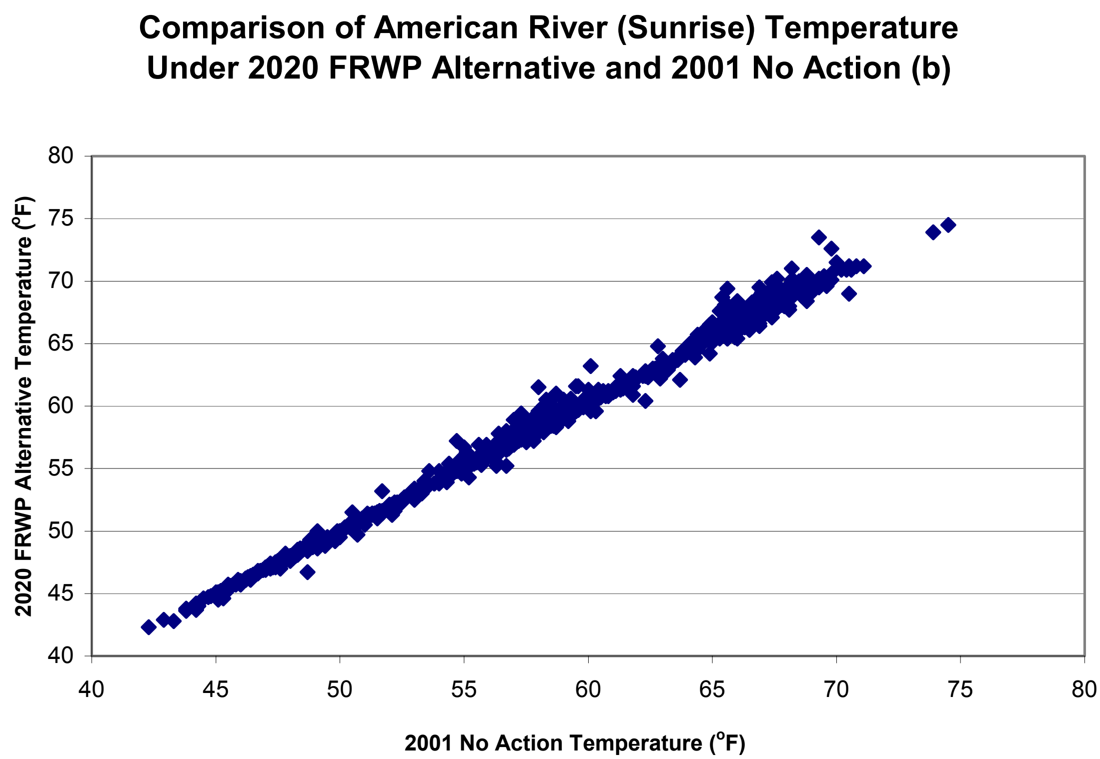


Figure 5-23
Water Temperature for the American River at Sunrise under 2020 No Action Operations (a) and 2020 FRWP Alternative Operations (b) Compared to Temperature under 2001 No Action Operations, 1922 – 1993 Simulation.

Table 5-16. Frequency of Occurrence of the Water Temperature Suitability Index for Chinook Salmon and Steelhead Life Stages in the American River at Sunrise under 2001 Base Case Operations (top) and Frequency of Occurrence of the Change in Water Temperature Suitability Index under 2020 Base Case Operations (bottom) Relative to 2001 Base Case Operations, 1922–1993 Simulation

	Chinook Salmon				Steelhead			
Base Index	Adult Migration	Spawning/ Incubation	Juvenile Rearing	Smolt Migration	Adult Migration	Spawning/ Incubation	Juvenile Rearing	Smolt Migration
1	334	332	805	617	380	276	801	403
0.9	14	62	49	24	37	30	56	22
0.8	4	46	7	7	5	8	5	7
0.7	50	22	1	0	27	9	0	0
0.6	76	13	0	0	30	6	1	0
0.5	42	14	0	0	11	10	1	0
0.4	22	9	0	0	8	2	0	0
0.3	11	10	1	0	3	6	0	0
0.2	7	5	1	0	0	2	0	0
0.1	6	4	0	0	1	3	0	0
0	10	59	0	0	2	152	0	0

Change in the Index	Chinook salmon				Steelhead			
	Adult Migration	Spawning/ Incubation	Juvenile Rearing	Smolt Migration	Adult Migration	Spawning/ Incubation	Juvenile Rearing	Smolt Migration
<+1.0	0	0	0	0	0	0	0	0
<+0.9	0	0	0	0	0	0	0	0
<+0.8	0	0	0	0	0	0	0	0
<+0.7	0	0	0	0	0	0	0	0
<+0.6	0	0	0	0	0	0	0	0
<+0.5	0	0	0	0	0	0	0	0
<+0.4	0	0	0	0	0	0	0	0
<+0.3	0	1	0	0	0	0	0	0
<+0.2	0	4	0	0	0	1	0	0
<+0.1	13	18	4	3	15	13	2	3
0	331	412	731	599	370	457	734	387
>-0.1	134	96	120	41	94	30	123	37
>-0.2	71	23	6	4	23	3	3	4
>-0.3	22	11	0	0	1	0	1	0
>-0.4	4	6	1	0	1	0	1	0
>-0.5	1	2	1	0	0	0	0	0
>-0.6	0	1	1	0	0	0	0	0
>-0.7	0	1	0	1	0	0	0	1
>-0.8	0	1	0	0	0	0	0	0
>-0.9	0	0	0	0	0	0	0	0
>=-1.0	0	0	0	0	0	0	0	0

Water temperature suitability indices for steelhead and chinook salmon life stages in the American and Feather Rivers are less than optimal for many months. Future operations will degrade conditions for most life stages of chinook salmon and steelhead. Adult chinook salmon and juvenile steelhead are most affected because water temperature conditions are less suitable during the period of life stage occurrence (i.e., late summer and fall) and warming has a greater adverse effect.

Water temperature was not simulated for the Mokelumne River, but changes in flow and reservoir storage provide an indication of potential effects on water temperature. The reduction in Mokelumne River flow occurs every month except October and generally affects higher flows (Figure 5-22). Storage affects the ability to release cold water to the Mokelumne River. The combined Camanche and Pardee Reservoir storage indicates a potential reduction in the coldwater pool (Figure 5-24). Warmer water temperature could be expected more frequently, and adverse effects on chinook salmon and steelhead could occur, similar to effects described above for the American River.

Warmer water temperature conditions under 2020 operations would have an adverse effect on adult migration, spawning, incubation, rearing, and juvenile migration life stages of chinook salmon and steelhead in the American and Mokelumne Rivers.

Entrainment

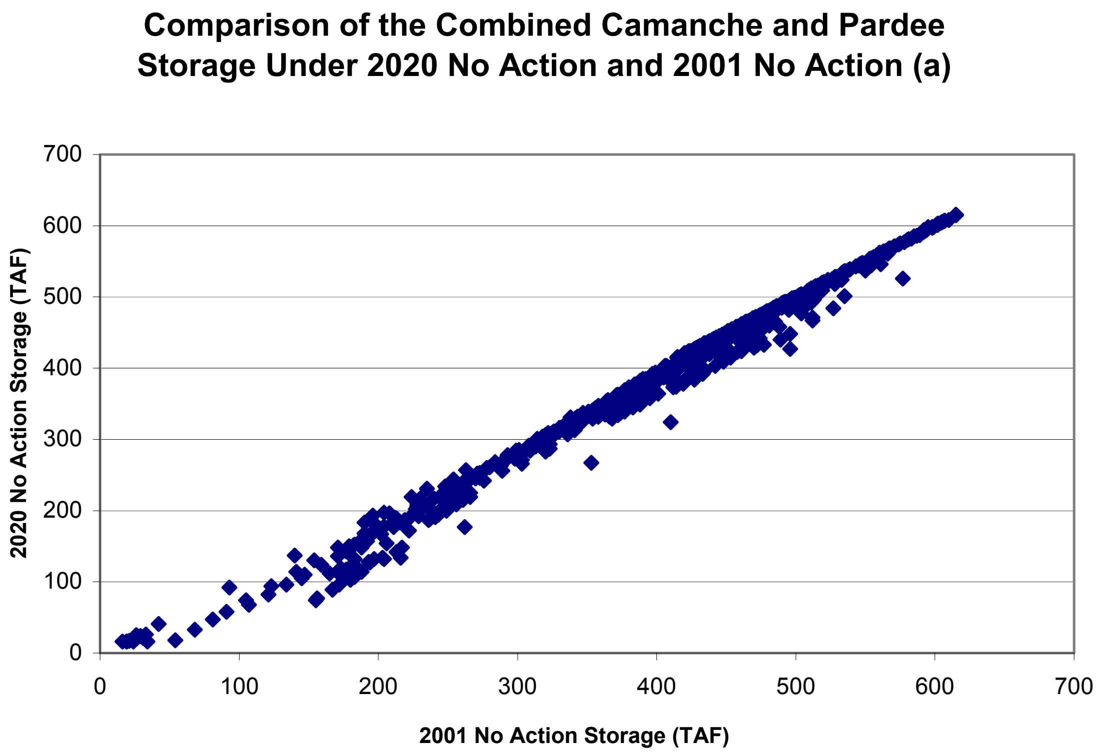
Exports increase slightly from November through July under 2020 operations (Figure 5-21). Although increased exports could increase entrainment, the slight increase in exports would have minimal effect on entrainment of Delta fishes.

Reservoir Species Habitat

Storage in Folsom, Pardee, and Camanche, and other Central Valley reservoirs varies substantially from month to month and year to year. The high variability in month-to-month and year-to-year storage provides relatively poor habitat for most fish species, especially sunfish and catfish. Falling surface elevation during the late spring and summer results in desiccation of spawning habitat and relatively barren rearing habitat. Under 2020 operations, storage would be reduced in Folsom, Pardee, and Camanche Reservoirs. Relative to 2001 operations, reduced storage could further degrade habitat conditions for reservoir fishes.

Alternatives 2–5

As described in earlier sections, water supply operations for Alternatives 2–5 affect fish and fish habitat in reaches of the Trinity, Sacramento, Feather, American, Mokelumne, and San Joaquin Rivers and in the Delta and Suisun Bay. As described for above for Alternative 1, the flow volume simulated for 1922–1993 in the Trinity, Sacramento, and Feather Rivers is similar for 2001 and 2020 operations (Figures 5-17, and 5-18). Operations under Alternatives 2–5 would not substantially change flow relative to flow under Alternative 1. Effects on fish



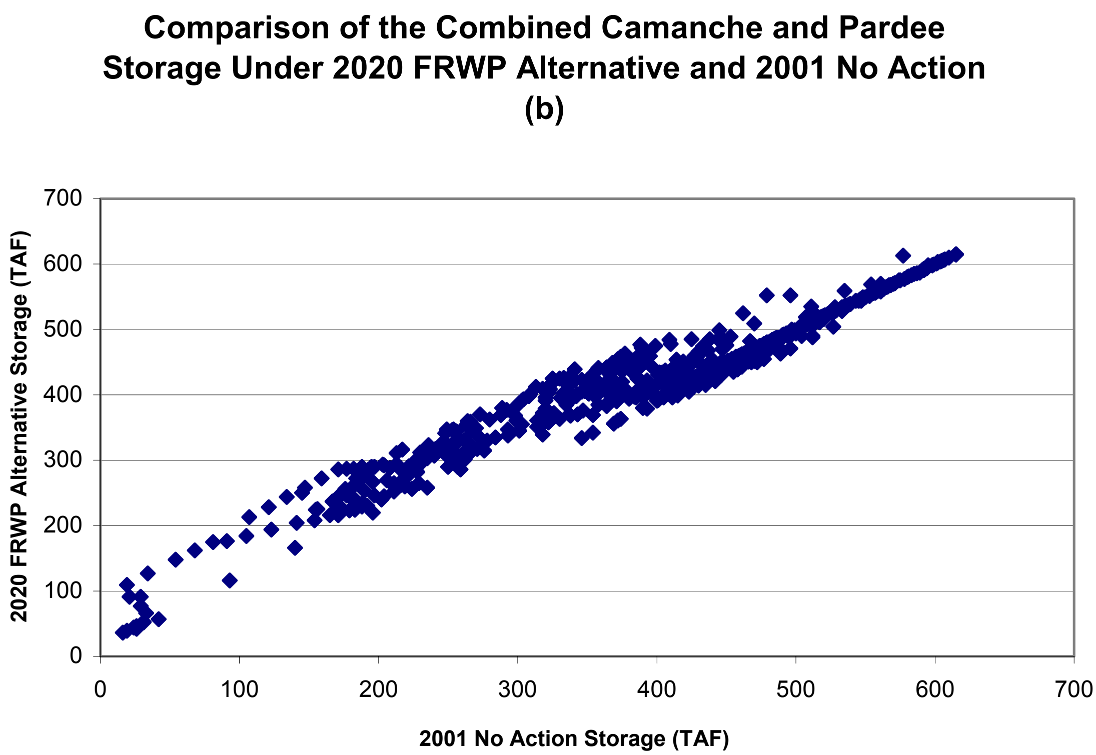


Figure 5-24
Combined Storage for Pardee and Camanche Reservoirs under 2020 No Action Alternations (a) and 2020 FRWP Alternative Operations (b) Compared to Combined Storage under 2001 No Action Operations, 1922 – 1993 Simulation.

habitat in the Trinity, Sacramento, and Feather Rivers is the same as described earlier in this chapter for 2001 operations assumptions. Implementation of Alternatives 2–5 would have less-than-significant cumulative impacts on fish species in the Trinity, Sacramento, and Feather Rivers.

Flow and export conditions simulated for the Delta are also similar for 2001 and 2020 operations (Figures 5-19, 5-20, and 5-21). Operations under Alternatives 2–5 would not substantially change Delta Cross Channel and Georgiana Slough flow, X2, and exports relative to conditions under Alternative 1. Effects on fish species and their habitat in the Delta are the same as described earlier in this chapter for 2001 operations assumptions. As indicated previously, implementation of Alternatives 2–5 would have less-than-significant cumulative impacts on fish species in the Delta.

Flows in the American and Mokelumne Rivers would be less under 2020 operations than under 2001 conditions (Figures 5-18 and 5-22). The reduced flow could adversely affect fish habitat in both rivers. The change in operations under Alternatives 2–5, however, would have minimal effect relative to flows that were simulated for Alternative 1. The effects on flow are related to projected growth under 2020 assumptions and are not attributable to operations under Alternatives 2–5. As described in the previous sections, operations associated with Alternatives 2–5 would cause little change relative to the No Action Alternative. On the Mokelumne River, higher flows and reservoir storage under Alternatives 2–5 would benefit spawning and rearing habitat for chinook salmon and steelhead and provide the potential for cooler discharge from Camanche Reservoir. The changes in flow and water temperature benefit chinook salmon and steelhead.

Effects on water temperature in the American River would be minimal (Figure 5-23). As described earlier in this chapter for 2001 operations assumptions, effects of warmer temperatures would have a less-than-significant impact on steelhead and chinook salmon. As indicated by the occurrence of both higher and lower indices relative to Alternative 1 under 2020 operations, no negative or positive effect is apparent. In the Mokelumne River, the combined Camanche and Pardee Reservoir storage is higher for Alternative 2 (Figure 5-24), indicating an increase in the coldwater pool. Under Alternative 1, Pardee Reservoir storage fell below 100,000 af during April through September in 3 years, indicating that water temperature management flexibility could be limited during those years. Under Alternatives 2–5, Pardee Reservoir storage below 100,000 af is less frequent (i.e., 1 year), and water temperature management flexibility would be enhanced. In general, slightly cooler water temperature could be expected more frequently because of the combined effect of increased reservoir storage and increased river flow (Figures 5-24 and 5-22). The cooler water temperature could have a small benefit to fall-run chinook salmon and steelhead. Similar to effects described for 2001 operations assumptions, implementation of Alternatives 2–5 under 2020 operations would have less-than-significant cumulative impacts on fish species in the American and Mokelumne Rivers. Relative to Alternative 1, operations under Alternatives 2–5 would lessen the effects attributable to 2020 demands.

Alternatives 2–5 include diversions to meet regional water supply needs for EBMUD and SCWA. EBMUD plans to take Sacramento River water at a maximum diversion rate of about 155 cfs during an EBMUD dry year (Chapter 3, "Hydrology, Water Supply, and Power"). As described in this chapter for 2001 operations assumptions, the proportion of flow diverted from the Sacramento River near Freeport is usually less than 1% (Figure 5-13). Juvenile steelhead and chinook salmon, adult and juvenile delta smelt, splittail, and juvenile and adult life stages of other species are unlikely to be entrained by the intake facility. The low potential for entrainment is attributable partially to the relatively small proportion of flow diverted from the Sacramento River. In addition, the intake facility would include a fish exclusionary system designed to meet DFG, NOAA Fisheries, and USFWS criteria. Specific criteria on adequate screen area, maintenance features, and facility hydraulics are mandated for compliance.

Fish eggs and larvae could be entrained in the intake facility. Delta smelt larvae occur infrequently in the vicinity of the diversion, and the potential for entrainment is low. Eggs and larvae of other species, such as striped bass, pass the proposed diversion point in substantial numbers.

As described for the 2001 operations assumptions, entrainment in the Freeport intake facility under 2020 operations would have a less-than-significant cumulative impact on chinook salmon, steelhead, delta smelt, striped bass, and other species because the proportion of Sacramento River flow diverted is small and the fish screen minimizes entrainment.

As indicated above for Alternative 1, storage in Trinity, Shasta, and Oroville reservoirs simulated under 2020 operations is similar to storage simulated for 2001 operations. Storage in Folsom, Pardee, and Camanche Reservoirs, however, is lower under 2020 operations. The effects on storage are related to projected growth and are not attributable to operations under Alternatives 2–5. Operations under Alternatives 2–5 would have minimal effect on Folsom Storage and would result in slightly greater storage in Camanche and Pardee Reservoirs (Figure 5-24). Given the small change in reservoir storage relative to Alternative 1 and ongoing poor habitat conditions for reservoir species attributable to high variability in month-to-month and year-to-year storage, implementation of Alternatives 2–5 would have less-than-significant cumulative impacts on reservoir fishes. Relative to Alternative 1, operations under Alternatives 2–5 would lessen the effects attributable to 2020 demands.

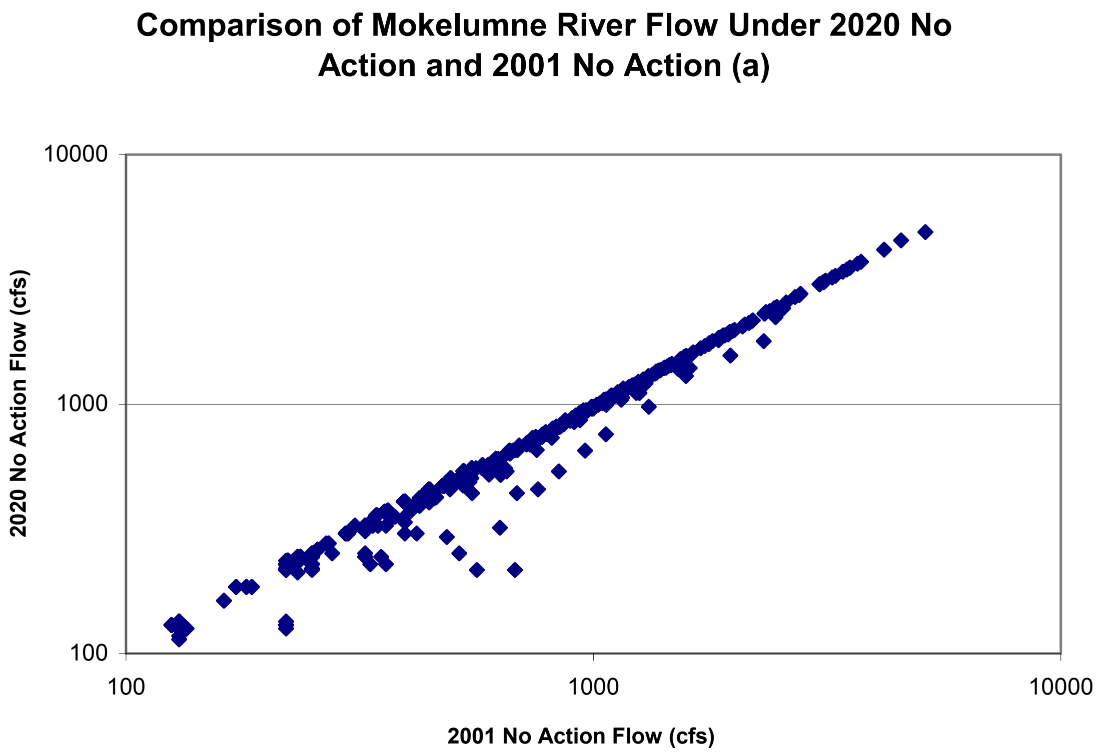
Alternative 6

Operations and effects on reservoir storage, flow, water temperature, and exports are similar to the effects described for Alternative 2. For the Trinity, Sacramento, Feather, and American Rivers; Trinity, Shasta, Oroville, and Folsom Reservoirs; and the Delta, effects would be less than described under Alternative 2. The smaller effect would occur because only Sacramento County would divert Sacramento River water and changes in CVP and SWP operations would be smaller (Chapter 3, "Hydrology, Water Supply, and Power"). As described under Alternative 2, operations under Alternative 6 would have less-than-significant cumulative impacts on fish species in the affected reservoirs, rivers and in the Delta.

Operations on the Mokelumne River under Alternative 6 would increase flow in some months (Figure 5-25). However, flows would be reduced during other months. The effect on spawning and rearing habitat area, however, is minimal, similar to effects previously described for Alternative 6 under the 2001 operations assumptions. The effects on flow are related primarily to projected growth under 2020 assumptions and are not attributable to operations under Alternative 6. As described in the previous sections, operations associated with Alternative 6 would cause little change relative to the No Action Alternative. On the Mokelumne River, higher flows and reservoir storage under Alternative 6 would benefit spawning habitat for chinook salmon. The combined storage in Pardee and Camanche reservoirs would increase (Figure 5-26). Under Alternative 1, Pardee Reservoir storage fell below 100,000 af during April through September in 3 years, indicating that water temperature management flexibility may be limited in those years. Under Alternative 6, Pardee Reservoir storage below 100,000 af is less frequent (i.e., at most 2 years) and water temperature management flexibility would be enhanced. The increased storage could result in cooler release temperatures and benefit chinook salmon and steelhead.

The potential for cooler discharge from Camanche Reservoir and the minimal effect on Mokelumne River flows during March through May, and the increased reservoir storage and re-operation of Pardee and Camanche Reservoirs would have a less-than-significant cumulative impact on chinook salmon, steelhead, splittail, and other species in the Mokelumne River, similar to effects described under Alternative 6 for the 2001 operations assumptions.

The average combined storage for Camanche and Pardee Reservoirs increases under Alternative 6, potentially resulting in a slight benefit to reservoir species (Figure 5-26). Based on the continued relatively poor spawning and rearing habitat for many reservoir species caused by continued month-to-month storage variation, increased reservoir storage would have minimal beneficial effect on reservoir fishes.



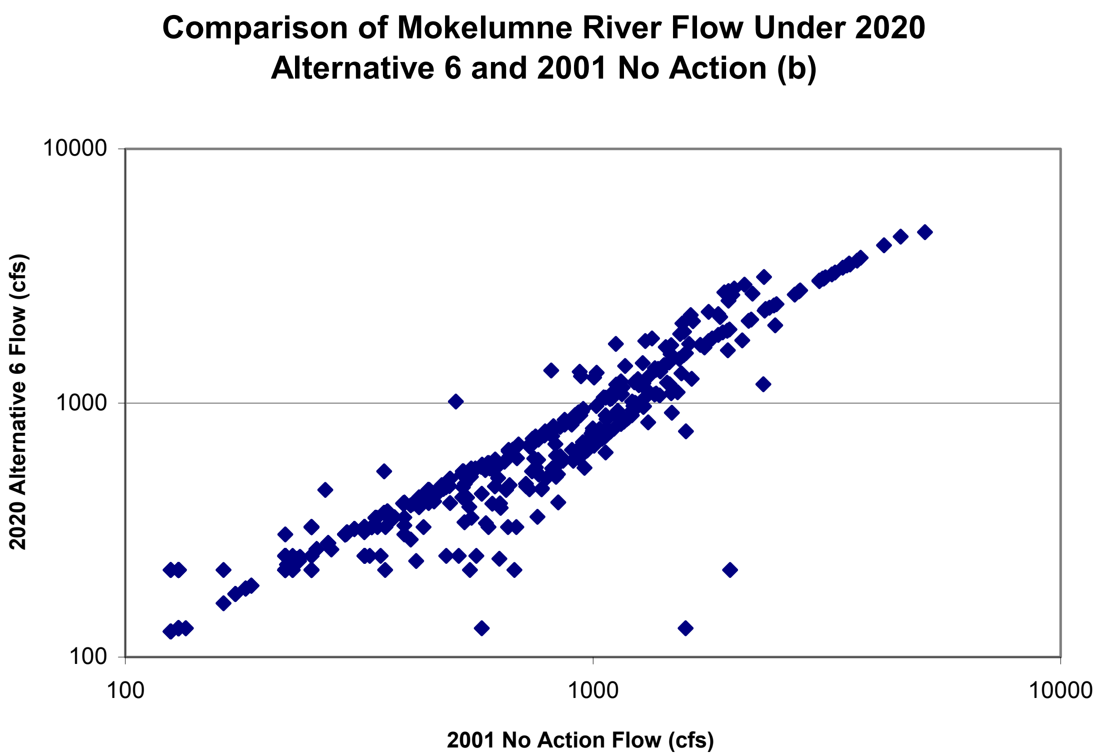
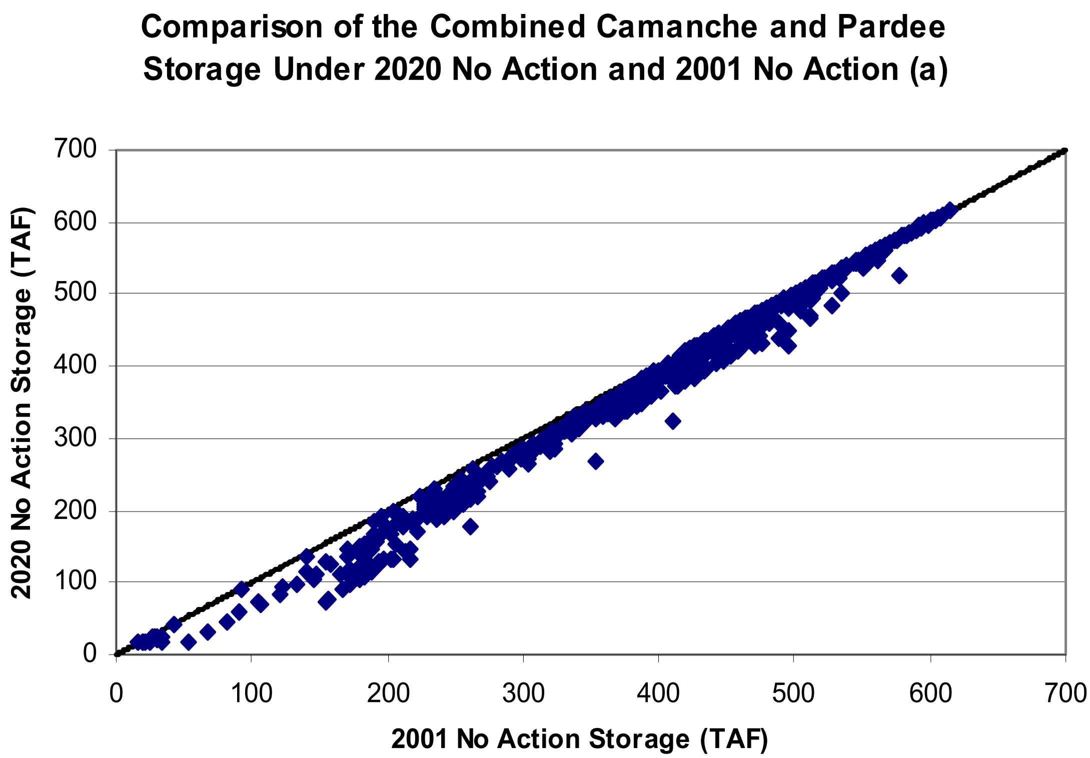


Figure 5-25
Mokelumne River Flow under 2020 No Action Operations (a) and 2020 Alternative 6 Operations (b) Compared to Flow under 2001 No Action Operations, 1922 – 1993 Simulation.



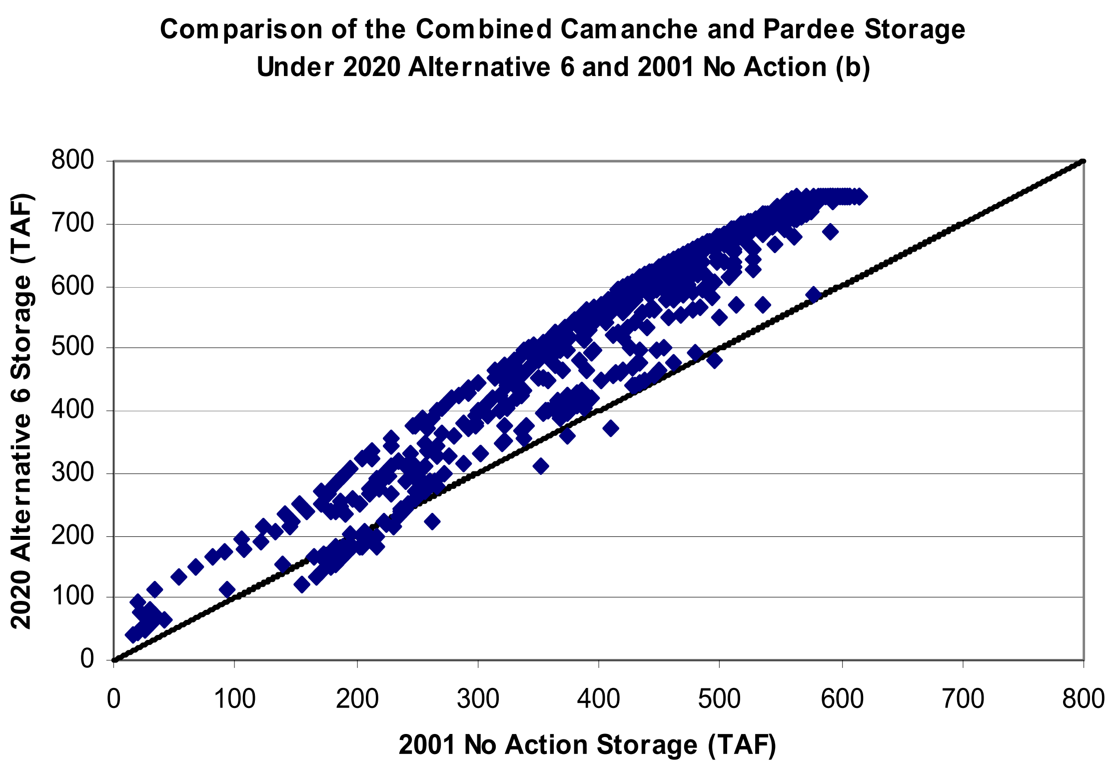


Figure 5-26
Combined Storage for Pardee and Camanche Reservoirs under 2020 No Action Operations (a) and 2020 Alternative 6 Operations (b) Compared to Combined Storage under 2001 No Action Operations, 1922 – 1993 Simulation.

Chapter 6

Recreation

Chapter 6
Recreation

Affected Environment

Shasta Lake

Shasta Lake is a unit of the Whiskeytown-Shasta-Trinity National Recreation Area (NRA) with recreational facilities and activities administered by the U.S. Forest Service (USFS). Approximately 80% of the recreational use in the Whiskeytown-Shasta-Trinity NRA occurs at Shasta Lake (U.S. Forest Service 2000). When full, the lake has a surface area of approximately 29,500 acres, 370 miles of shoreline, and surface elevation of 1,067 feet above mean sea level (msl). The lake has four main arms: the Sacramento River, McCloud River, Pit River, and Squaw Creek.

Water-dependent activities include power boating, house boating, water skiing, and warmwater and coldwater fishing. Water-enhanced activities include camping, hunting, and wildlife viewing. Recreational use at Shasta Lake averages about 2.4 million visitor days per year, with an estimated 75% of the recreational use occurring between May and September (Bureau of Reclamation 1997).

Facilities include several marinas, seven public boat ramps, three picnic areas, and 26 public campgrounds. Boat ramp facilities are located on all four arms of the reservoir. Several boat ramps have multiple lanes/ramps allowing boat launching to occur at low lake levels. The Hirz Bay and Packer's Bay boat ramps, located on the McCloud River arm, have three ramps and can remain in operation until the lake elevation is drawn down 155 feet. The Centimudi boat ramp near Shasta Dam and the Jones Valley boat ramp on the Pit River arm can both remain in operation until the lake elevation is drawn down 210 feet.

Trinity Lake

Trinity Lake is a unit of the Whiskeytown-Shasta-Trinity NRA with recreational facilities and activities administered by the USFS. The lake has 145 miles of shoreline 17,000 surface acres and a surface elevation of 2,370 feet above msl when full.

Water-dependent activities include power boating, house boating, water skiing, swimming and fishing. Water-enhanced activities include camping, hiking, hunting, and wildlife viewing. Recreational use at Trinity Lake was estimated at about 485,000 recreation visitor days in 1995 (U.S. Fish and Wildlife Service et al. 1999). Recreation facilities at Trinity Lake include 24 campgrounds, two swimming areas, and three day-use areas. Major boat ramps operated by the USFS include Minersville on the Stuart Fork arm, Trinity Center on the North Lake area, and Fairview near the Trinity Dam. There are four marinas located on the lake.

Oroville Reservoir

Recreation facilities and activities at Oroville Reservoir are managed by California Department of Parks and Recreation (DPR) as part of the Lake Oroville State Recreation Area (SRA). The reservoir has 167 miles of shoreline, 15,800 surface acres, and a surface elevation when full of 900 feet above msl.

Water-dependent activities include power boating, house boating, water skiing, swimming and fishing. Water-enhanced activities include camping. Bidwell Canyon and Loafer Creek on the southern shoreline and Lime Saddle on the West Fork are the major use areas. In addition to formal campgrounds, camping is allowed along the lake's shoreline and at boat-in campgrounds. Most water-dependent recreation occurs during the spring and summer months.

Folsom Reservoir

Folsom Reservoir is part of the Folsom Lake SRA, an 18,000-acre area encompassing Folsom Lake and Lake Natoma managed by the DPR. The Folsom Lake SRA is one of the most heavily used recreation areas in the California State Park System because of its proximity to large urban areas, the diminishing open space of the area, and the high regional interest in recreation. When full, the reservoir has a surface area of approximately 11,900 acres and 75 miles of shoreline and a surface elevation of 466 feet above msl.

Folsom Reservoir accommodates a variety of water-dependent recreational activities, including power and sail boating, camping, fishing, swimming, water skiing, jet skiing, and windsurfing. Major shoreline use areas are Beal's Point, Granite Bay, and Rattlesnake Bar on the western shoreline; Folsom Point (formerly Dyke 8) and Folsom Lake Marina at Brown's Ravine on the southern and eastern shorelines; and the Peninsula Campground between the north and south forks of the American River. Each of these areas contains a boat ramp and various other recreational facilities. Folsom Lake Marina at Brown's Ravine, the only marina on Folsom Lake, is open year-round and has a main boat ramp, a low-water boat ramp, and 685 slips available for mooring. The recreation area has approximately 80 miles of trails available for hiking and horseback riding and approximately 30 miles of paved and unpaved bicycling trails.

Boating, sailing, and water skiing take place throughout the main reservoir area. Anglers fish from boats throughout the lake and especially in the upper arms that are designated slow-boating zones. Fishing is mainly for coldwater species, such as rainbow trout and kokanee salmon, and warmwater species, such as bass, catfish, and sunfish. Swimming and sunbathing take place at many undesignated areas along the reservoir shoreline.

The water level at Folsom Lake dictates the type of recreation and length of the season. During years with normal precipitation the main recreational season is May through Labor Day in September, when recreation is focused primarily on water-dependent activities. Approximately 625,000 people visited Folsom Lake SRA between July and September of 2001 and approximately 695,000 people visited the SRA between April and June (California State Parks 2001). During the remaining months of the year, use consists mainly of fishing and land-based recreation. Visitation from October through December and January through March totaled approximately 175,000 and 165,000 people in 2001, respectively (California State Parks 2001). In general, the Granite Bay, Beal's Point, Folsom Point, and Brown's Ravine use areas account for approximately 50% of the use of Folsom Lake SRA.

Water-dependent activities account for nearly 85% of the recreation use at Folsom Lake. Boating is the most popular activity at the reservoir, followed by swimming and fishing. (Sacramento Area Flood Control Agency and U.S. Bureau of Reclamation 1994).

Lake Natoma

Lake Natoma, just downstream of Folsom Reservoir, is also a unit of the Folsom Lake SRA. The lake has a surface area of approximately 500 acres at full capacity and has approximately 10 miles of shoreline. As a regulating reservoir, Lake Natoma's water level may fluctuate up to 7 feet per day (EDAW and Surface Water Resources 1999).

Water-dependent activities include fishing, rowing, kayaking, sailing, and windsurfing. Water-enhanced facilities consist primarily of picnic areas and bicycle, equestrian, and pedestrian trails, which are located on the north and south shores of the lake. Facilities include the California State University, Sacramento (CSUS), aquatic center. CSUS sponsors local, regional, and national rowing competitions on Lake Natoma, and its intercollegiate and club teams use the lake for rowing practice. An 8.4-mile-long segment of the Jedediah Smith Memorial Trail extends along the north shore of the lake. Developed recreation facilities are located at Mississippi Bar, Nimbus Flat, and Negro Bar. Boat-launching facilities are located at Nimbus Flat and Negro Bar, along with swimming-designated beaches.

Annual visitation at Lake Natoma is reported as part of the total visitation to the Folsom Lake SRA, discussed above in the "Folsom Reservoir" section.

Water-enhanced activities and water-dependent activities each account for approximately 50% of all recreation activities. Trail use (jogging, bicycling, hiking, and horseback riding), rafting, and boating are the most popular recreational uses of the lake area. The lake's stable water level conditions make it a popular destination for boating, sailing, rowing, and windsurfing. (EDAW and Surface Water Resources 1999).

Lower American River

The lower American River extends for 23 miles between Lake Natoma and the confluence with the Sacramento River. The river passes through the American River Parkway, a 6,000-acre open space corridor that includes a series of interconnected parks along the publicly owned lands of the river. The parkway has 14 county parks that provide user access and the 32-mile Jedediah Smith Memorial Trail provides bicycling, hiking, and horseback-riding opportunities from Discovery Park to the Folsom Lake SRA.

The lower American River is a major site for recreational boating (rafting, kayaking, and canoeing), fishing, swimming, and wading. Boating activity, particularly commercial rafting, depends primarily on air temperature, river flows, and season of the year. The most popular reach for rafting is from Sunrise Avenue to Goethe Park. There are 10 popular swimming areas along the river including Paradise Beach and Tiscornia Park, both with large sand beach areas. Both shoreline and boat fishing take place throughout the river. Anglers fish mainly for salmon, steelhead, and shad. Fishing is permitted year-round within the parkway, except during fall and early winter when the river is closed from Ancil Hoffman Park on the west to the Hazel Avenue Bridge on the east to protect spawning fish (EDAW and Surface Water Resources 1999).

Parkway visitation in 1997 was estimated at 6 million visitor-days. Visitation is expected to increase to 9.6 million visitor-days by 2020, assuming river flows are stable. (County of Sacramento and Bureau of Reclamation 1997). Approximately 31% of all visits were associated with water-dependent activities. Boating, particularly rafting, is the most popular water-dependent activity on the river, followed by fishing and swimming. (Sacramento Area Flood Control Agency and U.S. Bureau of Reclamation 1994). About 90% of annual rafting rental business occurs between Memorial and Labor Day. (Jones & Stokes 2001).

Sacramento River

The Sacramento River extends for 300 miles between Keswick Reservoir and the Delta. Public access points to the river are administered by the State of California, Bureau of Land Management, and various counties and cities along the river. Popular water-dependent activities include boating and fishing. Water-enhanced activities include camping, hiking, picnicking, and sightseeing.

Keswick Dam to American River

Numerous recreation areas are located on the reach of the river between Keswick Reservoir and the American River confluence. Fishing, rafting, canoeing, and kayaking activities are available along most of the upper Sacramento River and are popular activities on the river's northern reach. Boating, rafting, and swimming generally take place in summer months, and fishing is a year-round activity. Water-dependent activities (swimming, boating, fishing) account for approximately 52% of the recreation uses on the Sacramento River (County of Sacramento and U.S. Bureau of Reclamation 1997).

American River to Courtland

Downstream of the American River, the Sacramento River, is a popular boating and fishing area, with most boating occurring during the summer months. Public parks and trails, private marinas, and public boat launching facilities are located along this reach of the river.

Public parks, including Miller and Garcia Bend, have picnic sites, playgrounds, and multi-use fields. Garcia Bend Park, located in Sacramento's Pocket Area, is a 24-acre riverfront park that has a major boat-launching ramp for the entire Sacramento area, a playground, soccer fields, and a parking area. On- and off-street bike trails extend along this portion of the river. The Sacramento River Bike Trail begins with an off-street trail at the American River confluence and connects to various on-street and off-street trail segments. The southern segment is a 2-mile-long, on-levee, two-lane bike trail extending from Garcia Bend Park to a point approximately 6,000 feet north of the Freeport Bridge. The City of Sacramento is planning to extend the trail from its current end point (approximately 6,000 feet north of the Freeport Bridge) to the Freeport Shores Youth Sports Complex, with construction scheduled for 2003. Boating facilities between Sacramento and Courtland include the large Sacramento Marina, the Freeport Marina (145 berths), three medium-size marinas (50–200 berths), five small marinas (fewer than 50 berths), and five launch ramps (Delta Protection Commission 1997).

In 1980 (the last recreation-user survey completed for the entire river), total annual recreational use was estimated to total 2 million 6-hour visitor days (Jones & Stokes Associates 1996). In May 1995, a survey was conducted of registered boat owners and licensed anglers who recreate in the Sacramento–San Joaquin Delta. The portion of the lower Sacramento River corridor from the City of Sacramento south to Courtland was included in the survey. Fishing from a boat, cruising, water-skiing, and swimming account for 90% of all recreation occurring on this segment of the river. Fifty-one percent of fishing took place from boats and 44% from shore. However, fishing in this segment of the river accounts for only 10% of all fishing in the Sacramento–San Joaquin Delta as a whole. In addition, recreation use of this segment of the river is low in all boat-use categories when compared to the Delta as a whole. (Delta Protection Commission 1997).

Water-enhanced activities occurring on this segment of the Sacramento River include sightseeing, viewing wildlife, visiting cultural or historic sites, and bicycling. Other less popular activities include walking, picnicking, and swimming from shore.

City of Sacramento

The City of Sacramento provides more than 160 developed parks and open space areas. These include neighborhood, community, and regional parks with playgrounds, play equipment, picnic areas, sports fields, basketball courts, boat launch ramps, restrooms, community centers, and other special facilities. Many miles of parkways, waterways, and off-street bikeways are also maintained. The city parks are divided into 11 community areas. The Airport-Meadowview Area includes 13 park and recreational facilities. The South Sacramento area includes 18 park and recreational facilities.

Sacramento County

Recreation facilities in southern Sacramento County are provided by the Southgate Park District (District). The District encompasses 52 square miles and includes 35 parks, four community centers, three sports complexes, two swimming pools, an 18-hole golf course, and many parkways and landscape corridors. Private facilities within the district area include the Champions Golf Links, located on the corner of Gerber Road and Elk Grove–Florin Road. Major bike trails include the Florin Creek Trail that runs from Persimmon Road to Stockton Boulevard, and the Laguna Creek Trail that extends along Laguna Creek from east of Vineyard Road to Calvine Road.

Folsom South Canal Bike Path

The reach of the canal from Nimbus Dam to about Sloughhouse Road includes a bike and foot path open to the public year-round. The path is used for recreational bicycling, commuter bicycling, and walking. South of Sloughhouse Road, the canal is not open to the public. Swimming and fishing are not allowed in the canal, and use of motorized vehicles along the canal is prohibited.

Upper Mokelumne River

The upper Mokelumne River is a popular recreational destination. The river is a very popular site for whitewater boating, though it hosts other water-dependent activities such as fishing, gold mining, and swimming.

Electra Recreation Area and Electra Run

The Mokelumne River is one of several rivers in the region that offer whitewater recreation opportunities. Popular whitewater recreation opportunities on the Mokelumne River include the Devil's Nose Run, the Tiger Creek Dam Run, the Ponderosa Way Run, and the Electra Run. The Electra Recreation Area and Electra Run is a 3.5-mile-long stretch of the Mokelumne River between PG&E's Electra Afterbay Dam and SR 49. The Electra Recreation Area supports whitewater boating, fishing, gold mining, and swimming. Various entities own the land along this stretch of the river, including private landowners, PG&E, and BLM. Public access to this area is via SR 49 and Electra Road, which runs along the north side of the river (Entrix 1998).

Picnicking, swimming, fishing, and gold-mining activities occur throughout this stretch of the river. Most activity is concentrated around PG&E's Electra Day Use Area, located approximately 0.20 mile below the Electra Powerhouse Afterbay Dam; the area has a restroom, parking area, picnicking facilities, and sandy beach area. Two other well-defined beaches with restroom facilities are located along this stretch of the river (0.45 and 0.91 mile downstream from the Electra Powerhouse Afterbay Dam). (Entrix 1998.).

The Electra Run extends approximately 3 miles from below the PG&E Electra Afterbay Dam to the SR 49 bridge. Access to the put-in for the whitewater run is from SR 49 and Electra Road, near the Electra Picnic Area. Two take-out areas are used by boaters: one on Electra Road approximately 0.5 mile upstream from the SR 49 bridge, and the other at the SR 49 bridge (Entrix 1998).

The run has a gradient of about 25 feet per mile and encompasses about 12 rapids ranging in difficulty from Class II to Class III. The resource is a very short 1-day run, which boaters often boat twice in one day. Two Class II/Class III rapids distinguish the run: the Chute, approximately 1.74 miles downstream from the Electra Powerhouse Afterbay Dam; and an S-turn about 2.31 miles downstream from the dam. The run features a slalom course site where the Sierra Club holds its annual Mokelumne River Slalom Race in mid-October (Entrix 1998).

Flows in the reach of the river between the Electra Afterbay and Pardee Reservoir are affected by releases from the Electra Powerhouse and upstream hydrologic conditions. Flows supporting whitewater boating range from 500 to 3,000 cfs. Based on boater evaluations, the minimum flow for whitewater boating on the river (i.e., the point at which the river provides a marginally acceptable whitewater experience) is 500 cfs. Flows of 800 cfs or greater are necessary to support quality whitewater experiences, while approximately 1,500 cfs is the optimum flow level for whitewater recreation. Above 3,000 cfs, the difficulty and danger of the whitewater increases significantly, providing fewer recreation opportunities (EA Engineering, Science, and Technology 1993). Table 6-1 lists the recreational resources in the Mokelumne River in greater detail.

Table 6-1. Recreational Resources in the Mokelumne River between SR 49 and the PG&E Electra Afterbay Dam

River Mile	Description	Elevation (ft)*
0.00	Electra Powerhouse Afterbay Dam	677.6 (crest)
0.05	Class II+ rapid: Maytag Hole	665.3
0.22	Electra Day Use Area (put-in)	660.6
0.45	Beach (two outhouses)	655.1
0.56	Class II rapid: Waterfall Rapid	653.7 (top)–649.3 (bottom)
0.91	Beach with restroom	642.3
1.01	Begin slalom course site	641.2
1.08	Class II+ rapid: Jet Ferry Rapid	Est. 640.0 (top)–634.0 (bottom)
1.24	End slalom course site	634.7
1.40	Class II rapid	N/A
1.50	Estimated elevation of 625.0	Est. 625.0
1.57	Class II rapid	N/A
1.74	Class II+/III rapid: The Chute	623.0 (top)–613.9 (bottom)
1.85	Class II rapid	N/A
2.02	Class II- rapid	N/A
2.10	Quiet pool and beach area	610.0
2.18	Class II- rapid	N/A
2.28	Class II	N/A
2.31	Class II+/III- rapid: S-Turn	606.6 (top)–601.8 (bottom)
2.40	Main take-out	≈598.0
2.48	Class II+ rapid	N/A
2.88	SR 49 bridge (take-out)	592.2

Source: Entrix 1998

* Elevations of recreational resources at Pardee Reservoir were derived from a digital elevation model developed by Pacific Aerial Surveys. Elevation data for recreational resources on the Mokelumne River between SR 49 and the Electra Afterbay Dam were derived through on-ground surveys by Entrix in October 1996. The area was re-surveyed in September 1997 by Topographic Surveys Inc. The 1997 survey confirmed the data developed by Entrix.

The popularity and use of the Electra Run is the result of a combination of factors. Few other river sections in the state offer the combination of proximity to local and regional populations, accessibility via good paved roads, and reliable later summer flows as the Electra Run. (EA Engineering, Science, and Technology 1993).

The Electra Run is a popular run for beginners to learn and practice whitewater boating. Peak use occurs between May and September. Surveys conducted between May and July 1993 indicate that approximately 900 people boated the Electra Run during that period. The predominant craft observed at that time were hard-shell kayaks (40%), followed by rafts (22%), inner tubes (19%), inflatable kayaks (12%), and canoes (7%). (EA Engineering, Science, and Technology 1993).

Typically, rivers providing adequate late summer flows for whitewater boating will have substantial use in late summer and fall months as flows in other rivers decrease. Field observation conducted October 16, 17, and 18, 1996, observed approximately two to six boats each day. (Entrix 1998). The Mokelumne River Slalom Race on October 19 and 20, 1996, had 39 contestants.

Middle Bar Bridge and Take-Out Facility

The Mokelumne River continues approximately 2 miles from the SR 49 bridge and flows into Pardee Reservoir near the Middle Bar Bridge. This reach of the river extends the Electra Run to more than 5 miles and depending on flow includes one Class III- rapid and four smaller rapids. Most of the land on both sides of this river segment is owned by EBMUD and is closed to the public. The only public access into the upper Pardee Reservoir is the Middle Bar Bridge crossing. The primary recreation use is fishing from the Middle Bar Bridge. When full, Pardee Reservoir extends approximately 1 mile upstream from the bridge crossing. Parking is allowed at the bridge's north and south abutments and a public restroom is provided near the south abutment.

Historically, EBMUD has not allowed egress from the river across EBMUD lands. As a result, trespassing on EBMUD property has occurred as boaters continuing downstream of the SR 49 take-out would exit the river or reservoir near the Middle Bar Bridge. For safety and management reasons, a take-out facility was proposed to provide easier egress from the river, thereby limiting bodily contact with reservoir waters and protecting reservoir water quality. Construction of the Middle Bar Take-Out Facility began in fall 2002 and was completed in May 2003. The take-out facility is located on the north side of the reservoir adjacent to the Middle Bar Bridge and Middle Bar Road and has a footprint of approximately 2 acres.

The facility extends inland from the current shore of the river to an approximate elevation of 600 feet above msl. The facility includes the following amenities:

- a gravel-surfaced parking area for approximately 20 to 25 vehicles, including one space designated for the disabled;
- an Americans with Disabilities Act (ADA)–compliant two-stall vault toilet facility, as well as trash and recycling receptacles;
- a pedestrian path from the parking area to a boating take-out on the upstream side of the Middle Bar Bridge, following the natural topography to provide a more gradual route of egress from the river;
- a pedestrian path to the Middle Bar Bridge from the parking facility for anglers; and
- appropriate signage and fencing to support the use and facilities as well as to protect the environment, including an information board in the parking area with rules and safety information.

Development of the new facility supports whitewater boating on the Middle Bar portion of the river and fishing from Middle Bar Bridge.

Pardee Reservoir

Pardee Reservoir provides both water-dependent and water-enhanced recreation opportunities. Water-dependent recreation includes boating and fishing. Recreation activities resulting in body contact with the water is prohibited to protect water quality. Water-enhanced recreation includes camping, picnicking, hiking, and horseback riding.

The Pardee Recreation Area is a major recreation site at Pardee Reservoir. The area is located on the west shore of the reservoir's north arm and provides facilities for recreation activities occurring at the reservoir. The area is open February through October and is closed during the migratory bird season as part of EBMUD's wildlife enhancement program. Recreation facilities include a marina, bait shop, boat rental, 10-lane launch ramp, fish-cleaning station, 100 tent campsites, short- and long-term RV areas, day-use areas with picnic tables, hiking trails, two swimming pools, barbecues, restaurants, and a coffee shop/store.

Average annual use of the Pardee Recreation Area totaled 71,000 visitors in 2000 and 82,000 visitors in 2001. The highest use generally occurs in April through July and then tapers off through October, when the recreation area closes. (Entrix 1998).

Except for the Pardee Recreation Area and trails, EBMUD-owned land around the reservoir is closed to general public access. Outside of the recreation area, the Mokelumne Coast to Crest Trail extends along the south side of the reservoir from the south arm to the end of the east arm (about 8 miles up the Mokelumne River Canyon). A staging area is located at the head of this horseback riding and hiking trail. The trail is 10.6 miles long with its lowest point, 600 feet above msl, at McAffee Gulch. The trail and staging areas are open year-round.

DFG and EBMUD support an active stocking program for rainbow trout and kokanee salmon, the primary target species for anglers on the reservoir. In addition to these coldwater species, anglers fish for warmwater species such as bass, catfish, and sunfish. Pardee Reservoir is host to several fishing derbies and special events each season. Each year the dates are dependent on the weather, water temperature, and the schedule of other regional events.

Camanche Reservoir

When full, Camanche Reservoir has a surface area of 7,622 acres, 64 miles of shoreline, and a surface elevation of 236 feet above msl. Facilities include a major recreation area on the south shore and another on the north shore. Both the north and south shore areas provide tent and RV campsites, cottages, marina, boat rentals, and paved boat ramps. Other facilities include hiking trails, picnic areas, and tennis courts.

Water-contact recreation is allowed at Camanche Reservoir because the reservoir is not used exclusively as a drinking water supply by EBMUD. Water-dependent recreational activities include swimming, water skiing, jet skiing, windsurfing, and fishing.

Use at Camanche Reservoir increased from 378,000 visitor use days in 2000 to 395,000 visitor use days in 2001.

Lower Mokelumne River

The lower Mokelumne River extends for approximately 30 miles from Camanche Dam to the tidal influence of the Sacramento–San Joaquin River Delta. Most of the lower Mokelumne River traverses private rural lands, and no single entity administers all the recreation and access facilities. Major public recreational facilities on the river include:

- EBMUD's Mokelumne River Day Use Area on McIntire Road near Camanche Reservoir,
- San Joaquin County's Stillman Magee County Park on Mackville Road near the town of Clements,
- the City of Lodi's Lake Lodi Park near the community of Woodbridge,
- San Joaquin County's Woodbridge Regional Park accessible from River Meadows Drive in Woodbridge, and
- San Joaquin County's 17-acre Woodbridge Regional Wilderness Area.

Most of the recreation facilities along the lower Mokelumne River are private boat launches or fishing access points. Popular water-dependent activities on the lower Mokelumne River include fishing, wading, swimming, canoeing, kayaking, and tubing.

Plans and Policies

American River Parkway Plan

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

The American River Parkway Plan was developed to protect and manage the parkway. The plan addresses the entire parkway regardless of jurisdiction and provides basic policy guidance for its future. The goals of the Parkway Plan are to:

- provide, protect, and enhance for public use a continuous open space greenbelt extending from the Sacramento River to the Sierra Nevada;
- provide appropriate access and facilities so that present and future generations can enjoy the amenities and resources of the parkway;
- preserve and improve the natural, archeological, historical, and recreational resources of the parkway, including an adequate flow of high-quality water, anadromous and resident fishes, migratory and resident wildlife, and diverse natural vegetation; and
- mitigate adverse effects of activities and facilities adjacent to the parkway.

Sacramento River Greenway Draft Plan

The Sacramento River Greenway Plan is a regional resource management plan for a portion of the Sacramento River. The Greenway Plan was initiated by the State Lands Commission, through a Memorandum of Understanding with the City of Sacramento and the Counties of Sacramento and Yolo. The general goals of the plan are: to preserve, protect, enhance, and restore the riparian corridor of the river and it associated ecosystems; and to design a system of controlled public access for active and passive recreational uses related to the river.

The Sacramento River Greenway Plan has a proposed land use designation at the intake facility of "Nature Study" area. Activities permitted within these areas are public access for nature study; pedestrian use on designated trails or observation areas; bicycling, where appropriate; and habitat restoration and monitoring, where suitable.

Sacramento River Parkway Plan

The Sacramento River Parkway Plan is the "area plan" for the City of Sacramento portion of the Sacramento River Greenway Plan. The main features of the plan are the preservation of riparian habitat, while providing public access to recreational opportunities along the Parkway. The plan contains land use policies and implementation measures that support these goals.

The proposed location of the intake facility is in an area designated as a proposed Major Access Point (Freeport Reservoir) in the Sacramento River Parkway Plan. The access point would include restrooms, a lawn, drinking fountain, parking and bicycle-staging area, bicycle access, and a bridge over Freeport Boulevard accessing the Freeport Shores Youth Sports Complex.

City of Sacramento General Plan

The City of Sacramento General Plan contains goals and policies to conserve and protect natural resources and planned open space areas. Specific to recreational resources, the City will continue the program established by the Department of Parks and Community Services in maintaining parks, trees, and other landscaping. The City will provide open space for recreation, including conservation and protection of the American and Sacramento River Parkways. It is a policy of the City to implement the goals and policies of the Sacramento River Parkway Plan. The City of Sacramento General Plan also contains goals and policies to develop bicycling as a major transportation mode.

Pocket Area Community Plan

The Pocket Area Community Plan includes the South Pocket Specific Plan. The South Pocket is generally bounded by Florin Road to the north, the City of Sacramento boundary to the south, the Sacramento River to the west, and Interstate 5 to the east. The South Pocket Specific Plan is intended to ensure a healthy and attractive living environment for residents of the area. Policies of the plan include providing suitable access to the Sacramento River, interfacing development with the Sacramento River in a manner that promotes the best use of this recreation resource, and ensuring that a continuous park–open space system is provided that links public facilities and activity centers wherever possible.

The plan designates the proposed intake facility site as a major parkway recreation node. This node will provide a variety of permanent recreation-related improvements such as lawns, picnicking facilities, restrooms, and parking. Also, an off-street bikeway is proposed for the levee top along the entire length of the area.

County of Sacramento General Plan

The Sacramento County General Plan includes a conservation element that addresses the preservation and protection of waterways for recreational purposes. It is the specific goal of the County to supply water to Sacramento residents while maintaining river flows and reservoir levels that protect environmental resources and provide substantial recreational benefits.

Vineyard Community Plan

The Vineyard Community Plan area is generally bounded by Jackson Highway (SR 16) and Kiefer Boulevard on the north, Calvine Road on the south, Elk Grove–Florin Road on the west, and Grant Line Road and Sunrise Boulevard on the east. The Plan supports open space and recreational opportunities within the plan area. The plan calls for encouraging the development of environmentally compatible recreation facilities and open space areas along stream channels and within floodplains and power transmission easements.

San Joaquin County General Plan

The San Joaquin County General Plan contains a community development element that addresses recreation. In general, there are several objectives that call for the provision of parks and recreational facilities, the promotion of the county's recreational potential, and the protection and preservation of the county's unique recreational resources, such as waterways. The plan also recognizes the importance of providing a countywide system of bicycle facilities for safe and convenient transportation and recreation use.

Amador County General Plan

The Amador County General Plan contains several objectives and policies that call for the maintenance and provision of high quality recreational facilities. The plan encourages recreational development and calls for the protection of the varied resources for public recreation in scenic and historical areas, hunting and fishing areas, lakes and waterways, forests and wilderness, and urban open spaces.

Calaveras County General Plan

The open space element of the Calaveras County General Plan includes a recreational resources section that contains many recreation-related goals and policies. It is the goal of the County to conserve national, state, and regional recreation areas in the county, to provide adequate local parks and recreation facilities to serve the county's population, and to preserve portions of the county's rivers and streams as a local recreation resource. It is County policy to support public and private entities in their efforts to maintain and improve recreation facilities, balance water resources development with the preservation of streams and rivers in their natural state, and protect public access to streams and rivers.

Environmental Consequences

This section describes the construction- and operation-related impacts on recreation that are expected to occur under each project alternative. The following discussion also includes a description of the methods and assumptions used to conduct the analysis and the criteria for determining the significance of impacts.

Methods and Assumptions

The recreational assessment describes the impacts on recreation as a result of changes in reservoir storage, river flows, and disruption in activities associated with facility construction. The assessment focuses on evaluating impacts on:

- water-dependent (e.g., boating and swimming) and water-enhanced recreation opportunities at the Sacramento River, Folsom Reservoir, Lake Natoma, the lower American River, Camanche Reservoir, Pardee Reservoir, the lower Mokelumne River, the upper Mokelumne River, and other major lakes (i.e., Trinity, Shasta, Oroville);
- recreation activities on the Sacramento River near the intake facility site; and
- recreation areas crossed by project facilities.

Effects on recreation that could occur during construction of various project facilities were evaluated qualitatively. Generally, construction activities could result in a short-term loss of recreation opportunities by disrupting use of recreation areas or facilities. A long-term effect could occur if a recreation opportunity is eliminated as a result of construction activities associated with a project facility.

Impacts on recreation could occur during operation of the various project alternatives. Placement of a project alternative facility that could reduce or eliminate a recreational opportunity was evaluated as an operation-related effect.

Operating the project alternatives could result in changes in reservoir storage and river flows. The resulting change in reservoir storage could change the frequency and duration that lake levels are within acceptable ranges or above the minimum level necessary to conduct recreational activities. Similarly, river flows could fall outside the ranges necessary to conduct recreation more frequently. The evaluation of effects on water-dependent recreation was conducted by comparing the CALSIM and EBMUDSIM hydrological modeling results for each alternative with the reservoir storage and river flow recreation thresholds. Key opportunity thresholds used in this analysis are shown in Table 6-2.

Table 6-2. Recreation Opportunity Thresholds for Important Recreation Resources

Water Resource	Elevation When Full	Recreation Opportunity Thresholds
Folsom Reservoir	466 msl	360 msl—last boat ramp out of operation 400 msl—limited surface area (boating constrained) 405 msl—marina closes 430 msl—decline in shoreline activities
Shasta Reservoir	1,067 msl	>952msl—at least one boat ramp available on each arm 1,017 msl—limited surface area (boating constrained)
Trinity Lake	2,370 msl	2,170 msl—last boat ramp out of operation 2,320 msl—limited surface area (boating constrained)
Oroville Reservoir	900 msl	710 msl—last boat ramp out of operation 750 msl—limited surface area 819 msl—beaches close
Lower American River	-	SWRCB thresholds: 1,500–2,000 cfs—boating minimum range 3,000–6,000 cfs—boating optimal range 1,250–5,000 cfs—swimming CVPIA thresholds: 1,750–3,000 cfs—boating optimal range 1,750 cfs—minimum boating flows 1,500 cfs—optimal swimming flows Hodge Decision: 1,750 cfs—minimum summer recreation flows
Sacramento River	-	2,500–12,000 cfs—boating optimal range

[a] Thresholds are measured in feet above msl for reservoirs and in cfs for rivers.

Sources: California State Water Resources Control Board 1988 (SWRCB opportunity thresholds for the Lower American River),
USFS 2001 (boat ramp opportunity thresholds for Shasta Reservoir),
USFWS et al. 1999 (boat ramp opportunity thresholds for Trinity Lake),
Environmental Defense Fund v. EBMUD 1990 (Hodge Decision),
Bureau of Reclamation 1997 (all other opportunities).

CALSIM was used to evaluate changes at Sacramento River reservoirs, Folsom Reservoir, the lower American River, and the Sacramento River. EBMUDSIM was used to evaluate changes at Pardee and Camanche Reservoirs and the lower Mokelumne River. A detailed discussion of CALSIM and EBMUDSIM is included in Chapter 3, "Hydrology, Water Supply, and Power."

As described in Chapter 3, "Hydrology, Water Supply, and Power," changes in storage at other CVP/SWP reservoirs (e.g., Whiskeytown, San Luis, New Melones), Delta flows, and operation of EBMUD terminal reservoirs would be very small and would not affect recreational opportunities at these areas. Therefore, impacts on recreation were not evaluated in detail for these areas.

Significance Criteria

The criteria used for determining the significance of an impact on recreational resources are based on Appendix G of the State CEQA Guidelines (Environmental Checklist) and professional standards and practices. Impacts on both water-dependent and water-enhanced recreation opportunities may be considered significant if implementation of an alternative would:

- cause a change in river flows or lake elevations that would result in substantial changes to existing recreational opportunities,
- locate project facilities that would result in a substantial long-term disruption of any institutionally recognized recreational activities,
- cause an increase in the use of existing neighborhood and regional parks or other recreational facilities such that substantial physical deterioration of the facility would occur or be accelerated.

Less-than-Significant Impacts

Alternative 1

Alternative 1 would not result in any construction-related or operation-related recreation impacts associated with construction of FRWP facilities.

Alternatives 2–5

Alternatives 2 through 5 differ only in the pipeline alignments from the Freeport intake facility to the FSC. Project construction and operation for Alternatives 2 through 5 are very similar. Impacts related to recreation for each alternative differ only slightly from each other; therefore, the results for Alternatives 2 through 5 are presented together but are representative of each individual alternative, unless otherwise noted.

Construction-Related Impacts

Impact 6-1: Temporary Disruption to Recreational Opportunities during Construction of the Freeport Intake Facility

Construction of the intake facility would temporarily disrupt the use of the recreation trail on the top of the left bank of the Sacramento River levee. During construction, the segment of trail through the project area would be closed. Once construction is completed, this portion of the trail would be reconstructed. Significant construction-related effects on recreation occurring at the intake facility site would be avoided because the project sponsors would implement a traffic control plan. As described in Chapter 2 under Environmental Commitments, the traffic control plan will ensure that the public will be notified of the duration of the trail closure and that a safe detour route for the trail will be established either through or around the construction site. The detour route will connect the existing portion of the Pocket area off-street bike trail to the City of Sacramento's planned trail extension. With implementation of the traffic control plan, rerouting of the levee trail would allow continued use of the trail and all other nearby recreation facilities would remain accessible. For safety purposes, there will be short periods of time when construction activities at the intake facility site will require closure of the detour route. However, these closures will be short-term and the traffic control plan will ensure that the public will be notified of the duration of the trail closure. The impact on recreation as a result of temporarily closing the levee trail is considered less than significant.

Also, construction of a bank-type intake facility could result in short-term disruption of water-dependent recreation activities in the Sacramento River near the location of the intake facility site. Use of and access to this portion of the river and all nearby recreation facilities would continue during construction of the intake facility and its auxiliary facilities. The impact on recreation is considered less than significant. No mitigation is required.

Impact 6-2: Temporary Disruption to Recreational Opportunities during Construction of the Pipeline from the Freeport Intake Facility to Zone 40 Surface WTP/FSC

Construction of any of the pipeline alignment alternatives that connect the intake facility with the Zone 40 Surface WTP and the FSC would temporarily disrupt access to recreation facilities. No recreation facilities would be directly affected because none are crossed by the pipeline alignments. As described in Chapter 2, "Project Description" under "Environmental Commitments," the project sponsors have committed to implementing a traffic control plan. This plan will maintain access to recreation facilities along the pipeline alignments during construction. With implementation of the traffic control plan, the impact on recreation as a result of disrupting access to recreation sites is considered less than significant.

Impact 6-3: Temporary Disruption to Recreational Opportunities along the Folsom South Canal

Constructing the connection between the pipeline and the FSC would temporarily disrupt use of the FSC bike trail. Constructing the canal pumping plant and the connection between the FSC and the FSCC would not disrupt recreation because the area where these improvements would be constructed is closed to the public.

During construction, the segment of the FSC bike trail through the project area would be closed. Once construction is completed, this portion of the trail would be reconstructed. Significant construction-related effects on recreation occurring at the connection would be avoided because the project sponsors would implement a traffic control plan. As described in Chapter 2 under "Environmental Commitments," the traffic control plan will ensure that the public will be notified of the duration of the trail closure and that a safe detour route for the trail will be established either through the construction site or on adjacent public streets. With implementation of the traffic control plan, the impact on recreation as a result of closing the FSC trail is considered less than significant.

Impact 6-4: Temporary Disruption to Recreational Opportunities during Construction of the Pipeline from the FSC to the Mokelumne Aqueducts

Construction of any of the pipeline alignment alternatives that connect the FSC with the Mokelumne Aqueducts may result in short-term disruption of access to recreation facilities maintained by San Joaquin County and EBMUD. No recreation facilities in Sacramento County would be disrupted by construction of the FSCC pipeline. Construction would temporarily disrupt access to recreation areas and scenic routes (SR 88 and Liberty Road) in San Joaquin County, which are considered as part of the county's bicycle route system in the San Joaquin County General Plan. Access to the lower Mokelumne River and the north and south shores of the Camanche Reservoir may be disrupted by construction of the pipeline across SR 88, Liberty Road, and SR 12.

All pipeline alignment alternatives would cross the lower Mokelumne River. Impacts on water-dependent and water-enhanced recreation would be avoided by tunneling under the river. The pipeline alignments also cross a large grove of valley oaks south of Camanche Reservoir and SR 12. The San Joaquin County General Plan indicates that this area is a desirable location for a regional park. Construction of the FSCC pipeline would still allow for development of a regional park in this location.

During construction, all recreation facilities would remain accessible and available for use by the public. As described in Chapter 2 under "Environmental Commitments," the traffic control plan will ensure that roadways remain open during the construction period and that access to recreation sites is maintained. The impact on recreation during construction of the FSCC pipeline is considered less than significant because access to recreation sites would continue and disruption would be short term.

Operation-Related Impacts

Impact 6-5: Change in Water-Dependent and Water-Enhanced Recreation Opportunities at Shasta, Oroville, and Trinity Reservoirs and the Sacramento River

Operation of Alternatives 2 through 5 would result in very small changes in the frequency with which the surface elevation of Shasta, Oroville, or Trinity Reservoirs would fall below levels identified as important water-dependent recreation thresholds. During the peak season, from May to September, the surface elevation of the three reservoirs would fall below the levels at which boating becomes constrained for only three additional months over the 72-year modeling period (see Table 6-3). Operation of the alternatives would also result in a very small change in the frequency with which flows in the Sacramento River are within a range suitable for water-dependent recreation during the peak recreation season (May to September). Flows in the river would fall outside the suitable range for two additional months over the 72-year modeling period (see Table 6-3). The small changes in reservoir surface elevations and river flows would not adversely affect recreation at the Shasta, Trinity, or Oroville Reservoirs or the Sacramento River. The impact on recreation is considered less than significant, and no mitigation is required.

Table 6-3. Comparison of Reservoir Level and River Flow Exceedance Frequencies for Recreation Opportunities at Important Recreation Resources[a]

		Project Change	
	Base Case	Alternatives 2 through 5	Alternative 6
Recreation Threshold	Months [b]/Percent [c]	Months [d]/Percent [c]	Months [d]/Percent [c]
Folsom Reservoir [e]			
Peak Season			
360 msl—last boat ramp out of operation	433/98.9	No change	No change
400 msl—limited surface area	386/88.1	-7/86.5	-2/87.7
405 msl—marina closes	361/82.4	-1/82.2	No change
430 msl—decline in shoreline activities	263/60.0	-2/59.6	-2/59.6
Off Season			
360 msl—last boat ramp out of operation	434/99.1	-3/98.4	No change
400 msl—limited surface area	357/81.5	-3/80.8	-1/81.3
Shasta Reservoir [f]			
Peak Season			
>952 msl—at least one boat ramp available on each arm	327/89.6	-2/89.0	+1/89.9
1,107 msl—limited surface area	201/55.1	-2/54.5	-4/54.0
Off Season			
>952 msl—at least one boat ramp available on each arm	459/89.8	-3/89.2	+2/90.2

	Project Change		
	Base Case	Alternatives 2 through 5	Alternative 6
Recreation Threshold	Months [b]/Percent [c]	Months [d]/Percent [c]	Months [d]/Percent [c]
1,107 msl—limited surface area	307/60.1	No change	-2/59.7
Trinity Reservoir [f]			
Peak Season			
2,170 msl—last boat ramp out of operation	356/97.5	-1/97.3	-1/97.3
2,320 msl—limited surface area	177/48.5	-1/48.2	+1/48.8
Off Season			
2,170 msl—last boat ramp out of operation	478/93.5	+3/94.1	+1/93.7
2,320 msl—limited surface area	213/41.7	-1/41.5	No change
Oroville Reservoir [f]			
Peak Season			
710 msl—last boat ramp out of operation	341/93.4	-3/92.6	-1/93.2
750 msl—limited surface area	312/85.5	No change	-1/85.2
819 msl—beaches close	206/56.4	-2/55.9	No change
Lower American River [g]			
SWRCB thresholds			
1,500-2,000 cfs—boating minimum range	26/7.1	+1/7.4	-1/6.8
3,000-6,000 cfs—boating optimal range	142/38.9	+4/40.0	+1/39.2
1,250-5,000 cfs—swimming	290/79.5	+3/80.3	+1/79.7
CVPIA thresholds			
1,750-3,000 cfs—boating optimal range	123/33.7	-3/32.9	-1/33.4
1,750 cfs—minimum boating flows	288/78.9	+1/79.2	No change
1,500 cfs—optimal swimming flows	-	-	-
Hodge Decision			
1,750 cfs—minimum summer recreation flows	180/61.6	+1/62.0	No change
Sacramento River [h]			
2,500-12,000 cfs—boating optimal range	269/73.7	-2/73.2	-1/73.4

	Project Change		
	Base Case	Alternatives 2 through 5	Alternative 6
Recreation Threshold	Months [b]/Percent [c]	Months [d]/Percent [c]	Months [d]/Percent [c]

[a] Project changes under Alternatives 2 through 5 and Alternative 6 are based on a comparison with the Base Case (conditions under the 72-year hydrologic period).

[b] Number of months the reservoir level is above indicated threshold or river flows are above indicated threshold or inside of indicated range.

[c] Percent of time lake level is above indicated threshold or river flows are above indicated threshold or inside of indicated range.

[d] Change in number of months above or below threshold or inside indicated range compared to Base Case: + additional months above threshold or inside of indicated range, - fewer months above threshold or inside indicated range.

[e] The peak season extends from April to September (432 months over the 72-year hydrologic period) and the off season extends from October to March (432 months over the 72-year hydrologic period).

[f] The peak season extends from May to September (360 months over the 72-year hydrologic period) and the off season extends from October to April (504 months over the 72-year hydrologic period).

[g] Exceedance frequencies are for the peak recreation season, which extends from May to September (360 months over the 72-year hydrologic period), except for Hodge Decision summer recreation flows which extends from July to October (288 months over the 72-year hydrologic period).

[h] Exceedance frequencies are for the peak recreation season, which extends from May to September (360 months over the 72-year hydrologic period).

Impact 6-6: Change in Water-Dependent and Water-Enhanced Recreation Opportunities at Folsom Reservoir

Operation of Alternatives 2 through 5 would result in very small changes in the frequency with which the surface elevation of Folsom Reservoir would fall below important water-dependent and water-enhanced recreation thresholds (Table 6-3). Over the 72-year modeling period, the surface elevation of the reservoir would fall below the levels at which boating becomes constrained for 7 additional months during the peak season (April to September). However, these months are not sequential and the average change in surface elevation is 2 feet below the recreation threshold. Also during the peak season, the operation of the Brown's Ravine Marina would be restricted for only 1 additional month and the elevation at which shoreline use declines becomes constrained for only 2 additional months. The surface elevation of the reservoir would fall below the levels at which boating becomes constrained for only 3 additional months over the 72-year modeling period during the off-season (October to March). The small change in the surface elevation of Folsom Reservoir would not substantially affect water-dependent or water-enhanced recreation. The impact on recreation is considered less than significant, and no mitigation is required.

Impact 6-7: Change in Water-Dependent Recreation Opportunities on the Lower American River

Operation of Alternatives 2 through 5, would result in very small changes in the frequency with which flows in the American River would fall below or outside important water-dependent and water-enhanced recreation thresholds (Table 6-3). Flows during the peak recreation season, from May to September, would fall outside of the range identified in the CVPIA as best for boating for only 3 additional months over the 72-year modeling period. In fact, flows would more frequently exceed the minimum flows identified in the Hodge Decision as the minimum to maintain recreation on the river and more frequently fall within the SWRCB's desired ranges for boating and swimming. The very small change in flows would not substantially affect water-dependent or water-enhanced recreation occurring on or adjacent to the river. The impact on recreation is considered less than significant, and no mitigation is required.

Impact 6-8: Disruption to Recreation Opportunities on the Sacramento River Associated with Location of the Freeport Intake Facility

The Pocket area off-street bike trail that currently exists on top of the river levee would traverse through the location of the intake facility. Upon construction completion, the trail would be reestablished to continue access and provide recreational opportunities for bicyclists and pedestrians. The trail would remain on the levee top, and the chain link fencing surrounding the intake facility would be aligned to parallel the levee trail to facilitate through-access to the levee crown. Maintaining the bike trail would also continue to allow for the proposed development of a continuation of the Pocket area off-street bike trail, such as the City of Sacramento's planned extension of the trail to the Freeport Youth Sports Complex, and possible connection to other recreation facilities. Also, access to the river and parkway would be reestablished and the amount of riverbank modified by locating the intake facility at this site would not substantially affect recreation along the parkway. This impact is less than significant.

Location of the intake facility is in an area designated as a proposed major access point to the bike trail (Freeport Reservoir) in the Sacramento River Parkway Plan and a major parkway recreation node in the Pocket Area Community Plan. The proposed recreation access point would include restrooms, drinking fountain, parking and bicycle-staging area, and a bridge over Freeport Boulevard accessing the Freeport Shores Youth Sports Complex. Intake facilities would be located on the river side of the levee and in the northern portion of the site. Although the intake facility would fall within the area proposed as a major access point, adequate land would remain available to accommodate the proposed recreation development. In addition, other existing and proposed recreation facilities (from 0.5 to 2 miles away from the intake facility location) would provide similar access to the bike trail as proposed at the Freeport site. The intake facility would not adversely affect access to the bike trail. The impact on recreation is considered less than significant, and no mitigation is required.

Impact 6-9: Potential Inconsistency with Local Plans and Policies Addressing Recreation

Local plans and polices provide for the protection and enhancement of recreation opportunities within City of Sacramento, Sacramento County, and San Joaquin County. They establish goals and policies that address maintaining and enhancing access to the Sacramento River, open space, and recreation facilities.

The project would result in the limited short-term disruption of access to a small segment of the Sacramento River. However, the project would not conflict with plans to provide enhanced access to the reach of the river near the intake facility. The pipeline alignments would follow existing right-of ways and would not conflict with policies to provide recreation facilities or access to open space. The construction and operation of Alternatives 2 through 5 would not conflict with the goals of the plans and policies to provide recreation.

Alternative 6

As described in Chapter 2, "Project Description," Alternative 6 consists of enlarging Pardee Reservoir and conveying water from the Sacramento River. Alternative 6 includes of the following project components: enlarge Pardee Reservoir (which includes additional components), Freeport intake facility, pipeline from intake facility to the Zone 40 Surface WTP, and the Zone 40 Surface WTP. Though slightly different in size, the Freeport intake facility, pipeline from the intake facility to the Zone 40 Surface WTP, and the Zone 40 Surface WTP project components are the same as those that make up Alternative 5. Therefore, several of the impacts associated with Alternative 5 (described above) are also associated with Alternative 6 and are restated below. Additionally, impacts associated with the enlarge Pardee Reservoir component of this alternative are described below.

Construction-Related Impacts

Impact 6-10: Temporary Disruption to Recreational Opportunities during Construction of the Intake Facility

The disruption to recreational opportunities associated with construction of the intake facility would be the same to that described above for Alternatives 2 through 5. This impact is less than significant.

Impact 6-11: Temporary Disruption to Recreational Opportunities during Construction of the Pipeline from the Freeport Intake Facility to the Zone 40 Surface Water Treatment Plant

The disruption to recreational opportunities associated with construction of the pipeline would be the same as that described above for Alternatives 2 through 5. This impact is less than significant.

Impact 6-12: Temporary Disruption of Whitewater Use along the Electra Run near State Route 49

Construction of the new SR 49 bridge would result in temporary disruption to whitewater recreation in the reach of the upper Mokelumne River near the existing SR 49 bridge. Construction of the bridge would not impede boaters from passing through the construction site and continuing downstream to the existing SR 49 take-out or the Middle Bar Bridge take-out. Because the new bridge would be constructed upstream of the existing bridge, the existing SR 49 bridge take-out would remain available to boaters. Boaters not choosing to boat through the construction site can use an existing take-out approximately ½ mile upstream from the SR 49 bridge. The impact on whitewater boating is considered less than significant, and no mitigation is required.

Impact 6-13: Temporary Disruption of Water-Dependent Recreation Activities near Pardee Dam

Breaching the existing Pardee Dam after the new dam is completed and filling the reservoir could result in disruption of water-dependent recreation near the existing dam. The disruption of recreation activities would only occur, within this small portion the reservoir's surface area, between April and October of the fourth year of construction. Therefore, these temporary construction activities would have little effect on reservoir recreation activities. This impact is less than significant. No mitigation is required.

Impact 6-14: Temporary Disruption to Water-Dependent and Water-Enhanced Recreation Activities on Pardee Reservoir

The existing Pardee Recreation Area would be decommissioned and removed before project construction starts, and a new recreation area would be located above the new inundation zone before construction of the new dam begins. Relocating the recreation area would allow recreation to continue on the reservoir during the construction period. Also, the new boat ramp and marina would be developed to extend from the shoreline of the new, enlarged reservoir to an elevation below the existing water line. This new ramp and marina will accommodate water-dependent recreation activities during the construction period. Therefore, the impact on water-dependent and water-enhanced recreation during project construction is considered less than significant. No mitigation is required.

Operation-Related Impacts

Impact 6-15: Change in Water-Dependent and Water-Enhanced Recreation Opportunities at Shasta, Oroville, and Trinity Reservoirs and the Sacramento River

Operation of Alternative 6 would result in very small changes in reservoir level and river flow exceedance frequencies for important recreation opportunities at Shasta, Oroville, and Trinity Reservoirs and the Sacramento River (shown in Table 6-3). During the peak season, from May to September, the surface elevation of the three reservoirs would fall below the levels at which boating becomes constrained for only 4 additional months over the 72-year modeling period. Flows in the Sacramento River would fall outside the suitable range for only 1 additional month during the peak season, from May to September, over the 72-year modeling period. The surface elevations of all three reservoirs and the river flows for Alternative 6 fall below the recreation threshold levels less frequently, at the same frequency, or no more than 2 additional months in comparison to the changes associated with Alternatives 2 through 5. The impact on water-dependent and water-enhanced recreation opportunities is considered less than significant, and no mitigation is required.

Impact 6-16: Change in Water-Dependent and Water-Enhanced Recreation Opportunities at Folsom Reservoir

Operation of Alternative 6 would result in very small changes in the frequency with which the surface elevation of Folsom Reservoir would fall below important water-dependent and water-enhanced recreation thresholds. As shown in Table 6-3, during peak and off-season periods, the surface elevation of the reservoir would fall below recreation thresholds no more than 2 additional months over the 72-year hydrologic period. Overall, these surface elevation changes would occur less frequently than the changes described for Alternatives 2 through 5. The impact on water-dependent and water-enhanced recreation opportunities is considered less than significant, and no mitigation is required.

Impact 6-17: Change in Water-Dependent Recreation Opportunities on the Lower American River

Operation of Alternative 6 would result in very small changes in the frequency with which flows in the American River would fall below or outside important water-dependent and water-enhanced recreation thresholds (Table 6-3). For all of the ranges identified as best for boating and swimming, flows during the peak recreation season would fall outside these ranges no more than 1 additional month over the 72-year modeling period. Overall, the frequency in which flows fall outside of threshold levels for Alternative 6 more closely parallels the base case conditions than the changes described for Alternatives 2 through 5. The impact on water-dependent and water-enhanced recreation opportunities occurring on and along the lower American River is considered less than significant, and no mitigation is required.

Impact 6-18: Disruption to Recreation Opportunities on the Sacramento River Associated with Location of the Intake Facility

The disruption to recreational opportunities on the Sacramento River associated with the location of the intake facility alternatives would be the same as that described for Alternatives 2 through 5. This impact is less than significant.

Impact 6-19: Change in Water-Dependent Recreation Opportunities on Pardee Reservoir

The storage capacity of the enlarged Pardee Reservoir would increase by approximately 172,000 af compared to the current reservoir capacity and existing water levels would be raised by 33 feet during most months. When full (601 feet above msl) the surface area of the reservoir would increase from 2,250 acres to 3,480 acres. The larger surface area is expected to benefit water-dependent recreation opportunities occurring at the reservoir. This impact is considered beneficial. No mitigation is required.

Impact 6-20: Change in Recreation Opportunities at Camanche Reservoir

As described in Chapter 3, "Hydrology, Water Supply, and Power," operation of the enlarged Pardee Reservoir may result in greater end-of-year storage in Camanche Reservoir. Increasing storage could benefit water-dependent and water-enhanced recreation occurring at Camanche Reservoir. Operation of the enlarged Pardee Reservoir would not adversely affect recreation occurring at Camanche Reservoir.

Impact 6-21: Change in Recreation Opportunities on the Lower Mokelumne River

As described in Chapter 3, "Hydrology, Water Supply, and Power," operation of the enlarged Pardee Reservoir may result in greater end-of-year storage in Camanche Reservoir and higher releases to the Mokelumne River. Increasing releases could benefit water-dependent and water-enhanced recreation occurring on the river by improving flow conditions for boating and the river's fishery. Operation of the enlarged Pardee Reservoir would not adversely affect recreation occurring on or along the lower Mokelumne River.

Impact 6-22: Inundation of Pardee Recreation Area

The existing Pardee Recreation Area would be inundated by the enlarged reservoir. Commensurate with construction, the existing facilities would be decommissioned and removed, and a new recreation area would be constructed above the new shoreline of the reservoir on 116 acres along the western shore of the reservoir's southern arm (shown in small scale in Figure 2-3 and shown in large scale in Figure 2-14). The new recreation area would provide an in-kind replacement for the loss of facilities at the existing Pardee Recreation Area in addition to providing some new amenities. The inundation and relocation of the Pardee Recreation Area would result in a less-than-significant impact on recreation opportunities at the reservoir.

Impact 6-23: Inundation of Middle Bar Bridge

The Middle Bar Bridge would be removed because it would be inundated at a reservoir elevation of 575 feet above msl and would result in a hazard to navigation if left in place. Fishing piers would be constructed on the south and north sides of the reservoir near the ends of Gwin Mine Road and Middle Bar Road with a turnaround and parking area constructed at the end of each road (see Figure 2-3). The fishing piers would compensate for the loss of fishing access to the upper portion of the reservoir currently provided by Middle Bar Bridge. The impact on recreation as a result of the loss of the Middle Bar Bridge is considered less than significant, and no mitigation is required.

Impact 6-24: Consistency with Local Plans and Policies Addressing Recreation

Local plans and polices provide for the protection and enhancement of recreation opportunities within Amador and Calaveras Counties. Both the Amador and Calaveras County General Plans support the protection and enhancement of recreation. Under Alternative 6, new recreation facilities will be constructed at Pardee Reservoir that would maintain and enhance recreation activities occurring at the reservoir. Construction would not conflict with recreation being provided at the reservoir. The construction and operation of Alternative 6 would not conflict with the goals of the general plans relative to recreation.

Significant Impacts and Mitigation Measures

There are no significant construction-related or operation-related impacts on recreation associated with Alternatives 1 through 5.

Alternative 6

Construction-Related Impacts

No significant construction-related impacts on recreation are associated with this alternative.

Operation-Related Impacts

Impact 6-25: Inundation of a Segment of the Mokelumne Coast to Crest Trail

The elevation of a segment of the Mokelumne Coast to Crest Trail is lower than both the proposed normal storage elevation of 601 feet above msl and the flood event storage elevation of 614 feet above msl. The lowest point of this segment of the trail crosses McAffee Gulch at an elevation of approximately 600 feet msl, and a segment approximately 0.5 mile long within the gulch is lower than 614 feet above msl. In addition, a 0.3-mile-long segment of the trail near the Wildermuth House is lower than 614 feet msl. Inundation of these segments of the trail would prevent access to more than half of the remaining length of the trail and would significantly impact use of this trail for hiking and equestrian purposes. Implementation of the following mitigation measure will reduce this impact to less than significant.

Mitigation Measure 6-1: Relocate a Portion of the Mokelumne Coast to Crest Trail

The trail segments near McAffee Gulch and the Wildermuth House that are currently below 614 feet msl will be relocated to a higher elevation. Rerouting these trail segments, which total approximately 0.8 mile, above 614 feet msl would allow for continued year-round use of the trail and staging areas.

Impact 6-26: Loss of Whitewater Boating on the Upper Mokelumne River between the Middle Bar Bridge and State Route 49 Bridge

Enlarging Pardee Reservoir will allow dam operators to store water up to an elevation of 614 feet above msl for flood control purposes and up to 601 feet above msl for water supply purposes. As indicated in Chapter 3, “Hydrology, Water Supply, and Power,” the surface elevation of the enlarged reservoir would be maintained at 601 feet during most months. The additional flood control space (601–614 feet above msl) would be used only during extremely large and infrequent flood events.

This 2-mile-long section of moving water between the SR 49 bridge and the Middle Bar Bridge includes a series of rapids for whitewater boating. By raising the reservoir elevation to 601 feet above msl, the segment of the upper

Mokelumne River between the SR 49 bridge and the Middle Bar Bridge would be inundated during normal operations and water-based public access would not be allowed below the extent of the reservoir's full pool (approximately the SR 49 bridge). Therefore, the impact would result in the loss of this river section as a whitewater boating recreation resource. Though the Electra Run is the main whitewater attraction along this area of the upper Mokelumne River, many boaters continue downstream along this section of river to lengthen the Electra Run from about 3 miles to approximately 5 miles. The loss of approximately 2 miles of moving water and the regional importance of this segment of the river would be considered a significant and unavoidable impact on whitewater recreation. There is no mitigation.

Impact 6-27: Inundation of the New Middle Bar Take-Out Facility

The 2-acre Middle Bar Take-Out Facility extends from the current shore of the river inland to an approximate elevation of 600 feet above msl. Enlarging the reservoir to an elevation of 601 feet above msl during most months and providing flood control storage up to 614 feet above msl would result in partial inundation of this new facility.

As stated above under Impact 6-26, the 2-mile-long section of river between the SR 49 bridge and Middle Bar Bridge would no longer be available to boaters for whitewater use. Therefore, inundation and loss of the boating take-out and pedestrian path between the parking area and take-out area would be superseded by the loss of the 2-mile-long river section.

However, inundation of the new facility's parking area and support amenities used by anglers and other recreationists would affect access to this area of the river, especially for anglers who would use the proposed fishing piers for mid-channel fishing opportunities and would continue to use the shore for fishing. This impact is significant. Implementation of the following mitigation measure will reduce this impact to less than significant.

Mitigation Measure 6-2: Replacement of Necessary Middle Bar Take-Out Facility Amenities

As part of the project description (see Chapter 2), FRWA will construct new fishing piers and turnaround areas at the ends of Gwin Mine Road and Middle Bar Road above the high water level on both sides of the reservoir. Therefore, the necessary amenities of the Middle Bar Take-Out Facility can be relocated and constructed above the high water level at the Middle Bar Road turnaround area. The following amenities will be relocated for continued use on this section of the river:

- the gravel-surfaced parking area for approximately 20 to 25 vehicles, including one space designated for the disabled;
- the ADA-compliant two-stall vault toilet facility, as well as trash and recycling receptacles;
- the pedestrian path to the new fishing piers from the parking facility for anglers; and

- the appropriate signage and fencing to support the use and facilities as well as to protect the environment, including an information board in the parking area with rules and safety information.

Impact 6-28: Loss of Whitewater Boating on the Upper Mokelumne River Electra Run

Enlarging Pardee Reservoir will allow dam operators to store water up to an elevation of 614-feet above msl for flood control purposes and up to 601-feet above msl for water supply purposes. As indicated in Chapter 3, "Hydrology, Water Supply, and Power," the surface elevation of the enlarged reservoir would be maintained at 601 feet during most months. The additional flood control space (601–614 feet above msl) would be used only during extremely large and infrequent flood events.

By raising the reservoir elevation to 601 feet above msl, a 0.5-mile segment of the river upstream of the SR 49 bridge would be inundated during normal reservoir operations. This portion of the Electra Run includes Class II moving water, one Class II+ rapid, the SR 49 bridge take-out, and the take-out 0.5 mile upstream from the SR 49 bridge. Therefore, this 0.5-mile segment of river would be closed to whitewater boating recreation.

Operation of Pardee Reservoir for flood control purposes and inundating the area between 601 and 614 feet above msl would not adversely affect white-water recreation on the upper Mokelumne River because such an occurrence would be very infrequent and of short duration. Storing water up to 601 feet above msl would result in a significant unavoidable impact on whitewater recreation because of the regional importance of this segment of the river and the loss of approximately 0.5 mile of moving water, the take-out at the SR 49 bridge, and the take-out 0.5 mile upstream from the SR 49 bridge. Mitigation would reduce this impact, but not to a less-than-significant level.

Mitigation Measure 6-3: Ensure Availability of a Take-Out on the Electra Run

To reduce the impact on whitewater recreation, but not to a less-than-significant level, FRWA will ensure that the take-out 0.5 mile upstream of the SR 49 bridge remains usable. In the event that this take-out is not usable, a new take-out will be developed just upstream from the existing take-out.

Cumulative Impacts

Methods and Assumptions

Methods and assumptions for the cumulative effects analysis are essentially identical to those described for the project alternatives analysis.

Cumulative impacts were evaluated for those conditions where the proposed project alternatives may contribute to cumulatively significant impacts, in combination with past, present, or reasonably foreseeable future conditions. The California water supply and demand conditions are a primary factor of future water-dependent and water-enhanced recreation conditions within the project area. Chapter 3, "Hydrology, Water Supply, and Power," describes the analysis conducted with CALSIM II and EBMUDSIM water supply models to estimate hydrological conditions. The cumulative scenarios of the alternative project facilities were modeled assuming the 2020 level of system development and 2020 demands. The cumulative scenarios reflect only changes to the systemwide level of development. The cumulative impacts are assessed as the difference between the cumulative project alternative scenarios and the 2001 no action conditions (Alternative 1). However, a 2020 no action scenario was used to determine the incremental effects of the project alternatives under cumulative conditions.

Construction-related effects are described earlier in this chapter and would not contribute to any cumulative recreation effects relative to 2020 conditions.

Results

Table 6-4 shows CALSIM and EBMUDSIM results for cumulative conditions with Alternatives 2–5 and Alternative 6 for Folsom Reservoir, Shasta Reservoir, Trinity Reservoir, Oroville Reservoir, Lower American River, and Sacramento River. As described above, the cumulative effects are represented by the difference between 2020 conditions with the project alternatives and the 2001 no action conditions. The incremental changes potentially attributable to the project alternatives are represented by the difference between the simulated 2020 conditions with the project alternatives and the 2020 no action conditions. The data indicate that recreational opportunities under 2001 no action conditions and 2020 no action conditions are similar. The pattern of recreational opportunities changes, with reductions in opportunities for some months and years and increases in other months and years. In general, as shown in Table 6-4, reservoir level and river flow exceedance frequencies are somewhat lower under future (2020) conditions. However, in all cases, the effects of the project alternatives are minor, and in many cases beneficial, and clearly do not meet the threshold of being cumulatively considerable. The incremental changes associated with the project alternatives are discussed more specifically below.

The incremental effects of project operations for Alternatives 2–5 under cumulative conditions would result in very small changes in the frequency with which the surface elevation of Shasta, Trinity, Oroville, and Folsom Reservoirs would fall below important water-dependent and water-enhanced recreation thresholds (Table 6-4). Over the 72-year hydrologic period, the surface elevations of the four reservoirs would fall below the identified important recreation thresholds for an average of only two additional months during the peak season (April to September for Folsom Reservoir, May to September for Shasta, Trinity, and Oroville Reservoirs). Though the surface elevation of Shasta Reservoir would fall below the levels at which boat ramps are available an additional 6 months over the 72-year hydrologic period, these months are not sequential, and the average change in surface elevation is 3 feet below the recreation threshold. The small change in reservoir surface elevations would not adversely affect recreation at Shasta, Trinity, Oroville, or Folsom Reservoir. This impact is less than significant, and no mitigation is required.

The incremental effects of project operations for Alternatives 2–5 under cumulative conditions would result in very small changes in the frequency with which flows in the Sacramento and lower American River would fall below or outside important water-dependent and water-enhanced recreation thresholds (Table 6-4). Flows in the Sacramento River would fall outside the suitable range for boating for only two additional months during the peak season, from May to September, over the 72-year modeling period. Flows in the lower American River more frequently would fall within the SWRCB's desired ranges for boating and swimming, more frequently exceed the minimum flows identified in the CVPIA as best for boating, and more frequently exceed the minimum flows identified in the Hodge Decision as the minimum to maintain recreation on the river. The very small change in Sacramento River and lower American River flows would not substantially affect water-dependent or water-enhanced recreation occurring on or adjacent to the rivers. The impact on recreation is considered less than significant, and no mitigation is required.

Under Alternative 6, project operations in combination with ongoing and future (year 2020) water supply operations would result in small changes in the frequency with which the surface elevation of reservoirs and the flows of rivers are within acceptable ranges or above the minimum level necessary to conduct recreational activities. Overall, the pattern of the Alternative 6 project-related contribution to cumulative changes is similar to that described for cumulative conditions under the scenario for Alternatives 2–5 (Table 6-4). In most cases, the surface elevation and river flow changes for the various recreational resources would occur less frequently or at the same frequency as the changes described for Alternatives 2–5.

Table 6-4. Comparison of Reservoir Level and River Flow Exceedance Frequencies for Recreation Opportunities at Important Recreation Resources: Alternatives 2–6 at a 2020 Level of Development[a]

Recreation Threshold	2001 No Action/ Base Case[b]	2020 Alternatives 2–5[b]	2020 Alternative 6[b]	2020 No Project/ Base Case[b]	2020 Change Alternatives 2–5[c]	2020 Change Alternative 6[c]	2020 Change Alternatives 2–5[d]	2020 Change Alternative 6[d]
Folsom Reservoir[e]								
Peak Season								
360 msl—last boat ramp out of operation	433	430	431	432	-2	-1	-0.4	-0.2
400 msl—limited surface area	386	373	374	375	-2	-1	-0.4	-0.2
405 msl—marina closes	361	351	353	355	-4	-2	-1.0	-0.5
430 msl—decline in shoreline activities	263	249	250	250	-1	0	-0.3	0.0
Off Season								
360 msl—last boat ramp out of operation	434	432	434	434	-2	0	-0.5	0.0
400 msl—limited surface area	357	348	350	351	-3	-1	-0.6	-0.2
Shasta Reservoir[f]								
Peak Season								
>952 msl—at least one boat ramp available on each arm	327	321	327	327	-6	0	-1.7	0.0
1,107 msl—limited surface area	201	185	185	185	0	0	0.0	0.0
Off Season								
>952 msl—at least one boat ramp available on each arm	459	456	456	456	0	0	0.0	0.0
1,107 msl—limited surface area	307	283	284	283	0	+1	0.0	+0.2
Trinity Reservoir[f]								
Peak Season								
2,170 msl—last boat ramp out of operation	356	364	364	364	0	0	0.0	0.0
2,320 msl—limited surface area	177	155	159	158	-3	+1	-0.8	+0.3

Table 6-4. Continued

Recreation Threshold	2001 No Action/ Base Case[b]	2020 Alternatives 2–5[b]	2020 Alternative 6[b]	2020 No Project/ Base Case[b]	2020 Change Alternatives 2–5[c]	2020 Change Alternative 6[c]	2020 Change Alternatives 2–5[d]	2020 Change Alternative 6[d]
Off Season								
2,170 msl—last boat ramp out of operation	478	502	503	504	-2	-1	-0.4	-0.2
2,320 msl—limited surface area	213	201	200	200	+1	0	+0.2	0.0
Oroville Reservoir [f]								
Peak Season								
710 msl—last boat ramp out of operation	341	336	338	339	-3	-1	-0.8	-0.3
750 msl—limited surface area	312	305	304	305	0	-1	0.0	-0.3
819 msl—beaches close	206	203	202	203	0	-1	0.0	-0.3
Lower American River [g]								
SWRCB thresholds								
1,500-2,000 cfs—boating minimum range	26	16	16	16	0	0	0.0	0.0
3,000-6,000 cfs—boating optimal range	142	108	105	107	+1	-2	+0.3	-0.5
1,250-5,000 cfs—swimming	290	269	268	268	+1	0	+0.3	0.0
CVPIA thresholds								
1,750-3,000 cfs—boating optimal range	123	141	145	141	0	+4	0.0	+1.1
1,750 cfs—minimum boating flows	288	267	268	266	+1	+2	+0.3	+0.5
1,500 cfs—optimal swimming flows	-	-	-	-	-	-	-	-
Hodge Decision								
1,750 cfs—minimum summer recreation flows	180	161	162	160	+1	+2	+0.3	+0.7
Sacramento River [h]								
2,500-12,000 cfs—boating optimal range	269	283	283	285	-2	-2	-0.6	-0.6

Table 6-4. Continued

Recreation Threshold	2001 No Action/ Base Case[b]	2020 Alternatives 2–5[b]	2020 Alternative 6[b]	2020 No Project/ Base Case[b]	2020 Change Alternatives 2–5[c]	2020 Change Alternative 6[c]	2020 Change Alternatives 2–5[d]	2020 Change Alternative 6[d]

Notes:

[a] Project changes under Alternatives 2 through 5 and Alternative 6 are based on a comparison with the Base Case (conditions under the 72-year hydrologic period).

[b] Number of months the reservoir level is above indicated threshold or river flows are above indicated threshold or inside of indicated range.

[c] Change in number of months lake level or river flows are above or below threshold or inside indicated range compared to 2020 No Project/Base Case: + additional months above threshold or inside of indicated range, - fewer months above threshold or inside indicated range.

[d] Change in percentage of time lake level is above indicated threshold or river flows are above indicated threshold or inside of indicated range compared to 2020 No Project/Base Case.

[e] The peak season extends from April to September (432 months over the 72-year hydrologic period) and the off season extends from October to March (432 months over the 72-year hydrologic period).

[f] The peak season extends from May to September (360 months over the 72-year hydrologic period) and the off season extends from October to April (504 months over the 72-year hydrologic period).

[g] Exceedance frequencies are for the peak recreation season, which extends from May to September (360 months over the 72-year hydrologic period), except for Hodge Decision summer recreation flows which extends from July to October (288 months over the 72-year hydrologic period).

[h] Exceedance frequencies are for the peak recreation season, which extends from May to September (360 months over the 72-year hydrologic period).

Chapter 7

Vegetation and Wetland Resources

Chapter 7

Vegetation and Wetland Resources

Affected Environment

Major Plant Communities

Study Methods

The study area was defined based on preliminary engineering design alternatives of the pipeline alignments, enlarged Pardee, and related facility construction footprints, including the Zone 40 Surface WTP and the intake facility. Vegetation and wetland resources were evaluated based on reconnaissance surveys, interpretation of aerial photography, and analysis of existing data. For the pipeline alignments, a 200-foot buffer (400-foot corridor) was typed for plant communities (Figures 7-1 a–c and 7-2 a–c). The occurrence and extent of plant communities directly affected by construction of the pipeline assumes a 130-foot pipeline construction corridor (Table 7-1). The construction corridor width was chosen to allow a fair quantification acknowledging that actual acreage will vary with location. Plant communities affected by facility construction are based on aerial photography and preliminary site plans. Because location-specific site plans are not available for the Zone 40 Surface WTP, affected area assumes probable plant communities, but not actual acreages.

The occurrence and extent of plant communities considered for analysis of Alternative 6 (enlarge Pardee Reservoir component) were those between the existing reservoir level and the projected future flood level of 614 feet in elevation, plus facility footprints above the maximum inundation level (Figures 7-3a–c).

Vegetation and wetland resources in the project area were initially evaluated by reviewing existing information on biotic resources in the study area, including the draft EIR/EIS (DEIR/EIS) (East Bay Municipal Utility District 1997), the recirculated EIR/supplemental EIS (REIR/SEIS) (East Bay Municipal Utility District 2000), and recent (April 2001) aerial photographs of the study area. Applicability of previous wetland and habitat data was assessed based on a comparison of recent and past (1997) aerial photos. A list of special-status plants with potential to occur in the study area was compiled using known occurrence information from the California Natural Diversity Database (CNDDB)

(California Department of Fish and Game 2002) and the California Native Plant Society (CNPS) Inventory (2001).

Reconnaissance-level surveys were performed in 2002 for all pipeline alignments and related facilities from the intake facility to the FSC. Reconnaissance surveys consisted primarily of visual observations from roads and other publicly accessible areas. For those portions of the study area that could not be accessed or observed directly from public roads, information on vegetation and wetland resources was obtained through analysis of existing information and aerial photographs, and comparison with equivalent adjacent areas that were directly observed. No focused surveys for special-status plants or formal wetland delineations were conducted in this portion of the project area.

An existing wetland delineation and rare plant survey of pipeline alignments from the FSC to the Mokelumne Aqueducts, conducted in 1997 and 1998, provided detailed information of vegetation and wetland resources in this portion of the project area. Reconnaissance-level surveys were performed to confirm the applicability of these data and to gather additional data on new alignments and facilities that were not included in the original survey.

Vegetation and wetland resources potentially affected by the enlargement of Pardee Reservoir were assessed primarily on the basis of existing field survey data (EDAW and Garcia and Associates 1995; Entrix 1998). These data included the results of a floristically based survey for special-status plants performed in May and July, 1997, and a vegetation map produced from a concurrent survey of plant community distribution. In addition, biologists conducted a reconnaissance-level survey of the project area to confirm the applicability of existing data and to assess riparian vegetation. Formal wetland delineations were not conducted. A review of current literature, including the CNDDB (California Department of Fish and Game 2002) and the CNPS Electronic Inventory (2002), was conducted to determine whether more recent changes in known plant distribution or status affect data accuracy. Finally, GIS software was used to re-analyze existing distribution data to examine impacts with potential to occur as a result of construction, inundation, or normal project activities and maintenance associated with enlarging Pardee Reservoir.

Freeport Intake Facility to Zone 40 Surface Water Treatment Plant/Folsom South Canal

The intake facility, pipeline, and Zone 40 Surface WTP occur in central Sacramento County, on the broad alluvial plain of the Sacramento River. The pipeline alignments traverse a mosaic of land uses ranging from developed urban and industrial land to grazed grassland. Nonnative annual grassland is the dominant natural community in the project area and in the Sacramento/San Joaquin Valley region in general. Within the grassland matrix, vernal pools occur where rainwater collects over isolated areas of slowly permeable soils. These and other seasonal wetlands provide a unique and regionally limited

Table 7-1. Occurrence and Extent of Major Plant Communities Likely to be Directly Affected (130-foot corridor) between Freeport Intake Facility and Mokelumne Aqueducts

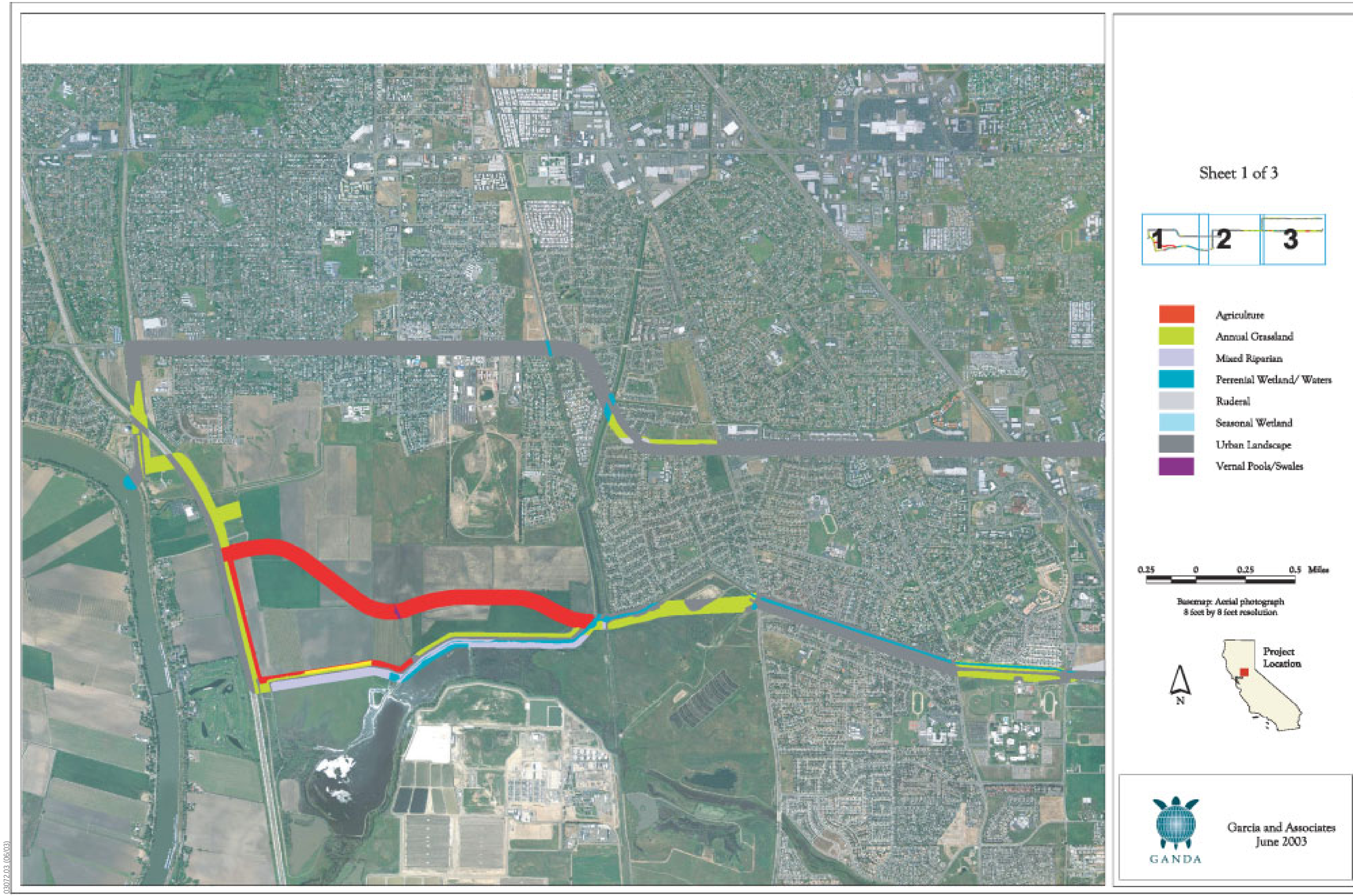
Alternative Alignments and Facilities	Urban Landscape/ Ruderal	Agriculture	Annual Grassland	Eucalyptus Stand	Blue Oak/ Interior Live Oak	Mixed Riparian	Vernal Pools/ Swales[1, 2]	Seasonal Wetland[1, 2]	Perennial Wetland[2]	Total
2	203.3	56.9	259.6	6.9	7.8	3.8	3.4	0.3	4.4	**546.5**
3	197.1	59.7	251.5	6.9	7.8	3.8	3.4	0.2	4.7	**535.2**
4	165.8	88.6	283.8	6.9	7.8	3.9	3.7	0.3	5.6	**566.6**
5	159.7	91.4	275.6	6.9	7.8	3.9	3.7	0.2	5.9	**555.2**
Segment Option 1[3]	12.0	-31.0	9.5			10.0	-0.3		6.2	**6.4**
Segment Option 2[3]	0.7									**0.7**
Segment Option 3[3]	-21.0	12.0	-26.0	-	-	-	-2.1	-0.1	7.0	**-30.2**
Intake Facility	10									**10**
Zone 40 Surface WTP[4]	X	X	X				X	X	X	**X**
Terminal Facility Settling Basins			14.0				1.0		1.0	**16**
Canal Pumping Plant			4.0							**4**
Aqueduct Pumping Plant and Pretreatment Facility (Camanche site)			14.0				1.0			**15**
Aqueduct Pumping Plant and Pretreatment Facility (optional Brandt site)	6.0		6.0							**12**

1 Acreages of vernal pools, swales and other seasonal wetlands for segments V, X, and Option 3 from Garcia and Associates (1998).

2 Acreages of vernal pools, swales, seasonal wetlands, and perennial wetlands for the pipeline segments from the intake to Zone 40 Surface WTP/FSC, Segment W, Canal Pumping Plant, and Aqueduct Pumping Plant and Pretreatment Facility are based on aerial photo interpretation.

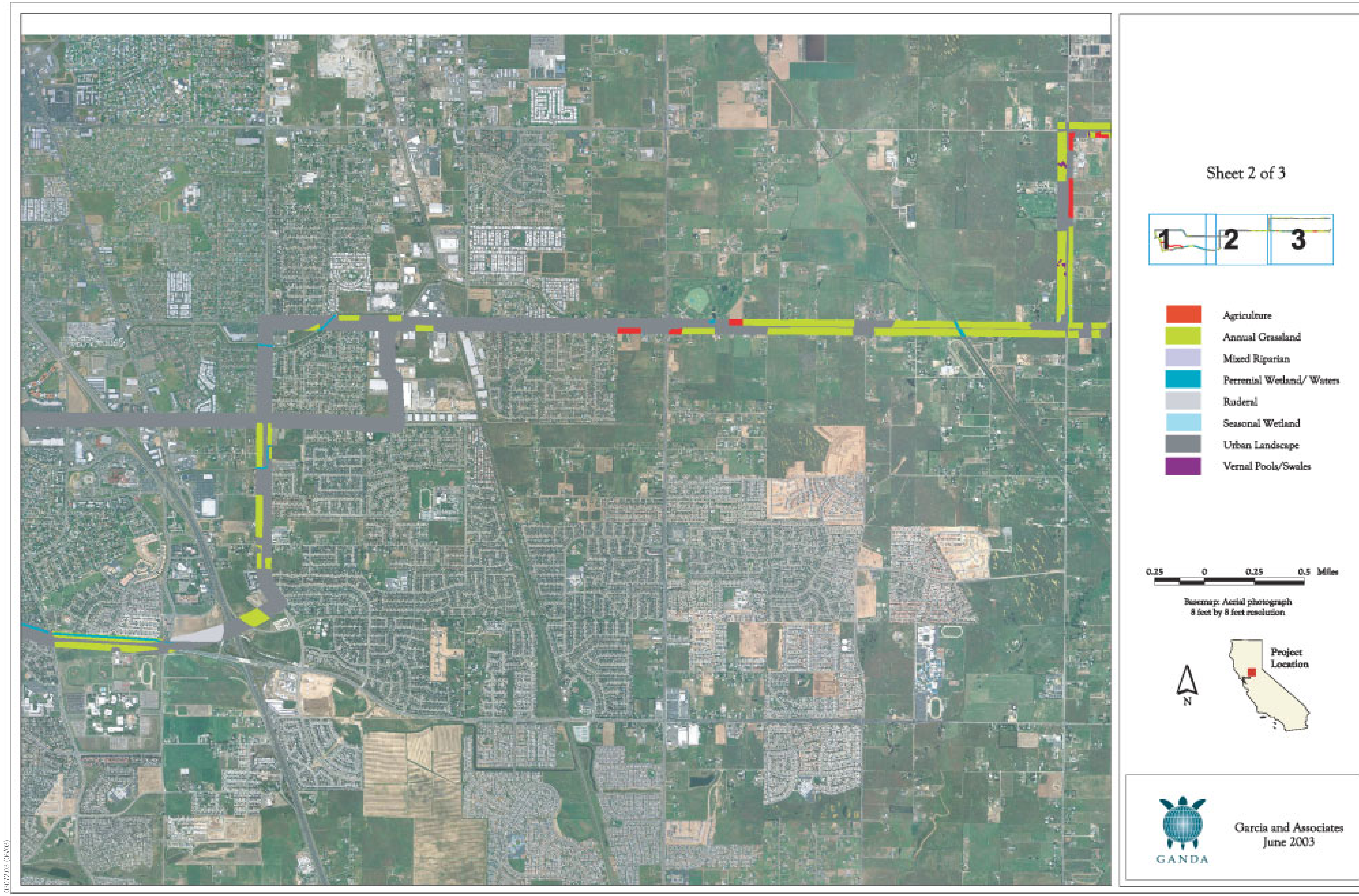
3 A negative acreage amount associated with an optional segment represents an acreage amount less than that identified for Alternatives 2–5 if that optional segment were used for Alternatives 2–5.

4 "X" represents the presence of identified plant communities. Plant communities of the Zone 40 Surface WTP are based upon aerial photos and are representative of communities in the vicinity. Actual acreages cannot be determined until the specific site location is identified.



Jones & Stokes

Figure 7-1a
Plant Community Distribution
Freeport Intake Facility to Zone 40 WTP / Folsom South Canal



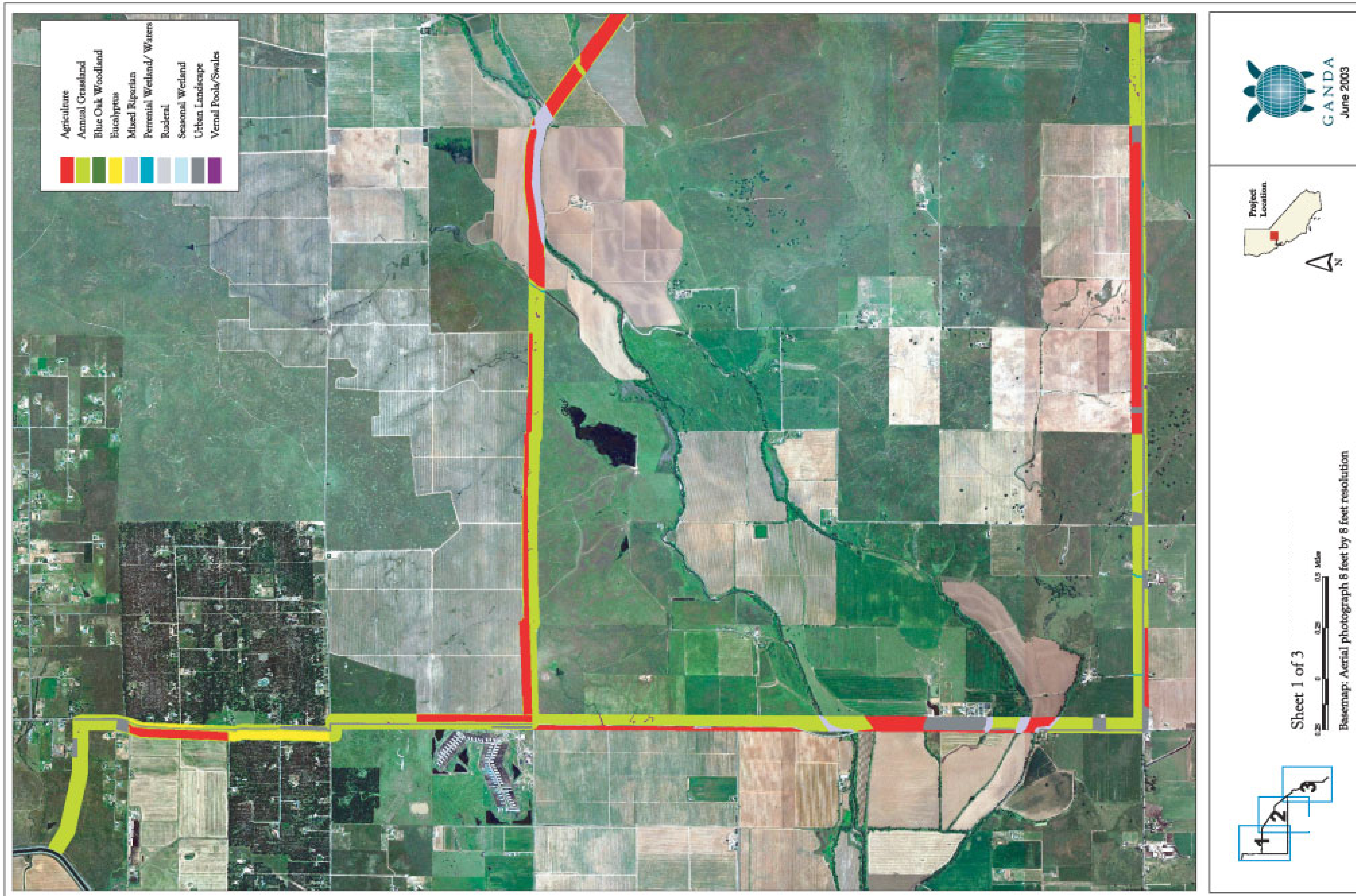
03072.03 (06/03)

Jones & Stokes

Figure 7-1b
Plant Community Distribution
Freeport Intake Facility to Zone 40 WTP / Folsom South Canal

Jones & Stokes

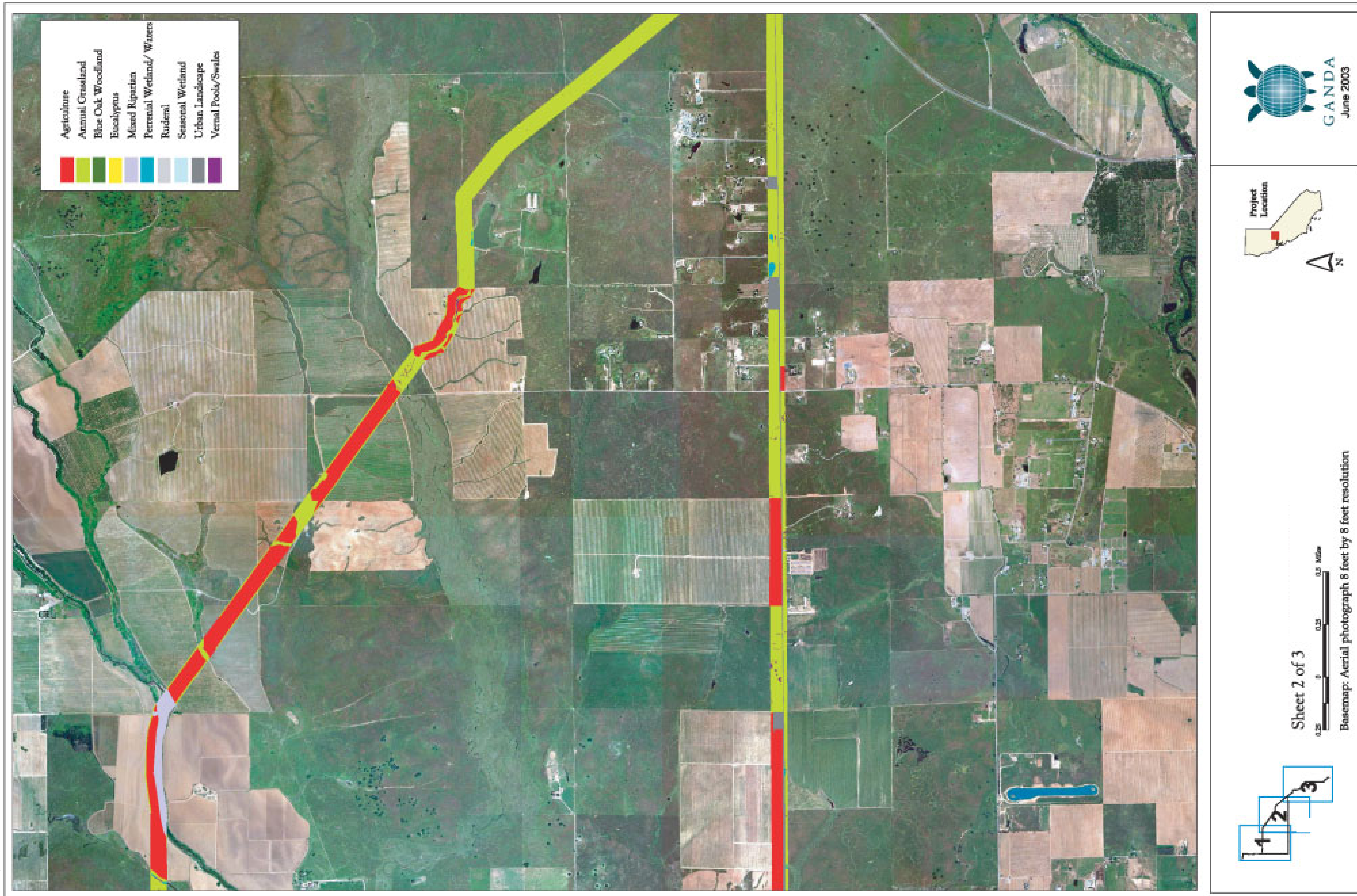
Figure 7-1c
Plant Community Distribution
Freeport Intake Facility to Zone 40 WTP / Folsom South Canal



03072.03 (06/03)

Jones & Stokes

Figure 7-2a
Plant Community Distribution
Folsom South Canal to Mokelumne Aqueducts



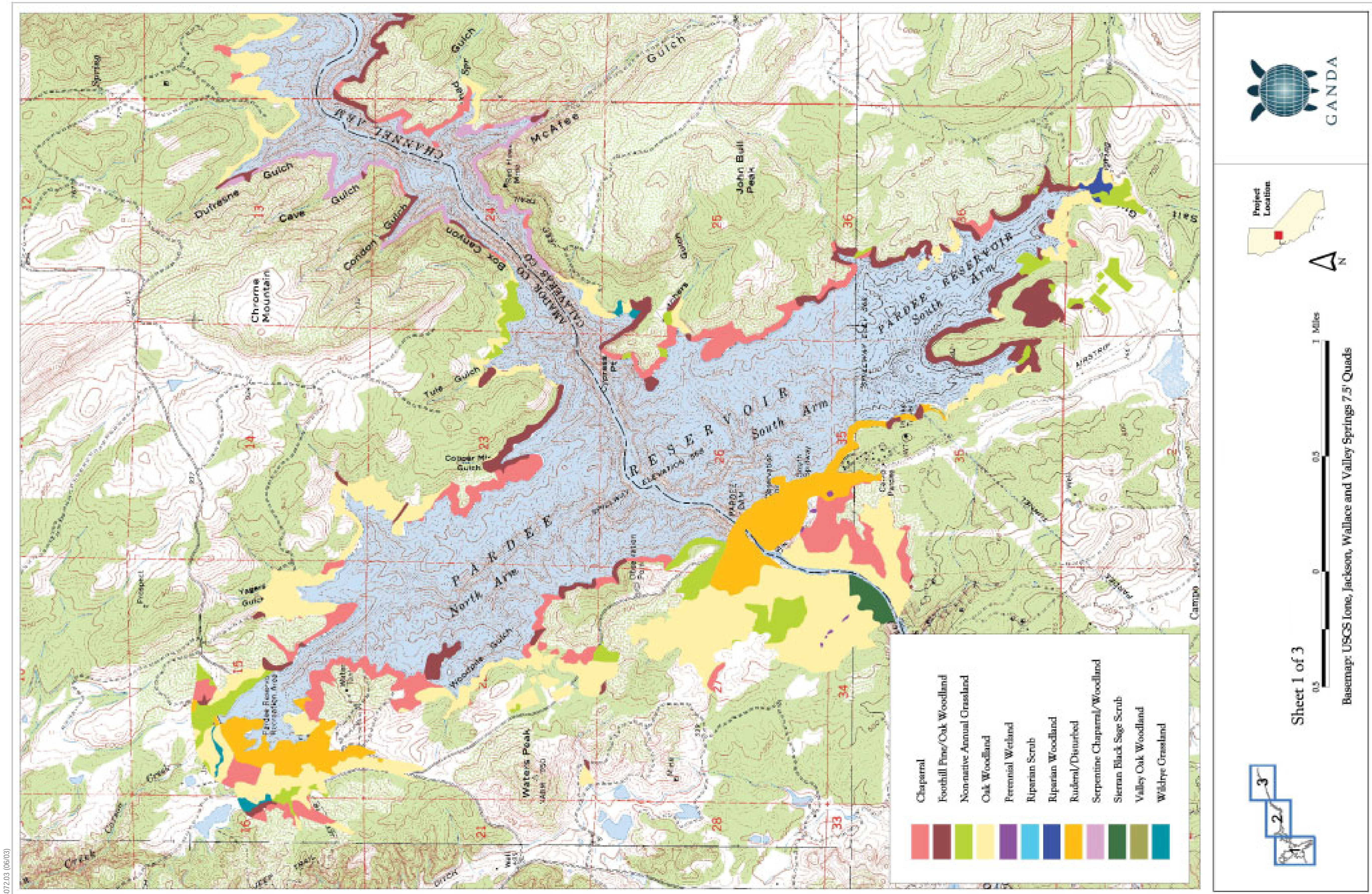
03072.03 (06/03)

Jones & Stokes

Figure 7-2b
Plant Community Distribution
Folsom South Canal to Mokelumne Aqueducts

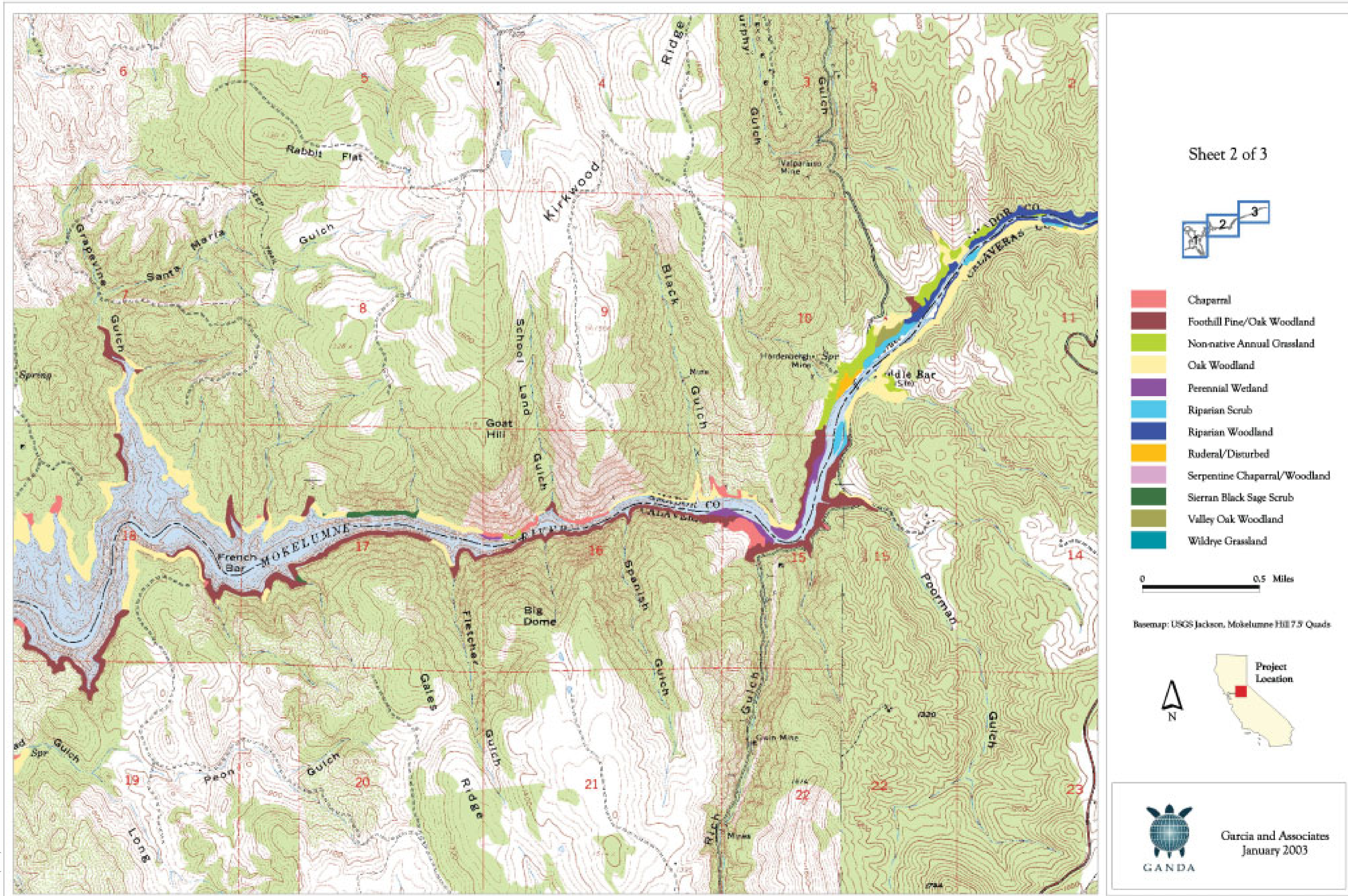
Jones & Stokes

Figure 7-2c
Plant Community Distribution
Folsom South Canal to Mokelumne Aqueducts



Jones & Stokes

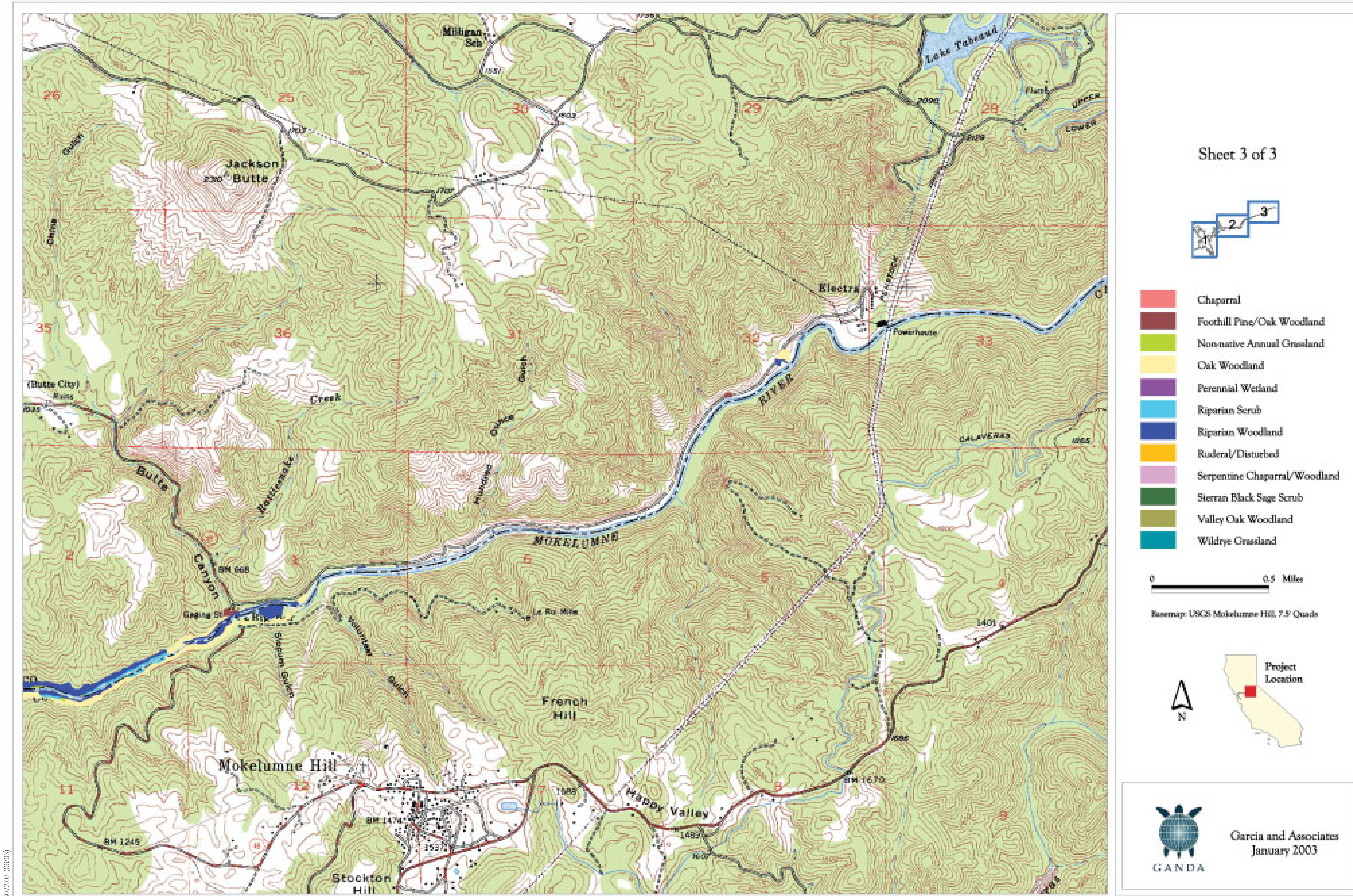
Figure 7-3a
Plant Community Distribution
Enlarged Pardee Reservoir



03072.03 (06/03)

Jones & Stokes

Figure 7-3b
Plant Community Distribution
Enlarged Pardee Reservoir



03072.03 (06/03)

Jones & Stokes

Figure 7-3c
Plant Community Distribution
Enlarged Pardee Reservoir

habitat for plants, several of which have threatened or endangered status. Although the study area comprises extensive areas of developed or otherwise altered land, high-quality vernal pools are scattered throughout remaining grassland habitat along the pipeline alignments. Other key natural attributes in this section include several major streams and associated riparian habitat and wetlands. Plant communities are described in detail below.

Eight distinct plant communities occur within this portion of the study area. These include urban landscape, ruderal, agriculture, annual grassland, mixed riparian habitat, vernal pools and swales, seasonal wetland, and perennial wetland. Mixed riparian, vernal pools, and seasonal and perennial wetlands are considered sensitive habitats by DFG and include areas that potentially qualify as waters of the United States, which are subject to jurisdiction of the Corps.

Plant communities are defined by DFG (2002) based on Sawyer and Keeler-Wolf (1995) and are compatible with Holland (1986). Communities were mapped on aerial photographs, and GIS software was used to create a digital habitat map to yield acreage. Typical plant species, soil characteristics, and occurrence in the study area of each community type are described below. The presence and extent of each habitat type in the project area are shown in Figures 7-1a, 7-1b, 7-1c.

Urban Landscape

Urban landscape exists in residential and commercial neighborhoods, parks, golf courses, and along streets throughout the study area. This habitat type includes developed and landscaped areas, as well as adjacent disturbed areas. Urban landscapes support a variety of horticultural plantings and remnants of native vegetation.

Ruderal

Highly disturbed, weedy plant communities occurring along roadsides and railroad tracks and interspersed within the urban landscape as vacant lots, unpaved roads, and constructions sites were classified as ruderal. Ruderal sites, while occasionally supporting a dense cover of introduced (nonnative) annual or perennial plants, provide little or no habitat for native plants and wildlife.

Agriculture

Major agricultural uses in the study area are orchards, vineyards, and other row crops.

Annual Grassland

Annual grassland is the dominant natural plant community in the study area and throughout the lower Delta. Annual grassland is characterized by a dominance of naturalized nonnative upland grasses such as wild oat (*Avena fatua*), soft chess (*Bromus hordeaceus*), and ripgut brome (*Bromus diandrus*). Herbs such as wild radish (*Raphanus sativus),* yellow star-thistle (*Centaurea solstitialis*), rose-clover (*Trifolium hirtum)*, hairy hawkbit (*Leontodon taraxicoides*), and filaree (*Erodium moschatum*) are also present among the grasses. Annual grassland remains unsaturated throughout most of the winter except for a short period following heavy or prolonged rains. Typical grassland soils include loams, gravelly loams, and sandy loams, many of which are underlain by a claypan or cemented hardpan. Vernal pools and swales occur within this community above such restrictive soils.

Mixed Riparian Habitat

This habitat type encompasses a variety of plant associations, including riparian woodland, willow riparian scrub, and blackberry/rose riparian scrub that generally occur along the margins of streams, creeks and other waterways. Other riparian habitat along the alignments consists of the tree species Fremont’s cottonwood (*Populus fremontii*), sandbar willow (*Salix exigua*), red willow (*Salix laevigata),* yellow willow (*Salix lutea*), box elder (*Acer negundo*), and Oregon ash (*Fraxinus latifolia*). Common herbs include Baltic rush (*Juncus balticus),* perennial pepperweed (*Lepidium latifolium*) and poison-oak. Steep banks and earthen levees confine riparian vegetation on the Sacramento River to a narrow strip. Mature native stands of Northern California black walnut (*Juglans hindsii*) are considered a sensitive plant community; however, black walnut seedlings or trees that are interspersed within riparian or other habitats are not considered a special-status species. No native stands were observed or are known to occur in the study area.

Vernal Pools and Swales

Vernal pools are seasonally flooded depressions underlain by a restrictive soil layer (claypan, hardpan, or bedrock) which inhibits the downward filtration of water. Vernal pools are periodically or continuously inundated through the winter months and gradually dry out during spring through evaporation. They remain desiccated throughout the summer and fall until the onset of the next season’s rains. Vernal swales are seasonally inundated or saturated drainages dominated by vernal pool indicator plants (see below). They frequently connect vernal pools and convey water through the vernal pool ecosystem. Most vernal swales remain saturated but not inundated for prolonged periods during the rainy season and tend to dry out sooner than vernal pools.

Common plant species include Mediterranean barley (*Hordium murinum* var. *leporinum*), Carter’s buttercup (*Ranunculus bonarrensis* var. *trisepalus*), smooth goldfields (*Lasthenia glaberrima*), popcornflower (*Plagiobothrys stipitatus* var. *micranthus*), button celery (*Eryngium castrense*), wooly marbles (*Psilocarpus brevissimus*), and pale spike-rush (*Eleocharis macrostachya*).

Seasonal Wetland

Seasonal wetlands are similar to vernal pools in that they are seasonally inundated or saturated during the winter and spring and become dry in the summer and fall. They are distinguished from vernal pools in that they support a different flora generally composed of species not particularly unique or restricted in distribution. Common plant species in seasonal marshes in the project area include knotgrass (*Paspalum distichum*), pale spike-rush, Baltic rush, cattail (*Typha* sp.), umbrella nut-sedge (*Cyperus eragrostis*), curly dock (*Rumex crispus),* watercress (*Rorippa* sp.), and cocklebur (*Xanthium stromarium*).

Perennial Wetland

All habitats sustained by a permanent water source are included as perennial wetlands in this analysis, including creeks, channels, ponds, and marshes. Although wetland delineations were not performed, a number of creek crossings and drainage channels were observed. Development of marsh habitat varies from a narrow fringe bordering permanent watercourses to extensive areas of perennial freshwater marsh. Perennial freshwater marsh is characterized by constant inundation, hydric soils, and the presence of hydrophytic vegetation such as cattail, common reed (*Phragmites australis*), bulrush (*Scirpus* sp.), and rushes (*Juncus* sp.).

Folsom South Canal to Mokelumne Aqueducts

Plant communities within this section are similar to those described above. However, the area is significantly less developed, and nonnative grazed grassland and other agricultural areas dominate the landscape (see Figures 7-2a through 7-2c). Plant communities in this portion of the project area include all those occurring west of the FSC, in addition to eucalyptus stands and blue oak woodland. These additional plant communities are described below.

Eucalyptus Stand

Mature eucalyptus trees (primarily *Eucalyptus globulus)* are planted in a monodominant stand near the terminus of the FSC. Eucalyptus stands are a naturalized plant community in California, which generally have sparse understory and low floristic diversity. Common herbs and forbs in this community include soft chess, ripgut brome, wild oat, and poison-oak (*Toxicodendron diversilobum*).

Blue Oak Woodland

Blue oak woodland occurs on well-drained ridges and slopes with shallow, rocky soils. It consists of dense to open stands of blue oaks (*Quercus douglasii*), sometimes interspersed with interior live oak (*Quercus wislizenii*), with an annual grassland understory. In general, soil characteristics and typical understory plant species found in blue oak woodland are similar to those of annual grassland.

Enlarged Pardee Reservoir

The enlarge Pardee Reservoir component occurs within natural communities typical of lower elevations of the western Sierra Nevada range. Key features of this foothill region include extensive areas of oak woodland; a diverse assemblage of chaparral including the unique and regionally limited serpentine chaparral community; freshwater wetland around seeps, springs, and small tributaries; and well-developed downstream riparian communities of willow, alder, and cottonwood. Serpentine chaparral and woodland, in particular, exhibit high rates of plant endemism. Within the study area, these communities are known to support four special-status plants, including Mariposa cryptantha (*Cryptantha mariposae)*, Bisbee Peak rush-rose (*Helianthemum suffructescens*), Ewan's larkspur (*Delphinium hansenii* ssp. *ewanianum*), and foothill jepsonia (*Jepsonia heteranda*). Plant communities and the special-status species they support are described briefly below.

Plant communities were classified according to the *List of Natural Communities Recognized by the Natural Diversity Database* (California Department of Fish and Game 2002) and are loosely based on original descriptions by Holland (1986). Eight major natural vegetation types occur in the project area, including nonnative annual grassland, wildrye grassland, chaparral, oak woodland, Sierran black sage scrub, riparian woodland, riparian scrub, and perennial wetland. Fine-scale classification was not performed except in cases where community sub-types have special status, namely, serpentine chaparral, serpentine woodland, and valley oak woodland. Natural plant communities as well as disturbed, developed, and unvegetated areas in the project area are described below and summarized in Table 7-2, and shown in Figures 7-3a, 7-3b, and 7-3c.

Table 7-2. Occurrence and Extent of Major Plant Communities within the Pardee Reservoir Inundation and Water Fluctuation Zone

Plant Community	Acres Inundated (below 601 ft.) Plus Facilities above 601 feet	Acres Periodically Flooded (601 ft.–614 ft.)
Enlarge Pardee Reservoir Component		
Chaparral	134.4	48.7
Oak Woodland	451.4	167.4
Perennial wetland*	11.3	0.0
Riparian Scrub*	9.5	0.1
Riparian Woodland*	25.8	8.3
Ruderal/Disturbed	136.6	12.4
Serpentine Chaparral/Woodland*	20.7	10.5
Sierran Black Sage Scrub	14.6	1.2
Valley Oak Woodland*	3.2	0.2
Annual Grassland	72.6	30.6
Creeping Wildrye Grassland	1.2	1.1
Foothill Pine Woodland	82.6	28.2
Total	**963.4**	**309.0**

* Communities are designated as special plant communities by DFG.

Nonnative Annual Grassland

Annual grassland, characterized by a dominance of naturalized winter-annual grasses, is well represented in the project area on the gentle slopes and rolling hills southwest of the reservoir. Typical grassland species also form the understory of oak woodland and intergrade with chaparral species on shallow, rocky soils throughout the project area. This naturalized plant community can support a diversity of species, particularly over volcanic, clay, adobe, or other uncommon soils. This is seen in the project area in a distinct volcanic mudflow zone where impervious soils have fostered the development of a system of swales, described below. Common species in nonnative annual grassland include soft chess (*Bromus hordeaceus*), wild oat (*Avena fatua*), ripgut brome (*Bromus diandrus*), and rat-tailed fescue (*Vulpia myuros*).

Creeping Wildrye Grassland

This native grassland community occurs in isolated broad swales intergrading with blue oak woodland and nonnative annual grassland north of the Jackson

Creek spillway. Soils are saturated though part of the year at these locations, enabling wildrye (*Leymus triticoides*) and other hydric herbaceous species such as annual rye grass (*Lolium multiflorum*), curly dock (*Rumex crispus*), verbena (*Verbena* sp.), and Baltic rush (*Juncus balticus*) to dominate.

Chaparral

Chaparral communities occur on shallow or rocky soils at lower elevations in the project area, concentrated between Middle Bar Bridge and Rag Gulch, and intergrading with woodland communities as elevation increases. The broad classification of chaparral is actually a mosaic of subtypes whose distribution varies with substrate type and quality, slope, aspect, and disturbance regime. Chamise chaparral is found on the driest, rockiest slopes and ridge tops, where chamise (*Adenostoma fasciculatum*) forms nearly monodominant stands. Chamise chaparral is common around the reservoir, particularly on the eastern shore of the north arm. Toyon (*Heteromeles arbutifolia*) and whiteleaf manzanita (*Arctostaphylos viscida*) share dominance with chamise in the cooler, moister microsites of ravines, while a dense thicket of chamise and toyon covers the steep, highly erodible slopes overlooking the southern arm of the reservoir. A unique chaparral association of bush monkeyflower (*Mimulus aurentiacus*) and California buckeye (*Aesculus californica*) is common on exposed rocky cliffs and outcrops within woodland, particularly on south-facing slopes above the Mokelumne River between Cypress Point and Middle Bar. Highly disturbed areas around the Pardee Recreation Area, at the woodland edge, and in burned areas support poison-oak (*Toxicodendron diversilobum*) chaparral. Finally, steep serpentine slopes between Dufresne Gulch and Condon Gulch on the north side of the reservoir support only a sparse shrub association variably dominated by chamise, whiteleaf manzanita, and snowdrop bush (*Styrax officinalis*). This mixed serpentine chaparral is considered a special community by DFG, and is particularly rich in special-status plants.

Sierran Black Sage Scrub

This community, unusual for the Sierra Nevada floristic province, occurs in a patchy distribution at scattered locations within the project area and extensively on south-facing slopes downstream of the Pardee Dam and between School Land Gulch and French Bar. Monodominant stands of black sage (*Salvia meliferia*) occur in a mosaic of chamise and bush monkeyflower in these locations.

Oak Woodland

Like chaparral, oak woodland in the project area consists of several distinct species associations whose distributions vary with topography and edaphic conditions. At the lowest elevations surrounding the reservoir and upstream of the river to Middle Bar Bridge, blue oak (*Quercus douglasii*) occurs in extensive stands of varying densities from dense woodland to open savanna, dominating the landscape around the reservoir. As elevations increase, foothill pine (*Pinus sabiniana*) becomes a frequent associate and increases to share dominance with blue oak on south-facing slopes. Foothill pine woodland is described below. Other oaks may be found distributed within blue oak woodland and are clearly dominant in distinct areas: valley oak (*Quercus lobata*) woodland, a special-status plant community described below, occurs on north-facing slopes upstream from the SR 49 bridge; a dense woodland of interior live oak (*Quercus wizlenii*) occurs on north-facing slopes upstream from Middle Bar Bridge and south-facing slopes upstream from the SR 49 bridge; and canyon live oak (*Quercus chrysolepis*) occurs in small, nearly pure stands in steep canyons near the SR 49 bridge. Oaks generally occur within a larger matrix of nonnative annual grassland, commonly associated with several shrubs such as whiteleaf manzanita, mariposa manzanita (*Arctostaphylos viscida* ssp. *mariposa*), coffeeberry (*Rhamnus californica*), buck brush (*Ceanothus cuneatus*), toyon, and mountain mahogany (*Cercocarpus betuloides*).

Valley Oak Woodland

Valley oak woodland, occurring in a discrete patch north of the SR 40 bridge, is dominated by a dense canopy of large valley oaks. The understory of valley oak woodland is composed of nonnative grasses (soft-chess, ripgut, wild oat, and rat-tailed fescue) and occasional shrubs such as coffeeberry. DFG considers valley oak woodland a high priority for inventory in the CNDDB.

Foothill Pine Woodland

Foothill pine is the sole dominant overstory species in this open, savanna-like woodland. Blue oak and California buckeye are frequent associates at lower elevations in the project area, where this community occurs at several scattered locations surrounding the reservoir and upstream to Middle Bar Bridge. At higher elevations, such as on the south banks of the Mokelumne from French Bar to Rich Gulch, chaparral species such as chamise, toyon, and whiteleaf manzanita form a dense, often impenetrable, thicket in the understory. Shrub cover is generally less dense on serpentine soils that occur from Box Canyon to Dufresne Gulch.

Riparian Woodland

Well-developed riparian woodland occurs on the upper Mokelumne River upstream from Middle Bar Bridge. Riparian communities are designated as special plant communities by DFG and are subject to regulation under Section 1600 of the California Fish and Game Code. Distribution of distinct riparian communities in the project area is a function of the fluvial geomorphology of the Mokelumne River. In low-gradient areas where sediment deposits are relatively deep, a forest dominated by Fremont's cottonwood (*Populus fremontii*) and black willow (*Salix goodingii*) with a dense understory of California grape (*Vitus* *californica*), Himalayan blackberry (*Rubus discolor*), and sandbar willow (*Salix exigua*) is present. In high-flow, frequently disturbed areas, alders (*Alnus rhombifolia*) colonize the cobble and bedrock substrates in a narrow strip along the waters edge; Oregon ash (*Fraxinus latifolia*), red willow (*Salix laevigata*), and sandbar willow are present in the shallower areas. Finally, at the southern arm of the reservoir, a mature community of valley oak occurs on deep, well-developed soils that are only infrequently inundated by a permanent spring.

Riparian Scrub

Areas along the river that are subject to frequent flooding and high rates of scour support a disturbance-tolerant community of shrubby willow (*Salix* sp.) and occasional Freemont's cottonwood. This community generally occurs on gravel bars within the river corridor. The understory is a sparse association dominated by torrent sedge (*Carex nudata*), Himalayan blackberry, or California rose (*Rosa californica*).

Perennial Wetland

Perennial freshwater marsh occurs on sediment deposits just downstream from Middle Bar Bridge. These areas are dominated by cattail (*Typha* sp.). Pale spike-rush (*Eleocharis macrostachya*), Baltic rush, common smartweed (*Polygonum punctatum*), and mugwort (*Artemisia douglasiana)* are common. Along the high-water mark of the reservoir, frequent inundation promotes the establishment of a narrow fringe of the hydric plant Baltic rush in gently sloped areas.

Ruderal/Disturbed Areas

Ruderal, or disturbed, areas contain little or no habitat for special-status plant species. Areas where roads, buildings, and pavement represent at least 10% of the ground cover (or where human intrusion is a conspicuous feature of the environment) are considered disturbed. Disturbed areas include landscaped areas around structures, the dam and spillway sites, day-use areas, and other facilities, as well as sites where ruderal, weedy vegetation is heavily dominant.

Special-Status Species

Special-status plant species include those species that are:

- listed, proposed, or candidates for listing as Threatened or Endangered under the federal Endangered Species Act (ESA);

- listed or candidates for listing as Threatened or Endangered under the California Endangered Species Act (CESA);
- considered “species of concern” by USFWS;
- included on Lists 1B or 2 of the CNPS Inventory of Rare and Endangered Plants of California;
- protected by other applicable federal, state, or local ordinances; or
- considered sufficiently rare by the scientific community to qualify for consideration under CEQA.

Freeport Intake Facility to Mokelumne Aqueducts

A target list of 23 special-status plants with potential to occur along the pipeline alignments and facilities was compiled based on the habitat types identified in the study area, and from known occurrences of special-status plants from the CNNDB (2002), CNPS (2001), unpublished reports, and local knowledge of the area. This target list is presented in Table 7-3. Based on known locations and the presence of suitable habitat, seven special-status plants (including two federally listed species) have a moderate to high potential for occurrence in the project area. These plants are described in detail below. Plants with a low or moderate potential for occurrence are included in Table 7-3 but not described in the text.

Special-status plants known to occur in vernal pools in the project vicinity include dwarf downingia (*Downingia pusilla*), Bogg’s Lake hedge-hyssop (*Gratiola heterosepala*), legenere (*Legenere limosa*), slender Orcutt grass (*Orcuttia tenuis*), and Sacramento Orcutt grass (*Orcuttia viscida*). Ahart’s dwarf rush (*Juncus leiospermus* var. *ahartii*) could potentially occur on the edges of vernal pools and other mesic sites within grassland, while seasonal marshes could potentially support Sanford’s arrowhead (*Sagittaria sanfordii*).

Freeport Intake Facility to Zone 40 Surface Water Treatment Plant/Folsom South Canal

No focused surveys for special-status plants or formal wetland delineations were conducted in this portion of the project area.

Dwarf Downingia

Dwarf downingia is a CNPS List 2 species with no federal or state status. This annual herb in the bellflower family blooms from March to May. Restricted to vernal pools, dwarf downingia is known to occur in the vicinity of Waterman Road, approximately 3 miles south of the proposed pipeline alignments. High-quality habitat occurs in the vernal pool complex between Elk Grove–Florin Road and Excelsior Road in the vicinity of the Zone 40 Surface WTP.

Bogg's Lake Hedge-Hyssop

Bogg's Lake hedge-hyssop, listed as Endangered by the State of California, is an annual herb in the snapdragon family blooming from April to August. This species requires clay soils in areas of shallow water such as the margins of lakes and vernal pools. Known populations range from the inner north coast ranges to the Central Sierra Nevada foothills. Bogg's Lake hedge-hyssop is known to occur in the vernal pool complex near Excelsior Road, approximately 1 mile south of Segment N.

Legenere

Legenere, an annual herb in the bellflower family blooming from April to June, is associated with deep vernal pools that remain inundated or saturated late into the blooming season. Legenere is a CNPS List 1B species and a federal species of concern. Populations are known from the southern Sacramento Valley and southern North Coast Ranges; it is documented to occur in the study area adjacent to Waterman Road and just north of the Gerber Road extension.

Ahart's Dwarf Rush

A CNPS List 1B species, this rare annual rush is known only from the eastern Sacramento Valley and the northeastern San Joaquin Valley, where it may be found growing on the edges of vernal pools or in other mesic sites. Known only from six documented occurrences, Ahart's dwarf rush is threatened by development throughout its habitat. Plants bloom from March to May. This species is documented by CNDDB to occur within 2 miles of the study area.

Slender Orcutt Grass

Slender Orcutt grass is a vernal pool endemic known from the northern Sacramento Valley, the Pit River Valley, and isolated populations in Sacramento and Lake counties. It is a state endangered and a federally threatened species. Flowers are produced from May to July. A known population of slender Orcutt grass occurs approximately 2,000 feet southeast of the intersection of Gerber and Excelsior Roads, approximately 0.3 mile south of Segment N.

Sacramento Orcutt Grass

This federal and state endangered species is endemic to vernal pools in Sacramento County. The bloom period extends from May to June. Suitable habitat occurs in the vernal pool complex in the vicinity of Excelsior Road.

Sanford's Arrowhead

A CNPS List 1B species, Sanford's arrowhead is a perennial herb in the water-plantain family. The flowering period extends from May to October. A variety of shallow freshwater systems support this species; drainage ditches, shallow canals, and small ponds and marshes provide suitable habitat. High-quality habitat exists for this species in the project area, and a number of known populations occur in channelized creeks in the western portion of the pipeline alignments near the Sacramento River.

Table 7-3. Special-Status Plant Species with Potential to Occur in the Freeport Intake Facility to Mokelumne Aqueducts Study Area

Species[1]	Status (Fed./State/CNPS)[2]	Bloom Period	Habitat	Known to Occur in Project Area?
Heartscale *Atriplex cordulata*	SC/--/1B	Apr–Oct	Alkali soils in grassland, meadows, chaparral	No
Brittlescale *Atriplex depressa*	SC/--/1B	May–Oct	Alkali soils in grassland, meadows, chaparral	No
San Joaquin Valley spearscale *Atriplex joaquiniana*	--/--/1B	Apr–Oct	Alkali soils in grassland, meadows, chaparral	No
Bristly sedge *Carex comosa*	--/--/2	May–Sep	Marshes and swamps	No
Dwarf downingia *Downingia pusilla*	--/--/2	March–May	Vernal pools	Yes
Round-leaved filaree *Erodium macrophyllum*	--/--/2	Mar–May	Clay soils in grassland	No
Succulent owl's-clover *Castilleja campestris* ssp. *succulenta*	T/--/1B	Apr–May	Vernal pools and swales	No
Hoover's spurge *Chamaesyce hooveri*	T/--/1B	Jul–Aug	Vernal pools	No
Spiny-sepaled button-celery *Eryngium pinnatisectum*	--/--/1B	June–Aug	Mesic sites in grassland, vernal pools	No
Bogg's Lake hedge-hyssop *Gratiola heterosepala*	--/E/1B	April–Aug	Vernal pools, marshes. Clay soils	Yes
California hibiscus *Hibiscus lasiocarpus*	--/--/2	Jun–Sep	Freshwater marshes and swamps	No
Delta tule-pea *Lathyrus jepsonii* var. *jepsonii*	--/--/1B	May–Sep	Freshwater/brackish marshes and swamps	No
Northern California black walnut *Juglans hindsii*	--/--/1B	Apr–May	Riparian forest, deep alluvial soils	No
Ahart's dwarf rush *Juncus leiospermus var. ahartii*	--/--/1B	Mar–May	Mesic sites in grassland. Known from within one mile of Gerber Road.	No
Legenere *Legenere limosa*	--/--/1B	Apr–June	Vernal pools	Yes

Species[1]	Status (Fed./State/CNPS)[2]	Bloom Period	Habitat	Known to Occur in Project Area?
Mason's lilaeopsis *Lilaeopsis masonii*	--/--/1B	Apr–Nov	Freshwater or brackish marshes, riparian scrub	No
Delta mudwort *Limosella subulata*	--/--/2	May–Aug	Marshes	No
Pincushion navarretia *Navarretia myersii ssp. myersii*	--/--/1B	May	Vernal pools	No
Slender Orcutt grass *Orcuttia tenuis*	T/E/1B	May–Aug	Vernal pools	Yes
Sacramento Orcutt grass *Orcuttia viscida*	E/E/1B	Apr–Jul	Vernal pools	Yes
Sanford's arrowhead *Sagittaria sanfordii*	--/--/1B	May–Oct	Marshes, ponds and swamps; roadside ditches	Yes
Blue skullcap *Scutellaria lateriflora*	--/--/2	Jul–Sep	Mesic meadows, marshes	No
Greene's tuctoria *Tuctoria greenei*	E/--/1B	May–Jul	Vernal pools	No

1 Scientific names, common names, and habitat notes from Hickman (1993) and CNPS (2001).

2 Plant status definitions and governing agencies are as follows:

Federal (U.S. Fish and Wildlife Service)

E = listed as Endangered under the Federal Endangered Species Act

T = listed as Threatened under the Federal Endangered Species Act

SC = Species of Concern

State (California Department of Fish and Game)

E = listed as Endangered under the California Endangered Species Act

T = listed as Threatened under the California Endangered Species Act

California Native Plant Society

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

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

List 4: Plants of limited distribution: A watch list.

Folsom South Canal to Mokelumne Aqueducts

Garcia and Associates (GANDA) conducted focused rare plant surveys for this section of pipeline in 1996–1998 (Garcia and Associates 1998). No rare plants were found during these surveys, although over 150 vernal pools and swales were intensively searched.

Bogg's Lake Hedge-Hyssop

This species is known to occur on both sides of Angrave Road along Segment Option 3. See species description above.

Sacramento Orcutt Grass

A known population of Sacramento Orcutt grass occurs at Rancho Seco Lake, 3.5 miles north of the study area. See species description above.

Enlarge Pardee Reservoir

A review of available literature and current databases (California Native Plant Society 2002; California Department of Fish and Game 2002) yielded a target list of 17 special-status plant species with potential to occur at Pardee Reservoir. These species are listed in Table 7-4. Plants described below are known to occur in the project area based on previous field survey data (Entrix 1998). No plants listed by either the state or federal ESAs are known to occur at Pardee Reservoir.

Table 7-4. Special-Status Plant Species with Potential to Occur in the Enlarge Pardee Reservoir Area

Species[1]	Status (Fed./State/CNPS)[2]	Bloom Period	Habitat	Known to Occur in Project Area?
Three-bracted onion *Allium tribracteatum*	SC/--/1B	Apr–Jul	Volcanic soils within chaparral, montane coniferous forest.	No
Ione manzanita *Arctostaphylos myrtifolia*	PT/--/1B	Nov–Feb	Acidic Ione formation of clay soils within chaparral and cismontane woodland.	No
Hoover's calycadenia *Calycadenia hooveri*	SC/--/1B	Jul–Sep	Rocky substrates within cismontane woodland and grassland.	No
Red Hills soaproot *Chlorogalum grandiflorum*	SC/--/1B	May–Jun	Ultramafic soils within chaparral, cismontane woodland, or lower montane coniferous forest.	No
Slough thistle *Cirsium crassicaule*	SC/--/1B	May–Aug	Riparian scrub, marshes, and swamps.	No
Mariposa cryptantha *Cryptantha mariposae*	--/--/1B	Apr–May	Serpentine chaparral.	Yes
Ewan's larkspur *Delphinium hansenii* ssp. *ewanianum*	-SC/--/4	Mar–May	Rocky substrates in cismontane woodland or grassland	Yes

Species[1]	Status (Fed./State/CNPS)[2]	Bloom Period	Habitat	Known to Occur in Project Area?
Ione buckwheat *Eriogonum apricum* var. *apricum*	E/E/1B	Jul–Oct	Openings in chaparral on Ione soils.	No
Irish Hill buckwheat *Eriogonum apricum* var. *prostratum*	E/E/1B	Jun–Jul	Openings in chaparral on Ione soils.	No
Tuolumne button-celery *Eryngium pinnatisectum*	SC/--/1B	Jun	Mesic sites within cismontane woodland, and lower montane coniferous forest, vernal pools.	No
Delta button-celery *Eryngium racemosum*	SC/E/1B	Jun–Aug	Vernally mesic clay depressions within riparian scrub.	No
Bisbee Peak rush-rose *Helianthemum suffrutescens*	SLC/--/3	Apr–Jun	Ultramafic soils within chaparral	Yes
California rose-mallow *Hibiscus lasiocarpus*	SC/--/2	Aug–Sep	Marshes and swamps.	No
Parry's horkelia *Horkelia parryi*	SC/--/1B	Apr–Jun	Ione formation soils within chaparral and cismontane woodland.	No
Ahart's dwarf rush *Juncus leiospermus* var. *ahartii*	SC/--/1B	Mar–May	Vernal pools.	No
Stebbins's lomatium *Lomatium stebbinsii*	SC/--/1B	Mar–Apr	Volcanic clay soils within chaparral and lower montane coniferous forest.	No
Whipple's monkeyflower *Mimulus whipplei*	SC/--/1A	May	Lower montane coniferous forest. Believed extinct.	No
Sanford's arrowhead *Sagittaria sanfordii*	SC/--/1B	May–Aug	Shallow freshwater marshes and swamps.	No
Prairie wedge grass *Sphenopholis obtusata*	--/--/2	Apr–Jul	Mesic meadows and openings in cismontane woodland.	No

1 Scientific names, common names, and habitat notes from Hickman (1993) and CNPS (2001).

2 Plant status definitions and governing agencies are as follows:

Federal (U.S. Fish and Wildlife Service)

E = listed as Endangered under the Federal Endangered Species Act

T = listed as Threatened under the Federal Endangered Species Act

SC = Species of Concern

PT = Proposed Threatened

SLC = Species of Local Concern

State (California Department of Fish and Game)

E = listed as Endangered under the California Endangered Species Act

T = listed as Threatened under the California Endangered Species Act

California Native Plant Society

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

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

List 3: Plants about which more information is needed: A watch list.

List 4: Plants of limited distribution: A watch list.

Mariposa Cryptantha

This rare annual herb in the Borage family was recently upgraded from the CNPS watchlist to a List 1B, indicating a status of rare or endangered throughout its range. This species is known from Calaveras, Mariposa, Stanislaus, and Tuolumne counties, where it is associated with the serpentine chaparral community at elevations ranging from 600 to 1,950 feet. Mariposa cryptantha flowers from April to May. One population, consisting of approximately 100 individuals, occurs in the study area on an east-facing slope in McAffee Gulch.

Ewan's Larkspur

Ewan's larkspur is a federal species of concern and a CNPS 4 (watchlist) species. This perennial herb in the buttercup family is associated with oak woodland or annual grassland communities at elevations between 90 and 900 feet. Current distribution includes Calaveras, Kern, Madera, and Tulare Counties. There are 39 occurrences, ranging in size from 1 to more than 200 individuals, in the study area, typically associated with blue oak and California buckeye.

Bisbee Peak Rush-Rose

Bisbee Peak rush-rose is a species of local concern and a CNPS List 3 species (plants about which more information is needed). This evergreen shrub is endemic to Amador, Calaveras, El Dorado, Sacramento, and Tuolumne Counties, where it is an associate of the serpentine chaparral community. Bloom period extends from April to June. Three populations, ranging in size from 4 to 25 individuals, occur within chamise chaparral around Pardee Reservoir.

Regulatory Setting

In addition to the State CEQA Guidelines (discussed in the following section), selected federal, state, and local laws, regulations, and policies pertaining to vegetation and wetland resources apply to impacts on waters of the United States, including wetlands, riparian communities, oak communities, the spread of noxious weeds, and individual heritage or protected trees. These regulations and policies include the following:

- Section 404 of the Clean Water Act;
- California Fish and Game Code Sections 1601;
- Federal Executive Order 11990 and DFG's no-net-loss policy on wetlands;
- Section V of the Conservation Element of the County of Sacramento General Plan;

- Conservation and Open Space Element of the City of Sacramento General Plan;
- San Joaquin County General Plan 2010 and Habitat Conservation and Open Space Plan;
- Sections 403 and 461 of the California Food and Agriculture Code;
- Senate Concurrent Resolution 17 regarding protection of oak woodlands;
- City of Sacramento Heritage Tree Ordinance (Title 45: Trees)
- County of Sacramento Tree Preservation Ordinance of the Sacramento County Code, Chapter 19.12;
- Title 9 of the San Joaquin Development Title Code on protection of heritage oak, native oak, and historical trees;
- Policy 15 of the Amador County Plan Development Policy Statement;
- Conservation and Open Space Elements of the Amador County Plan; and
- Goals V-1 and V-3 of the Open Space Element of the Calaveras County General Plan.

Environmental Consequences

Significance Criteria

The criteria used for determining the significance of an impact on vegetation and wetland resources are based on Appendix G of the State CEQA Guidelines environmental checklist and professional standards and practices. Impacts on vegetation and wetland resources may be considered significant if implementation of an alternative 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 California Department of Fish and Game or U.S. Fish and Wildlife Service;
- have a substantial adverse effect on any riparian habitat or other sensitive natural community identified in local or regional plans, policies, or regulations or by the California Department of Fish and Game or U.S. Fish and Wildlife Service;
- have a substantial adverse effect on federally protected wetlands as defined by Section 404 of the Clean Water Act (including marshes, vernal pools, coastal wetlands) through direct removal, filling, hydrological interruption, or other means;
- interfere substantially with the movement of any native resident or migratory fish or wildlife species or with established native resident or migratory wildlife corridors or impede the use of native wildlife nursery sites; or

- conflict with any local policies or ordinances protecting biological resources, such as a tree preservation policy or ordinance.

Significant impacts on biological resources are not limited to projects affecting only state or federally listed endangered species. DFG often considers CNPS List 1B and 2 plants to be equivalent to listed rare or endangered species; a species that is not listed will also be considered rare or endangered if it can be shown to meet the following criteria (State CEQA Guidelines 15380):

- when its survival and reproduction in the wild are in immediate jeopardy from one or more causes; or
- it is existing in such small numbers throughout all or a significant portion of its range that it may become endangered if its environment worsens; or
- it is likely to become endangered within the foreseeable future throughout all or a significant portion of its range.

Survey Methods and Assumptions

Freeport Intake Facility to Mokelumne Aqueducts

Vegetation and wetland resources could be directly and indirectly affected by construction of the intake facility, pipelines, the Zone 40 Surface WTP, terminal facility, canal pumping plant, and the aqueduct pumping plant and pretreatment facility. Direct project effects include permanent loss of vegetation and wetlands resulting from construction of facilities and establishment and use of equipment staging areas and access roads. Indirect impacts on vegetation and wetland resources could result from the following types of activities:

- grading, trenching or excavation that affects surface or subsurface hydrology;
- soil compaction, erosion, dust, and surface water runoff from construction sites;
- side casting or disposal of excess soil, cement, gravel, equipment wash water or other excess construction water materials; and
- temporary parking of vehicles or storage of construction materials outside designated construction areas.

Because the exact location and extent of disturbances related to equipment and material staging area and haul routes cannot be precisely determined at this time, impacts are described qualitatively. The following assumptions were made regarding construction-related impacts on vegetation and wetland resources:

- All vegetation and wetland resources within the 130-foot-wide pipeline construction corridor could be adversely affected during construction. The pipeline footprint was assumed to be 130 feet wide and to include the pipeline trench, stockpile area, and construction access.

- Vegetation and wetland resources within the footprint of permanent facilities were assumed permanently removed by project construction.
- In flat terrain, vegetation and wetland resources next to construction areas could be temporarily disturbed or stressed by heavy equipment, inadvertent side casting of trench materials, or changes in drainage and soil compaction.

Enlarge Pardee Reservoir

Reservoir enlargement and construction of associated facilities could directly and indirectly affect vegetation and wetland resources. Direct effects include permanent loss of vegetation and wetlands resulting from permanent inundation, periodic inundation, construction of facilities, and establishment and use of equipment staging areas and access roads (Table 7-2). Indirect impacts on vegetation and wetland resources could result from the following types of activities:

- soil compaction, erosion, dust, and surface water runoff from construction sites;
- side casting of disposal of excess soil, cement, gravel, equipment wash water of other excess construction water materials; and
- temporary parking of vehicles or storage of construction materials outside designated construction areas.

Because the exact location and extent of disturbances related to equipment and material staging areas and haul routes cannot be precisely determined at this time, impacts are described qualitatively. The following assumptions were made regarding project-related impacts on vegetation and wetland resources:

- Vegetation and wetland resources between the existing reservoir shoreline and the 601-foot elevation contour up to and including the new dam were considered to be permanently lost.
- Vegetation and wetland resources between the 601-foot and 614-foot contours were considered to be inundated during the growing season (March–November) for approximately 1 week during wet years.
- Vegetation and wetland resources within the footprint of permanent facilities were considered to be permanently lost.
- In flat terrain, vegetation and wetland resources next to construction areas were considered sites that could be temporarily disturbed or stressed by heavy equipment, inadvertent side casting of trench materials, or changes in drainage and soil compaction.

Less-than-Significant Impacts

Alternative 1

Alternative 1 would have no impact on vegetation or wetland resources associated with construction of FRWP facilities within any of the affected counties.

Alternatives 2–5

Impact 7-1: Temporary Disturbance to and Permanent Loss of Developed Areas, Agricultural Land, Eucalyptus Stands, Artificially Created Roadside Drainage Ditches, and Annual Grassland Habitat within the Construction Corridor

These areas provide limited values to dependent species and are locally and regionally common. Temporary disturbance to or permanent loss of these plant communities would not substantially diminish habitat for dependent plant species. This impact is less than significant. No mitigation is required.

Alternative 6

In addition to the impacts previously identified for Alternatives 2–5, the following impacts could occur under Alternative 6.

Impact 7-2: Permanent Loss of Developed Areas, Non-serpentine Chaparral, and Annual Grassland Habitat within the Inundation Zone

These areas provide limited values to dependent plants and/or are locally and regionally common. Temporary disturbance to or permanent loss of these plant communities would not substantially diminish habitat for dependent plant species. This impact is less than significant. No mitigation is required.

Significant Impacts and Mitigation Measures

Alternatives 2–5

Impact 7-3: Temporary Disturbance to or Potential Loss of Sensitive Vegetation and Wetland Resources Near Active Construction Areas

Sensitive-plant communities protected by local, state, and federal policies and laws and located outside identified construction areas could be disturbed during construction of the pipeline and project facilities. These communities include mixed riparian scrub, perennial wetland, seasonal wetland, and vernal pools and swales. This impact is significant. Implementation of the following mitigation measures can reduce this impact to a less-than-significant level.

Mitigation Measure 7-1: Confine Construction Activities and Equipment to the Designated Construction Work Area

To minimize potential impacts on sensitive vegetation and wetland resources, the contractor would be required to designate work areas outside the currently identified work zone. These designated work areas would include staging areas, equipment and vehicle parking areas, and pipeline trench and construction access corridors. Before construction, additional work areas would be surveyed by a qualified botanist, relocated as necessary to avoid impacts on sensitive resources, approved by FRWA, and demarcated before construction with lath and flagging, temporary orange construction fencing, or chain-link fencing. Construction contractors would require construction equipment and personnel to stay within these designated areas.

Mitigation Measure 7-2: Avoid and Protect Sensitive Vegetation and Wetland Resources Near Designated Construction Work Areas

To minimize impacts on sensitive vegetation and wetland resources immediately adjacent to designated construction areas, FRWA would designate areas containing sensitive vegetation and wetland resources as “Restricted Areas” and protect them with temporary barriers. The construction contractor would be required to keep construction equipment and personnel out of designated restricted areas.

Mitigation Measure 7-3: Reestablish Preconstruction Site Conditions to Allow Natural Colonization of Plant Species and Reseed, If Necessary

FRWA would require the construction contractor to restore the construction zone to preconstruction site conditions. To ensure that impacts on native plant species and other natural communities are not long-term, native topsoil would be stockpiled and immediately replaced, and natural site topography (including necessary amendments to soil structure) reestablished to allow natural colonization of plant species. In areas that require immediate stabilization, nonvegetative techniques that allow native species to reestablish can be used, including use of weed- and disease-free mulch, erosion blankets, or rolled organic fiber material.

Erosion control seed mixes may be necessary on selected sites. If sites need to be stabilized through seeding, the seed mix would include native or sterile seed varieties that are appropriate for stabilizing local site conditions. Special attention would be given to erosion control near wetland areas such as vernal pools.

Site-specific erosion control measures (nonvegetation or mechanical techniques) would be determined on a site-specific basis by a vegetation specialist and project engineer.

Impact 7-4: Introduction and Spread of Noxious Weeds

Project equipment and vehicles could cause the introduction and/or spread of noxious weeds into natural vegetation communities, including vernal pools and other wetlands, which could affect the structure and function of these communities. Implementation of the following mitigation measure would reduce this impact to less than significant.

Mitigation Measure 7-4: Implement Best Management Practices during Construction Activities

FRWA would follow BMPs to prevent the introduction and spread of noxious weeds into the project site and adjacent natural areas. This includes implementing a worker training program instructing in the identification of, and threats associated with, the most invasive noxious weeds (those rated "A", most invasive, by the California Department of Food and Agriculture); washing trucks and equipment prior to entering any natural vegetation communities, particularly vernal pools and wetlands, during pipeline construction; and washing trucks and equipment after leaving areas with serious infestations of noxious weeds.

Impact 7-5: Degradation of Blue Oak Woodlands and Loss of Individual Locally Protected Trees

Construction of FSCC pipeline alignments could fragment blue oak and valley oak woodland habitats, remove individual trees, and degrade overall woodland habitat quality. Individual trees are protected under local policies and the oak woodlands provide important travel corridors for wildlife species. This impact is significant. Implementation of the following mitigation measures would reduce this impact to a less-than-significant level.

Mitigation Measure 7-5: Identify and Avoid Oak Woodland and Individual Locally Protected Trees

To the extent possible, fragmentation of oak woodlands and loss of individual native trees would be minimized as part of determining the final alignment of the selected pipeline alternative. Before ground-disturbing construction activities, FRWA would identify protected trees outside designated construction areas with flagging or temporary construction fencing and post the protected area with restricted signs. Fencing would encompass the tree dripline and a buffer to be determined in consultation with the local planning departments. Construction specifications would require construction equipment and personnel to stay out of designated restricted areas. Construction activities that could affect tree health, such as trenching and placement of fill, would be prohibited within posted restricted areas.

Mitigation Measure 7-6: Obtain and Comply with County and City Tree Removal Permits and Implement Conditions of Permits

In areas where locally protected trees cannot be avoided during final project design, county and city tree removal permits would be obtained. The permit terms and conditions would be included in the construction specifications. Local ordinances require successful replacement of lost trees as a condition of tree removal permits. FRWA can either require the construction contractor to implement tree replacement as a condition of the construction contract or retain a qualified consultant to implement tree replacement requirements and conduct appropriate monitoring to verify that the permit conditions have been implemented.

Impact 7-6: Loss of, or Disturbance to, Riparian Communities

Construction of the pipeline alignments, the intake facility, and other project facilities would cause the permanent loss of riparian habitat and could cause additional direct temporary impacts on riparian vegetation in the vicinity. Project facilities cross several waterways that support woody riparian communities, including Dry Creek, Coyote Creek, Morrison Creek, and the Cosumnes River. These communities provide important functions and values, are regulated by state and federal agencies, and are of concern to local planning departments. Construction of the pipeline alignments could affect riparian communities. This impact is significant. Implementation of the following mitigation measures would reduce this impact to a less-than-significant level.

Mitigation Measure 7-7: Establish a Protection Buffer around Woody Riparian Communities

To the extent feasible, a buffer would be established for each drainage in the project area that supports woody riparian vegetation and that could be affected by construction activities. This buffer would be established in the field and would generally extend from the outer edge of the riparian vegetation. The width of the buffer would be identified before initiation of construction activities and would be based on site-specific conditions, seasonal restrictions for wildlife, local planning department specifications, and resource agency (e.g., USFWS and DFG) requirements. The outer edge of the designated riparian protection buffer would be demarcated using flagging or temporary orange mesh construction fencing.

Mitigation Measure 7-8: Compensate for Unavoidable Riparian Woodland Losses

A combination of restoration and enhancement of degraded riparian sites would be used to compensate for the relatively minor losses of this community that would result from construction of the intake facility and pipelines. Restoration would occur as close as possible to the area affected, preferably along the same drainage that would sustain the impacts.

Compensation for riparian community losses would encompass the goal of "no net loss" of riparian habitat acres or values. Impacts on riparian communities would be compensated for at a minimum ratio of 2:1 (2 acres treated for every 1 acre affected). The ratio of trees and shrubs planted for each tree or shrub eliminated would be determined on a site-by-site basis to ensure long-term replacement of habitat functions and values. A revegetation plan would be prepared by a qualified restoration ecologist and reviewed by the appropriate agencies. The revegetation plan would specify the planting stock appropriate for the region and each site and employ the most successful techniques available at the time of planting. Success criteria would be established as part of the plan. Plantings would be monitored for 5 years to ensure they have established successfully. The riparian community mitigation would be considered successful when sapling trees are established, no longer require active management, and are arranged in groups that, when mature, replicate the area, natural structure, and species composition of similar riparian habitats in the region.

Impact 7-7: Loss of or Disturbance to Jurisdictional Waters of the United States, Including Wetlands

Construction of the pipeline alignments would result in the loss or temporary disturbance of waters of the United States, including sensitive wetland plant communities and unvegetated open-water habitat. These plant communities, including vernal pools and other wetlands, perform important natural functions, provide important habitat to dependent plant and wildlife species, are regionally and locally uncommon, and are regulated by local, state, and federal laws and policies. The project area is within proposed critical habitat for 11 plant and wildlife vernal pool species, including vernal pool tadpole shrimp, slender Orcutt grass, and Sacramento Orcutt grass. This impact is significant. Implementation of the following mitigation measures would reduce this impact to a less-than-significant level.

Mitigation Measure 7-9: Avoid and Minimize Impacts on Jurisdictional Waters of the United States, Including Wetlands, by Installing Protective Barriers and Implementing Best Management Practices

During final project design, FRWA would attempt to further avoid vernal pool and other wetland plant communities to the extent feasible (e.g., tunneling). Where the avoidance is infeasible, FRWA would minimize the size of construction work areas in and around wetland plant communities and ensure that construction is contained within designated work areas.

To expedite site restoration after construction, FRWA would require construction contractors to separate and stockpile native topsoil and plant material at waterway crossings, immediately replace soil and plant materials after construction is complete and restore trenched areas to original site contours. Topsoil from vernal pools and swales, including inoculum (seed-bearing material), would be retained for use in off-site habitat creation, as described in Mitigation Measure 7-11.

Mitigation Measure 7-10: Obtain and Comply with State and Federal Wetland Permits

FRWA would obtain and comply with state and federal permit requirements pertaining to impacts on waters of the United States. FRWA would coordinate with the USACE to obtain a permit under Section 404 of the Clean Water Act. FRWA would also coordinate with DFG to obtain Section 1600 streambed alteration agreements. Permit conditions would be included in the construction specifications, where applicable.

Mitigation Measure 7-11: Compensate for Unavoidable Impacts on Jurisdictional Waters of the United States

FRWA would likely be required by the Corps to implement a wetland mitigation and monitoring plan as a condition of permit issuance. A restoration specialist would be retained to prepare and implement a wetland mitigation and monitoring plan to compensate for unavoidable impacts to waters of the United States. The wetland mitigation plan would specify the form and size of mitigation sites appropriate for the region and each site and employ the most successful techniques available at the time of planting. Wetland mitigation would occur on- or off-site. A monitoring plan would be implemented to ensure the success of the restoration effort over a period of 5 years.

FRWA would coordinate with USFWS and DFG to implement the creation of compensatory vernal pool habitat either on- or off-site at a replacement ratio of 2:1, or at a similar ratio determined by regulatory agencies. Pools would be constructed on a site that historically supported vernal pools, has a clay hardpan soil similar to soils in the project area, and is adequately buffered from adjacent developed areas. Pools would be constructed to mimic the side slopes and pool bottoms of project-affected pools in order to duplicate the hydrologic depth, surface area, and inundation period. Inoculum collected from the project site would not be stored for more than a period of 1 year to avoid adverse affects to the establishment of vegetation. A monitoring program would be developed to verify the establishment of biological variability in the constructed pools. Species cover and diversity would be compared with that of natural vernal pools from the immediate area, and a series of annual success standards would be developed to ensure the success of the restoration effort. Vegetation, hydrology, wildlife, and water quality would be monitored on a consistent basis for a period of 10 years.

Alternatively, FRWA could coordinate with USFWS and DFG to acquire and maintain land containing natural vernal pools. FRWA could develop a long-term maintenance and monitoring program to ensure the continued viability of the project pools. Extant vernal pools would be managed according to the latest technical and biological guidelines in order to sustain the native flora. Grazing can be managed to mimic the historic grazing and disturbance regime under which the current vernal pool systems have evolved. Preserved land would be large in extent and adequately buffered from surrounding development, and would be acquired at a ratio of 4:1 acres or a similar ratio determined by regulatory agencies.

Impact 7-8: Potential Loss of Special-Status Plant Populations

Floristically based surveys of the FSCC pipeline segments V, Option 3, and X conducted in 1996–98 (Garcia and Associates 1998) found no occurrences of special-status plants. Focused surveys have not been performed for Segment W or for any alignment from the intake facility to the Zone 40 Surface WTP/FSC. Because of the presence of high-quality suitable habitat for special-status plants in these areas, construction of pipeline alignments has the potential to eliminate plants and their occupied or unoccupied habitat. These impacts would be considered significant. Implementation of the mitigation measures listed below would reduce or eliminate impacts on special-status plant populations potentially occurring along the alignments to less-than-significant levels.

Mitigation Measure 7-12: Conduct Preconstruction Surveys in Areas Not Previously Inventoried

Before initiating construction of the selected alignment, FRWA would retain a qualified botanist to conduct floristic surveys within areas not previously inventoried.

Mitigation Measure 7-13: Avoid Known Special-Status Plant Populations during Project Design

To the extent possible, FRWA would design the project to avoid special-status plant populations. Where avoidance is infeasible, FRWA would focus on minimizing the width of construction work areas in and around special-status plant populations. Before construction, special-status plant populations would be demarcated with temporary orange construction fencing and posted as a restricted area. Depending on the proximity of the populations to the construction work area, populations would be monitored to ensure inadvertent impacts on special-status plant populations are avoided. If impacts on special-status plant populations are unavoidable, FRWA would implement Mitigation Measure 7-14 described below.

Mitigation Measure 7-14: Compensate for Impacts on Special-Status Plant Populations

If impacts on a special-status plant population are unavoidable, FRWA would coordinate with USFWS and DFG to determine the appropriate mitigation strategy. If affected plants are listed under the federal ESA, the appropriate take permits would be obtained from USFWS. Currently accepted mitigation of impacts on special-status plants includes acquisition and preservation of nearby occupied habitat, or habitat creation at a ratio determined by the regulatory agency. Transplantation of affected populations is not considered a viable mitigation option. Creation of habitats with high levels of endemism, such as vernal pools, is effective only with stringent management guidelines such as those described in Mitigation Measure 7-11. FRWA would coordinate with USFWS to develop an effective mitigation and monitoring plan for specific vernal pool plants in conjunction with the construction of compensatory vernal pool habitat. Alternatively, FRWA could acquire and preserve nearby high-quality occupied habitat. Stewardship of the preserved populations would follow guidelines described in Mitigation Measure 7-11, with FRWA responsible for the long-term management of the preserve.

Alternative 6

In addition to the impacts previously identified for Alternatives 2–5, the following impacts could occur under Alternative 6.

Impact 7-9: Permanent Loss of Riparian Woodland and Riparian Scrub Communities within the Inundation Zone

Riparian woodland and scrub are sensitive plant communities protected by local, state, and federal policies and laws. There are 35 acres of riparian vegetation located within the inundation zone that would be permanently removed. Riparian woodland and scrub provide valuable and regionally limited habitat for wildlife and serve important ecosystem functions. This impact is significant. Because of the nature of the disturbance and the lack of appropriate low-gradient areas immediately adjacent to the inundation zone, these impacts cannot be mitigated on site. Implementation of Mitigation Measure 7-15 would reduce impacts on riparian habitat in the inundation zone to a less-than-significant level.

Mitigation Measure 7-15: Compensate for Unavoidable Riparian Habitat Losses

Preservation of intact riparian woodland and scrub through creation of a protected reserve on the Mokelumne River would mitigate for the unavoidable loss of these communities resulting from inundation. Alternatively, degraded riparian habitat in the vicinity of the project area could be restored to ensure long-term replacement of habitat functions and values. Compensation for riparian community losses would encompass the goal of “no net loss” of riparian habitat acres.

FRWA would coordinate with USFWS and DFG to acquire and maintain land containing intact riparian habitat. FRWA would develop a long-term maintenance and monitoring program to ensure the continued viability of the protected habitat. Extant riparian woodland would be managed according to the latest technical and biological guidelines in order to sustain the native flora. Preserved land would be large in extent and adequately buffered from surrounding development, and would be acquired at a ratio of 4:1 acres or a similar ratio determined by regulatory agencies.

Alternatively, a revegetation plan could be prepared by a qualified restoration ecologist and reviewed by the appropriate agencies. The revegetation site would be chosen to ensure the long-term viability of the restored habitat; qualified specialists will be retained to ensure that site hydrology and geomorphology are appropriate to support high-quality riparian habitat. Restoration of degraded riparian habitat is described in detail in Mitigation Measure 7-8 under the discussion of Alternatives 2–5, above.

Impact 7-10: Potential Impacts on Jurisdictional Waters of the United States, including Wetlands and Riparian Woodland, within the Water Fluctuation Zone

Less than 1/10 of an acre of freshwater marsh occurs in the water fluctuation zone of 601 to 614 feet elevation. However, this zone encompasses 8 acres of high-quality riparian woodland. Studies on the upper American River (Fugro 1991) have shown that riparian vegetation can tolerate as much as 30 days of inundation in the dormant season of December through February. During the growing season of March through November, riparian species are less tolerant to inundation, but no specific data are available. For the purposes of this analysis, it is assumed that tree species such as Freemont’s cottonwood, valley oak, and California walnut would be adversely affected by inundation periods of 2 weeks or more during the growing season. Because the mortality of these species would substantially change the character, quality, and habitat value of riparian woodland in the project area, this impact is considered significant. Implementation of Mitigation Measure 7-16, and, if necessary, Mitigation Measure 7-15 would reduce impacts on riparian habitat in the water fluctuation zone to a less-than-significant level.

Mitigation Measure 7-16: Monitor and Adaptively Manage Vegetation Impacted by Inundation

FRWA would implement a monitoring and adaptive management program that would monitor vegetation within the expanded inundation zone over the life of the project. This would include establishing baseline conditions around the reservoir that would be updated at a predetermined interval. After major flood events that encroach on the inundation area above 601 feet, vegetation would be surveyed and damages attributable to inundation would be determined. Appropriate mitigation, as described in Mitigation Measure 7-15, would be implemented to compensate for losses.

Impact 7-11: Temporary Disturbance to or Potential Loss of Sensitive Vegetation and Wetland Resources Near Active Construction Areas

Sensitive plant communities protected by local, state, and federal policies and laws, and located outside identified construction areas could be disturbed during construction of the enlarged dam and other facilities. Impact mechanisms could include habitat alteration or direct mortality of dependent species due to construction vehicle traffic and staging, sidecast and spoil piles, and excessive dust. These communities include riparian woodland, riparian scrub, and perennial wetland. This impact is significant. Implementation of the Mitigation Measures 7-1 through 7-3 described above would reduce this impact to a less-than-significant level.

Impact 7-12: Permanent Loss of Jurisdictional Waters of the United States, Including Wetlands, as a Result of Inundation

Raising Pardee Dam would result in the loss of 11 acres of freshwater marsh. It is unlikely that this wetland community would naturally regenerate above the new high-water line because of the lack of flat or low-gradient sites above 601 feet. Freshwater marsh performs important natural functions; provides important habitat to dependent plant and wildlife species; is regionally and locally uncommon; and is regulated by local, state, and federal laws and policies. This impact is significant. Implementation of Mitigation Measures 7-9, 7-10, and 7-11 described above would reduce impacts on wetlands and other waters of the United States to a less-than-significant level.

Impact 7-13: Permanent Loss of Oak Woodland Communities within the Inundation and Flood Zone

Inundation to 601 feet in elevation would remove 452 acres of oak woodland, predominantly open blue oak woodland. Blue oak woodland provides important habitat for dependent plant and wildlife species and is provided protection under Senate Concurrent Resolution 17. Furthermore, removal of this habitat conflicts with Goal V-3 of the Calaveras County General Plan to “protect and preserve significant wildlife habitats” and would be considered a “a substantial adverse change in physical conditions” (State CEQA Guidelines Section 15382). There is currently no evidence for successful reestablishment of lost habitat functions and values associated with intact oak woodland. This impact is significant. Impacts on oak woodland in the inundation zone would be mitigated through implementation of Mitigation Measures 7-17 and 7-18.

Mitigation Measure 7-17: Replacement of Individual Trees

Individual trees could be replaced at ratio of three trees planted for every tree removed (or other similar ratio determined by regulatory agencies). Restoration efforts would be geared to achieve a 50% canopy density relative to pre-inundation reference sites within 6 years. Plantings would occur in a location, either on-site or off-site, that is preserved in perpetuity through a conservation easement or donation to a land trust. The restoration site would be a large contiguous area that it adequately buffered from surrounding development. Restored sites would be maintained and monitored under the supervision of a qualified restoration biologist for a minimum of 10 years following revegetation.

Mitigation Measure 7-18: Permanent Preservation of Intact Blue Oak Woodland

FRWA would provide the financial resources to preserve and protect intact blue oak woodland in the Mokelumne River watershed. Woodland would be preserved in perpetuity in a ratio of three acres preserved for every 1 acre removed. Priority will be given to those sites that are large, contiguous woodland providing high-quality habitat to dependent plant and animal species and that are endangered by future development or degradation because of surrounding land uses. Land acquisition should include funding for oak restoration on site as well as for long-term stewardship to ensure continued habitat quality. FRWA would be responsible for the long-term stewardship of the preserve.

Impact 7-14: Loss of or Disturbance to Oak Woodland Communities within the Water Fluctuation Zone

Inundation for periods greater than 1 week during the growing season is likely to have substantial adverse effects, including direct mortality, on 167 acres of oak woodland between 601 feet and 614 feet in elevation.[1] This impact is significant. Impacts on oak woodland in the water fluctuation zone would be mitigated through implementation of Mitigation Measures 7-16, 7-17, and 7-18 listed above.

Impact 7-15: Permanent Loss of Special-Status Plants and Habitats within the Inundation and Flood Zone

Inundation would eliminate one population (consisting of approximately 100 individuals) of Mariposa cryptantha, a CNPS List 1B species. Because this population occurs at the northern limits of the known range of the species, its loss could adversely affect the overall viability of the species, and is therefore a significant impact. In addition, 39 populations of Ewan's larkspur (federal

[1] Tolerance to periodic inundation varies greatly between species and is affected by initial tree vigor, age, and stature as well as length, frequency, and height of flood events (Kozlowski et al. 1991). Specific data on the inundation-tolerance of blue oak are not available. However, most upland oak species for which data are available are either somewhat tolerant (unable to survive flooding or saturated soils for more than 30 consecutive days during the growing season) or intolerant (unable to survive more than a few days of flooding during the growing season without significant mortality) of inundation (Whitlow and Harris 1979).

species of concern), and three populations of Bisbee Peak rush-rose (federal species of local concern), would be eliminated by inundation. These impacts are significant.

Twenty acres of serpentine chaparral would be permanently inundated and an additional 10 acres would be inundated for at least 1 week during the growing season in wet years. Serpentine chaparral is recognized and tracked by DFG as a sensitive plant community due to extremely high levels of plant endemism associated with the community (including numerous special-status plants), the relative scarcity of serpentine substrates in the state, and current threats to this community due to development pressure. Inundation for more than a few days during the growing season is likely to displace native species of the serpentine chaparral community, including Mariposa cryptantha. This impact is significant. Impacts on rare plants and the sensitive plant community serpentine chaparral would be mitigated through implementation of Mitigation Measure 7-19.

Mitigation Measure 7-19: Compensate for Impacts on Sensitive Vegetative Communities and Associated Special-Status Plants

Development of an appropriate mitigation strategy for loss of populations of Mariposa cryptantha, Ewan's larkspur, and Bisbee Peak rush-rose would be coordinated with DFG. Currently accepted mitigation of impacts on special-status plants includes acquisition and preservation of nearby occupied habitat, or habitat creation, at a ratio determined by the regulatory agency. Transplantation of affected populations is not considered a viable mitigation option. Creation of habitats with high levels of endemism, such as serpentine chaparral, is effective only with stringent management guidelines.

Nearby high-quality occupied serpentine chaparral habitat would be preserved. Stewardship of the preserved populations would follow guidelines described in Mitigation Measure 7-11 above.

Impact 7-16: Introduction and Spread of Noxious Weeds

Project equipment and vehicles could cause the introduction and/or spread of noxious weeds into natural vegetation communities, including riparian woodland and scrub, which could impact the structure and function of these communities. Implementation of Mitigation Measure 7-4 described above would reduce this impact to less than significant.

Chapter 8
Wildlife

Chapter 8
Wildlife

Study Methods

Wildlife species and habitats in the project area initially were evaluated by reviewing existing information on biotic resources in the study area and vicinity, including the 1997 DEIR/EIS (East Bay Municipal Utility District 1997), 2000 REIR/SEIS (East Bay Municipal Utility District 2000), South Sacramento County Streams Investigation (U.S. Army Corps of Engineers 1998), previous biological assessments (BioSystems Analysis 1993, 1994), environmental studies (EDAW and Garcia and Associates 1995; Entrix 1998), a wintering bald eagle population study (Ibis and Entrix 1997), and other relevant sources. A list of special-status animals with potential to occur in the project area was compiled using occurrence records from the CNDDB (California Department of Fish and Game 2002) for the following USGS 7.5 minute Quadrangle Maps: Sacramento West, Sacramento East, Carmichael, Buffalo Creek, Clarksburg, Florin, Elk Grove, Sloughhouse, Clay, Goose Creek, Ione, Lockeford, Clements, Wallace, Jackson, Mokelumne Hill, Valley Springs, San Andreas. USFWS species lists for Calaveras, Amador, San Joaquin, and Sacramento Counties (U.S. Fish and Wildlife Service 2002), published and unpublished data, and results of reconnaissance-level field surveys were reviewed.

Reconnaissance surveys of the intake facility to Mokelumne Aqueducts portions of the study area were conducted by GANDA on January 31, February 1, and October 18, 2002. An earlier biological survey of the project area from the intake facility to the Zone 40 Surface WTP/FSC was performed by Jones & Stokes on July 5, 2001 (Jones & Stokes 2001). The reconnaissance surveys consisted of visual observations from public roads and other publicly accessible areas. For each proposed pipeline segment, a 200-foot-wide corridor was evaluated for wildlife habitats and the potential for occurrence of special-status species. For those portions of the study area that could not be accessed or observed directly from public roads, information on wildlife habitats was obtained through analysis of existing information and aerial photographs, and by comparison with equivalent adjacent areas that were directly observed.

GANDA wildlife biologists conducted a reconnaissance-level survey of the enlarge Pardee Reservoir project area on November 20 and 25, 2002, to confirm current conditions and assess habitat potential for special-status species identified in the literature and database review. The survey was conducted by boat traveling along the reservoir shoreline and from public roads and other publicly accessible locations. Wildlife habitats and the potential for occurrence of special-status species were evaluated within the proposed permanent inundation zone (up to 601 feet elevation), and the maximum flood zone (up to 614 feet elevation).

Affected Environment

Freeport Intake Facility to Mokelumne Aqueducts

The project area from the intake facility to the Mokelumne Aqueducts supports a diversity of wildlife habitats characteristic of California's Central Valley. Wildlife habitats in this project area generally correspond to the plant communities described in Chapter 7, "Vegetation and Wetland Resources." These habitats include urban landscape, agriculture, annual grassland, blue oak woodland, mixed riparian habitat, vernal pools and swales, seasonal wetland, and perennial wetland. Most of these communities provide important wildlife habitat benefits, and several provide vital habitat for special-status wildlife species.

Vernal pools are unique and sensitive ecosystems that support a diverse assemblage of rare and endemic wildlife species. Once widespread in the Central Valley, they have been greatly reduced by agricultural conversion and urban development. Similarly, the once extensive riparian and wetland communities of the Central Valley have been substantially diminished, and the remaining natural riparian and wetland areas provide important habitats and refuges for a large diversity of wildlife species.

Characteristic wildlife species for each major habitat type are described below, followed by a discussion of special-status wildlife species that could occur in the project area from the intake facility to the Mokelumne Aqueducts.

Enlarge Pardee Reservoir

The enlarge-Pardee-Reservoir project area supports wildlife habitats characteristic of both the Sierra Nevada foothills and the adjacent Central Valley. Wildlife habitats in this project area correspond generally to the plant communities described in Chapter 7, "Vegetation and Wetland Resources." These habitats include developed areas, grassland (including nonnative annual and creeping wildrye grassland), chaparral, Sierran black sage scrub, mixed riparian (including riparian scrub and riparian woodland), oak woodland, perennial wetland, and open water.

Habitat Types

Freeport Intake Facility to Mokelumne Aqueducts

Urban Landscape

Urban environments are generally low-quality wildlife habitat and support predominantly common and opportunistic species. Common vertebrate species found in this habitat include mostly birds that use landscaped vegetation and human structures for nesting. Typical species include house sparrow, house finch, western scrub jay, northern mockingbird, and European starling. Common mammals of this habitat type include striped skunk, opossum and raccoon.

Agriculture

Agricultural lands that can provide wildlife habitat include croplands, orchards and vineyards. In general, the annual regime of planting, harvesting crops, and soil disking reduces the suitability of these habitats for resident wildlife. However, depending on the crop pattern and the proximity to native habitats, agricultural lands can provide high-value foraging habitat for many animal species. Insect and rodent populations on agricultural lands provide a prey base for raptors such as American kestrel, red-tailed hawk, red-shouldered hawk, barn owl, and great horned owl. Agricultural habitats also provide foraging and resting sites for migrating and wintering waterfowl and shorebirds.

Annual Grassland

Annual grassland provides relatively high habitat value for wildlife. Grasslands support a somewhat lower diversity of species compared with other natural communities in the project area, but they provide important foraging habitat for raptors and other bird species. Birds commonly found in annual grasslands in the project area include red-tailed hawk, American kestrel, western meadowlark, yellow-billed magpie, and Brewer's blackbird. Typical mammals include California ground squirrel and Botta's pocket gopher. Grassland also forms the matrix that surrounds sensitive habitats such as vernal pools. Grassland areas therefore can provide important corridors for dispersal or connectivity for wildlife populations localized in these sensitive habitats.

Eucalyptus Stand

Eucalyptus stands provide roosting and nesting sites for a number of bird species, particularly raptors such as red-tailed hawk and red-shouldered hawk. The sparsely vegetated understory of these stands provides limited wildlife habitat value but can be used by some rodents and reptiles.

Blue Oak Woodland

Open oak woodlands and oak savannas provide high-quality nesting habitat for a variety of birds and small mammals. These communities also provide productive foraging habitat, shade, and refuge sites for wildlife. Acorns are an important food source for mammals and birds such as mule deer, western gray squirrel, and acorn woodpecker. Other bird species commonly associated with this habitat type include northern flicker, western scrub jay, white-breasted nuthatch, and oak titmouse. The understory of open oak woodland supports species characteristic of annual grassland habitat.

Mixed Riparian Habitat

Riparian plant communities provide high-quality habitat and a diversity of habitat niches for wildlife species. These communities offer abundant nesting sites, shelter, and foraging resources as well as a favorable microclimate for many animals. The remaining natural riparian communities in the project area are reservoirs of species diversity and abundance and provide important movement corridors as well as refuges from the hot, dry surrounding environment. Riparian areas also may include, or be closely associated with, other sensitive habitats such as freshwater marsh. Characteristic species of riparian habitats include amphibians such as Pacific tree frog, reptiles such as western terrestrial garter snake, and a great variety of birds including California quail, hawks, woodpeckers, flycatchers, warblers, spotted towhee, and song sparrow.

Vernal Pools and Swales

Vernal pools and swales in the project area support a unique and diverse assemblage of plant and animal species adapted to the seasonal regime of inundation and desiccation. When filled or saturated, these habitats support an abundance of aquatic invertebrates and provide breeding habitat for amphibians such as Pacific tree frog and western toad. These habitats also support a number of rare and endemic wildlife species. In winter and spring, these pools and swales also provide foraging habitat for migratory and resident birds such as killdeer, snowy egret, and greater yellowlegs.

Seasonal Wetland

Seasonal wetlands are similar to vernal pools in terms of wildlife habitat. Which species use these habitats depends in part on the duration of inundation during the wet season. Seasonal ponds or marshes that are inundated for only a few weeks can provide breeding sites for invertebrates and Pacific tree frog, while other amphibians may require several months of ponding for successful breeding. During the dry season, these areas provide wildlife habitat similar to the surrounding annual grassland.

Perennial Wetland

Perennial wetlands provide very high habitat value for wildlife. These areas generally have very high biological productivity and provide valuable foraging habitat for waterfowl and other wildlife. Tules and cattails provide cover and breeding sites for amphibians such as Pacific tree frog, reptiles such as garter snakes, and birds such as red-winged blackbird. Several species that require open water or moist conditions are found in these habitats. Characteristic bird species of these habitats include pied-billed grebe, American coot, mallard, ruddy duck, marsh wren and song sparrow.

Enlarge Pardee Reservoir

Several of the wildlife habitat types present in the enlarge Pardee Reservoir project area are equivalent to those described for the project area from the intake facility to the Mokelumne Aqueducts. These equivalent habitat types—which include grassland, mixed riparian, and perennial wetland—are expected to support an assemblage of wildlife species similar to those described for the project area from the intake facility to the Mokelumne Aqueducts. Wildlife habitats in the enlarge Pardee Reservoir project area that *differ* from those described for the project area from the intake facility to the Mokelumne Aqueducts and that would be affected by the project are discussed below.

Developed

Developed areas around Pardee Reservoir, which include dams, spillway structures, paved roads, and recreational facilities, provide low to moderate habitat value for wildlife. These areas generally experience less intensive human use than urban environments in the project area from the intake facility to the Mokelumne Aqueducts, and interface to a greater extent with adjacent natural habitats. Developed areas around Pardee Reservoir can provide foraging habitat for opportunistic species such as Brewer’s blackbird and scrub jay, and can also provide movement corridors and temporary habitats for other species occupying adjacent natural habitats. In addition, some of the existing dam and spillway structures can provide roosting sites for bats and nesting sites for birds. For example, cliff swallows’ nests have been observed under the concrete arches of the South Spillway buttress (BioSystems Analysis 1994).

Chaparral

Chaparral is a diverse habitat type that provides moderately high value for wildlife. The varied composition of chaparral vegetation provides foraging and nesting habitat for a variety of birds and small mammals. Typical chaparral birds of the Sierra foothills include wrentit, Bewick's wren, and spotted towhee. Common mammals of these habitats include rodents, such as California ground squirrel, Merriam's chipmunk, California mouse, and brush mouse.

Sierran Black Sage Scrub

From a wildlife standpoint, this community type is similar to chaparral in its habitat characteristics and species composition. Sage scrub communities provide habitat for a variety of birds and small mammals and are also important as winter habitat for migrating mule deer.

Oak Woodland

The oak woodland habitats around Pardee Reservoir provide valuable foraging and nesting habitat for a variety of birds, including acorn woodpecker, white-breasted nuthatch, oak titmouse, scrub jay, and Steller's jay. Mammals commonly found in these habitats include mule deer, western gray squirrel, and deer mouse. The abundant seed crop produced by blue oaks provides an important food source for rodents and birds. In more dense woodland areas, the shade and leaf litter on the woodland floor provides favorable habitat for amphibians, such as ensatina (*Ensatina eschscholtzii*).

Open Water

The surface and shoreline of Pardee Reservoir support a diversity of waterfowl and waterbirds that use the reservoir as wintering or nesting habitat. Common species include mallard, American coot, eared grebe, western grebe, and a variety of gulls. The reservoir may also serve as a migratory stopover for waterfowl and other birds.

Special-Status Species

Special-status wildlife species include those species that are:

- listed, proposed, or candidates for listing as threatened or endangered under the federal ESA;
- listed or candidates for listing as threatened or endangered under CESA;

- considered *species of concern* by the USFWS;
- designated as *special concern* or *fully protected* species by DFG;
- protected by other applicable federal, state, or local ordinances; or
- considered sufficiently rare by the scientific community to qualify for consideration under CEQA.

Freeport Intake Facility to Mokelumne Aqueducts

A target list of special-status wildlife with potential to occur in the project area from the intake facility to the Mokelumne Aqueducts was compiled based on the habitat types identified in the study area and from known occurrences of special-status animals documented in the CNDDB (California Department of Fish and Game 2002), U.S. Fish and Wildlife species lists, and other sources. Table 8-1 describes the special-status wildlife species that could occur between the intake facility and Mokelumne Aqueducts. Table 8-2 provides a breakdown of special-status wildlife species that could be affected at pipeline segments and facilities. Special-status species that have been documented in the project area from the intake facility to Mokelumne Aqueducts (CNDDB occurrences shown in Figures 8-1 and 8-2) and with high potential to occur along the pipeline alignments from the intake facility to Mokelumne Aqueducts are discussed in more detail below.

Vernal Pool Fairy Shrimp, Vernal Pool Tadpole Shrimp, Midvalley Fairy Shrimp, and California Linderiella

These species inhabit vernal pools and other temporary ponds, primarily in grassland communities of the Central Valley. There is considerable overlap in the distribution and habitat preferences of these four species in the project area. There are several CNDDB records of vernal pool fairy shrimp in the project area from the FSC to the Mokelumne Aqueducts (FSCC pipeline alignments) and the eastern portion of the project area from the intake facility to Zone 40 Surface WTP/FSC, near Florin and Gerber Roads. Vernal pool tadpole shrimp has also been documented in several locations in the project area near Florin Road. Midvalley fairy shrimp, a recently described species (Eriksen and Belk 1999), has been documented south of the intake facility to Zone 40 Surface WTP/FSC pipeline. California linderiella has been identified in the vicinity of the project area from the intake facility to Mokelumne Aqueducts.

These vernal pool crustaceans are most likely to occur in vernal pools and other seasonal wetlands in the eastern portions of the intake facility to Zone 40 Surface WTP/FSC pipeline, as well as the FSCC pipeline. Temporary ponds in agricultural and urban habitats may also support remnant populations of these species. California linderiella is the species most likely to occur in disturbed or degraded ephemeral pool habitats, but vernal pool tadpole shrimp were recently found in a ponded area adjacent to the Southern Pacific Railroad tracks in Elk Grove.

Sacramento Valley Tiger Beetle and Sacramento Anthicid Beetle

These beetles occur on sandy substrates in riparian and riverine habitats, typically among willows, reeds, and other streambank vegetation. There are no records of these species in the project area, but potential habitat for these beetles exists at natural stream crossings along the FSCC pipeline alignments and in the eastern portion of the project area from the intake facility to the Zone 40 Surface WTP/FSC.

Valley Elderberry Longhorn Beetle

This species lives on elderberry plants, primarily in riparian communities, but may also occur in upland habitats such as oak savanna. There are records of the species along the Cosumnes River east of the intake facility to Zone 40 Surface WTP/FSC pipeline and adjacent to the Mokelumne River in the vicinity of the FSCC pipeline. This species has potential to occur where elderberries are present in riparian habitats throughout the project area.

California Tiger Salamander

This salamander breeds in seasonal or permanent ponds in grassland and oak savanna communities. It spends the warm, dry months in rodent burrows and other underground refuges in upland habitats within 1 kilometer (0.6 mile) of breeding ponds. There are records of California tiger salamander in the vicinity of FSCC pipeline segments W, X, and Option 3. Potential habitat for the species is also present in the eastern portion of the project area from the intake facility to the Zone 40 Surface WTP/FSC.

Western Spadefoot

This species of toad inhabits grasslands and oak woodlands throughout the Central Valley and adjacent foothills. It breeds in shallow, temporary pools and spends most of the year in underground burrows. There is one record of western spadefoot approximately 1 mile east of the FSC at the eastern end of the intake facility to Zone 40 Surface WTP/FSC pipeline, and additional records of occurrence near the eastern portion of the FSCC pipeline.

Table 8-1. Special-Status Wildlife Species That Could Potentially Occur between the Freeport Intake Facility and Mokelumne Aqueducts

Species	Status (Fed./State)[1]	Habitat	Potential Occurrence in Project Area
Invertebrates			
Vernal pool fairy shrimp *Branchinecta lynchi*	T/--	Vernal pools and ephemeral pools in sandstone rock outcrops	Several known occurrences in project vicinity; high potential to occur in vernal pools throughout the project area
Midvalley fairy shrimp *Branchinecta mesovalliensis*	SC/--	Vernal pools and other ephemeral ponds	Documented in project vicinity; high potential to occur in vernal pools and ephemeral ponds in the project area
Vernal pool tadpole shrimp *Lepidurus packardi*	E/--	Vernal pools and ephemeral ponds	Several known occurrences in project vicinity; high potential to occur in vernal pools in the project area
California linderiella *Linderiella occidentalis*	SC/--	Vernal pools and ephemeral ponds	Several known occurrences in project vicinity; high potential to occur in vernal pools in the project area
Sacramento anthicid beetle *Anthicus sacramento*	SC/--	Sandy areas in riparian and similar habitats among willows and reeds	No focused surveys conducted, but potential habitat exists at stream crossings along the FSCC pipeline and eastern portions of the intake facility to Zone 40 Surface WTP/FSC pipeline
Sacramento Valley tiger beetle *Cicindela hirticollis abrupta*	SC/--	Sandy areas among willows in riparian and riverine habitats	No focused surveys conducted, but potential habitat exists at stream crossings along the FSCC pipeline and eastern portions of the intake facility to Zone 40 Surface WTP/FSC pipeline
Valley elderberry longhorn beetle *Desmocerus californicus dimorphus*	T/--	Restricted to elderberry shrubs in riparian and oak savanna communities	Documented in vicinity of FSCC pipeline; potential to occur in riparian zones throughout the project area where elderberry plants are present
Amphibians			
California tiger salamander *Ambystoma californiense*	C/SC	Breeds in seasonal ponds in grassland and oak woodland; uses underground burrows in upland habitats for summer dormancy	Documented in the vicinity of FSCC pipeline; potential habitat exists in the eastern portions of the project area from the intake facility to Zone 40 Surface WTP/FSC
Western spadefoot *Spea hammondii*	SC/SC	Breeds in vernal pools and other temporary ponds in grassland habitats; burrows underground for most of the year	Documented in vicinity of FSCC pipeline and east of the intake facility to Zone 40 Surface WTP/FSC pipeline; potential for occurrence is moderate in the eastern project area from the intake facility to the Zone 40 Surface WTP/FSC

Species	Status (Fed./State)[1]	Habitat	Potential Occurrence in Project Area
Reptiles			
Western pond turtle *Clemmys marmorata*	SC/SC	Ponds, marshes, streams and irrigation canals with aquatic vegetation in woodland and grassland communities	Documented in project vicinity; suitable habitat exists in perennial stream crossings, freshwater marshes and perennial ditches in the project area
Giant garter snake *Thamnophis gigas*	T/T	Freshwater marshes, sloughs, and canals with emergent vegetation; requires high ground above water for winter dormancy	Documented in the Laguna Creek drainage; potential habitat exists in perennial marshes, canals and drainages in the project area
Birds			
Cooper's hawk *Accipiter cooperii*	--/SC	Riparian deciduous and oak woodland habitats	Documented in project vicinity; limited suitable woodland habitat present in the project area.
Swainson's hawk *Buteo swainsonii*	SC/T	Nests in deciduous trees in riparian areas, forages in grasslands and agricultural fields	Nesting sites documented along the Sacramento River and other locations in the project vicinity; suitable nesting habitat exists at several creek crossings in the project area
Northern harrier *Circus cyaneus*	--/SC	Grasslands, marshes, and seasonal wetlands with tall vegetation cover	Observed in project vicinity; potential habitat exists in marshes and seasonal wetlands in the project area
White-tailed kite *Elanus leucurus*	SC/FP	Valley grasslands, oak savanna, riparian areas or marshes near open grassland	Documented and observed in project vicinity; potential habitat exists in marshes and grasslands in the project area
Western burrowing owl *Athene cunicularia hypugaea*	SC/SC	Inhabits rodent burrows in open grasslands, deserts and agricultural fields	Documented sightings in western portion of the project area from the intake facility to the Zone 40 Surface WTP/FSC; suitable habitat exists in many parts of the project area
Bank swallow *Riparia riparia*	SC/T	Nests in colonies in cavities in vertical river banks, bluffs or cliffs with sandy substrate	Suitable nesting habitat not observed and no records in the project area, but could occur along larger streams in the vicinity of the FSCC pipeline
Tricolored blackbird *Agelaius tricolor*	SC/SC	Nests in dense colonies in marshes or moist upland sites with dense vegetation; forages in marshes, pastures and fields	Documented in project vicinity and observed in marsh near SRWWTP; limited suitable habitat in the project area

Species	Status (Fed./State)[1]	Habitat	Potential Occurrence in Project Area
Greater sandhill crane *Grus canadensis tabida*	--/T	Summers in open terrain near shallow lakes or freshwater marshes. Winters in plains and valleys near bodies of fresh water.	Outside of the species known breeding range. Suitable winter foraging areas present in study area.
Mammals			
California mastiff bat *Eumops perotis californicus*	SC/SC	Roosts in deep rock crevices or in crevices in trees, buildings or tunnels	No records, probably not within the species' known range
Yuma myotis *Myotis yumanensis*	SC/--	Roosts in natural and human-made sites including caves, trees, mines, buildings and bridges	No records, but could occur in riparian woodlands in the project area.
San Joaquin pocket mouse *Perognathus inornatus*	SC/--	Grasslands and oak savannas with friable soils	No records, but could occur in hilly grasslands at the eastern end of the project area.

[1] Wildlife status definitions and governing agencies are as follows:

Federal (U.S. Fish and Wildlife Service)

- E = listed as Endangered under the Federal Endangered Species Act
- T = listed as Threatened under the Federal Endangered Species Act
- C = candidate for listing as Threatened or Endangered
- SC = U.S. Fish and Wildlife Service "species of concern"

State (California Department of Fish and Game)

- E = listed as Endangered under the California Endangered Species Act
- T = listed as Threatened under the California Endangered Species Act
- SC = California Department of Fish and Game Special Concern species
- FP = California Department of Fish and Game Fully Protected species

[2] Status designations based on California Department of Fish and Game *Special Animals* list, July 2002.

Table 8-2. Special-status wildlife species that could potentially be affected by segment of the proposed Freeport Intake to Mokelumne Aqueducts

Segments and Facilities	Fairy Shrimp and Tadpole Shrimp*	Sacramento Valley Beetles**	Valley Elderberry Longhorn Beetle	California Tiger Salamander	Western Spadefoot	Giant Garter Snake and W. Pond Turtle	Swainson's Hawk	Burrowing Owl	Tricolored Blackbird
Freeport Intake Facility								X	
Freeport Intake Facility to Zone 40 SurfaceWTP/FSC Pipeline									
Segment A							X	X	
Segment B							X	X	
Segment C								X	
Segment D								X	
Segment E								X	
Segment F								X	
Segment G								X	
Segment H	X		X	X	X	X		X	
Segment I	X			X	X			X	
Segment J	X			X	X		X	X	
Segment K	X	X	X	X	X	X	X	X	X
Segment L	X			X	X			X	
Segment M	X	X	X		X	X		X	X
Segment N	X	X		X		X		X	X
Segment O				X	X		X	X	
Segment P							X	X	
Segment Q							X	X	
Segment R	X				X		X	X	
Segment S					X			X	

Segments and Facilities	Fairy Shrimp and Tadpole Shrimp*	Sacramento Valley Beetles**	Valley Elderberry Longhorn Beetle	California Tiger Salamander	Western Spadefoot	Giant Garter Snake and W. Pond Turtle	Swainson's Hawk	Burrowing Owl	Tricolored Blackbird
Segment T					X			X	
Segment U					X			X	
Segment Option 1						X	X	X	
Segment Option 2								X	
Zone 40 Surface WTP	X	X	X	X	X	X	X	X	X
Terminal Facility and Settling Basins	X	X	X	X	X	X	X	X	X
Canal Pumping Plant							X	X	
FSC to Mokelumne Aqueducts Pipeline (FSCC Pipeline)									
Segment V	X	X	X	X	X	X	X	X	
Segment W	X	X	X	X	X	X	X	X	
Segment X	X	X	X	X	X	X	X	X	
Segment Option 3	X	X	X	X	X	X	X	X	
Aqueduct Pumping Plant and Pretreatment Facility (Camanche site and optional Brandt site)	X			X	X		X	X	

* includes vernal pool fairy shrimp, vernal pool tadpole shrimp, midvalley fairy shrimp, and California linderiella

** includes Sacramento anthicid beetle and Sacramento Valley tiger beetle

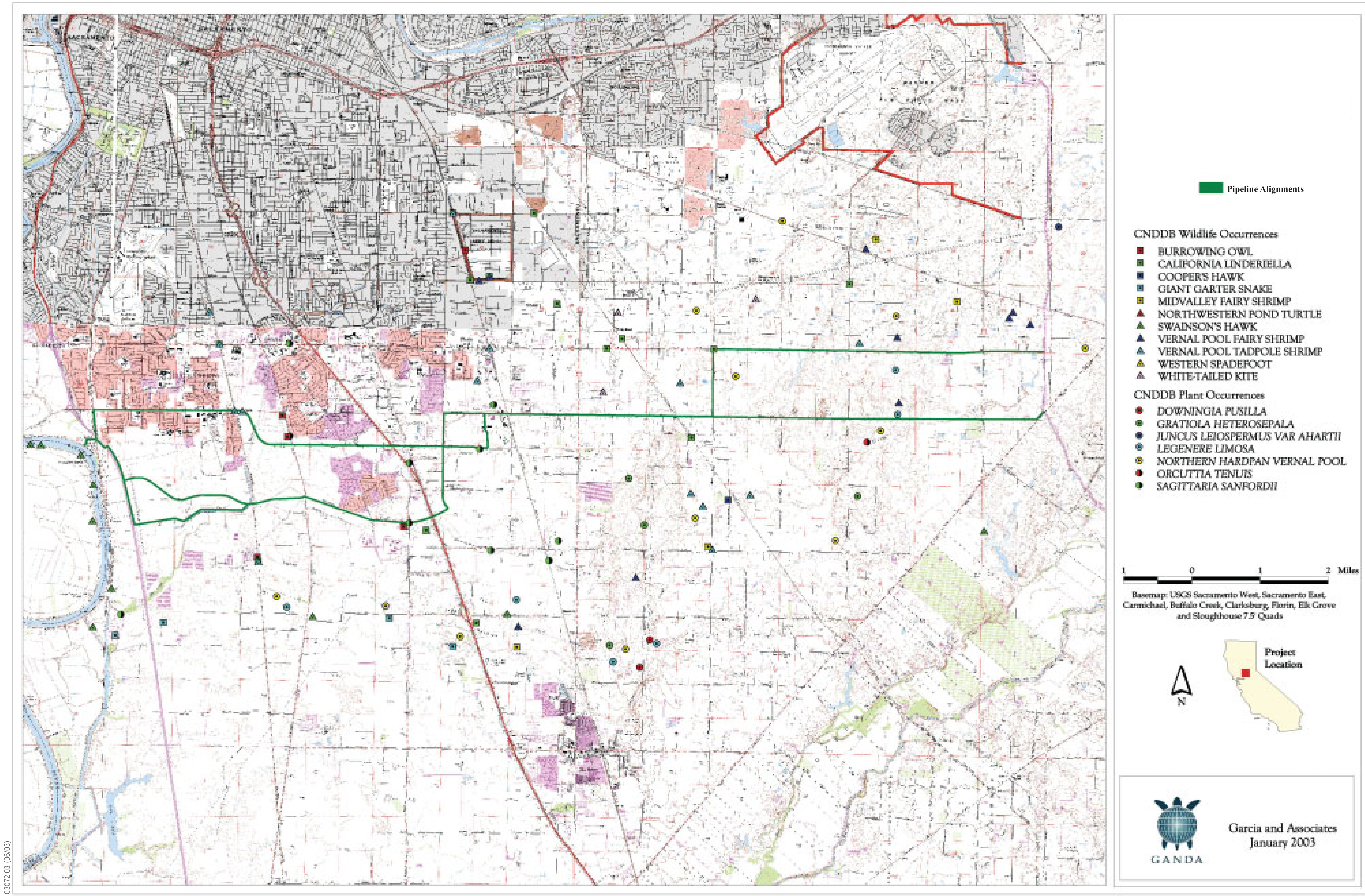


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Figure 8-1
Known Populations of Special Status Species
Freeport Intake Facility to Zone 40 WTP / Folsom South Canal

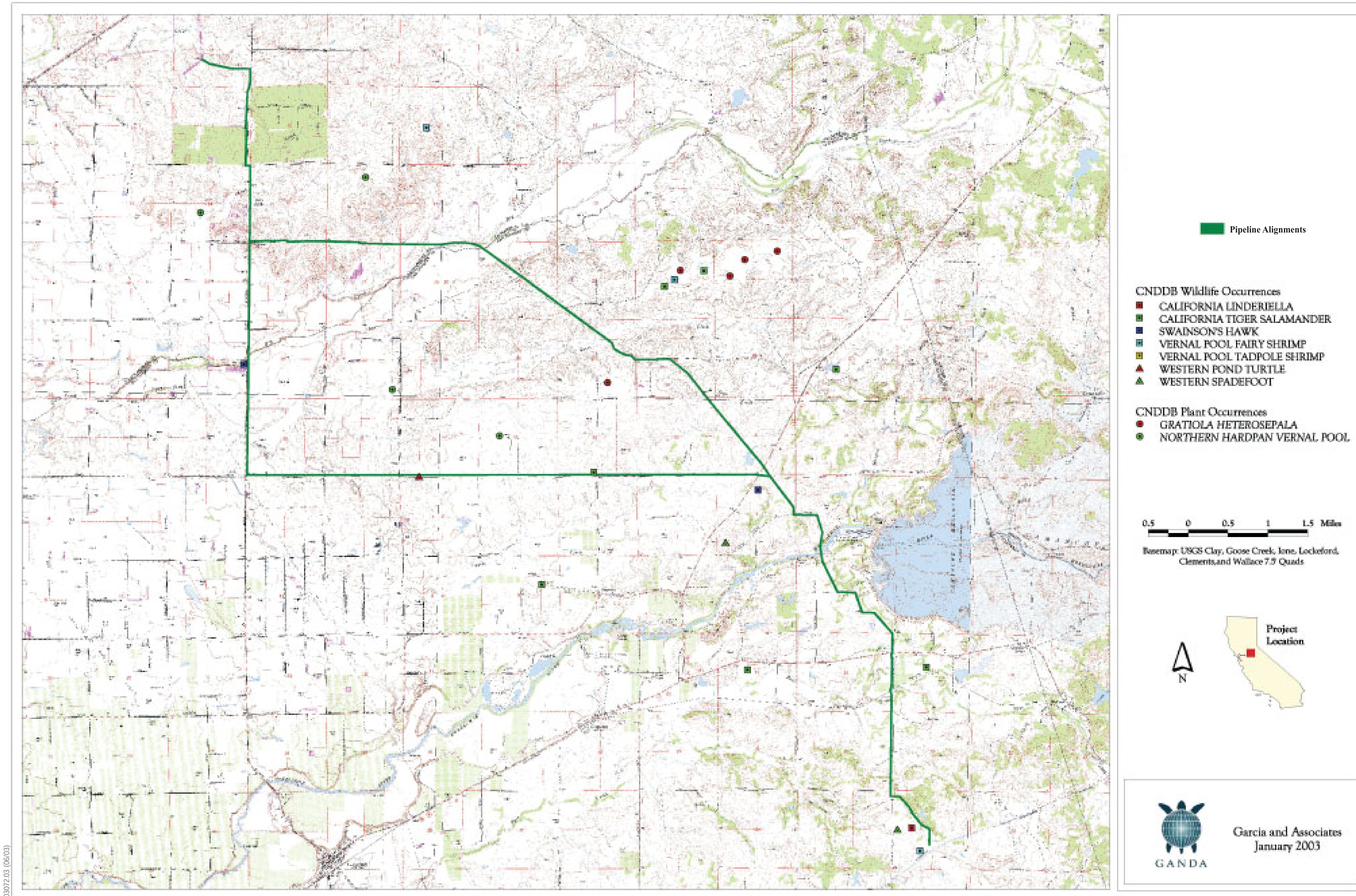

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Figure 8-2
Known Populations of Special Status Species
Folsom South Canal to Mokelumne Aqueducts

Western Pond Turtle

This species lives in aquatic habitats such as ponds, freshwater marshes, quiet stream zones, sloughs, and irrigation ditches. Pond turtles bask on protected sites such as logs or exposed rocks and lay their eggs in upland areas adjacent to their aquatic habitat. Western pond turtle is recorded along Segment W and south of the intake facility to Zone 40 Surface WTP/FSC pipeline, near the confluence of Morrison Creek and the Sacramento River. In the project area, this species is most likely to occur in the larger streams of the project area such as the Cosumnes River, Mokelumne River, Deer Creek, and Dry Creek but also could occur in perennial ditches or permanent ponds.

Giant Garter Snake

This species inhabits small waterways such as sloughs, canals, and quiet creek zones with emergent vegetation and grassy banks. During winter, it requires high ground away from water for dormancy. There are records of giant garter snakes approximately 1.5 miles south of the western portion of the project area from the intake facility to the Zone 40 Surface WTP/FSC. These occurrences were in the Laguna Creek drainage and south of Morrison Creek near the Sacramento River. Potential habitat for this species also may be present in the Morrison Creek channel and in creeks and perennial wetlands in the eastern portion of the project area from the intake facility to the Zone 40 Surface WTP/FSC and along the FSCC pipeline alignments.

Swainson's Hawk

This species nests in tall deciduous trees in or near riparian habitats, and forages in open habitats such as grasslands and agricultural fields. In the project vicinity, records document nesting Swainson's hawk along the Sacramento River, Mokelumne River (near the intersection of segments W and Option 3), and Deer Creek. Potential nesting habitat for this species is present in riparian zones along the pipeline alignments from the intake facility to the Mokelumne Aqueducts. Grasslands and agricultural fields throughout the project area can provide suitable foraging habitat for Swainson's hawk.

Northern Harrier

This hawk species nests and forages in marshes or fields with dense vegetation cover. There are no nesting records of this species in the project area, but a northern harrier was observed during the February 2002 reconnaissance survey foraging over a marsh adjacent to the SRWWTP, south of the project area from the intake facility to the Zone 40 Surface WTP/FSC. In the project area, potential habitat for this species is limited mostly to freshwater marshes.

White-Tailed Kite

This species of hawk nests in trees in riparian and oak woodland habitats and forages in a variety of open habitats such as grasslands and marshes. There is a record of nest sites near Elder Creek in the central portion of the project area from the intake facility to the Zone 40 Surface WTP/FSC. Potential nesting habitat is also present in riparian zones in the project area along the FSCC pipeline alignments and the eastern portion of the intake facility to Zone 40 Surface WTP/FSC pipeline.

Western Burrowing Owl

This species lives in rodent burrows in a variety of open habitats including grasslands, deserts, and agricultural fields. They also may be found in urban areas where sufficient open space exists, such as vacant lots or utility corridors, and existent burrows. There are records of burrowing owls in the western portion of the project area from the intake facility to the Zone 40 Surface WTP/FSC, and potential habitat for this species exists in many open areas along the pipeline alignments from the intake facility to the Mokelumne Aqueducts.

Tricolored Blackbird

This species nests in large colonies in cattail or tule marshes, and forages in open habitats such as agricultural fields and pastures. There are no nesting records of this species in the project vicinity. A wintering flock of about 60 tricolored blackbirds was observed during the February 2002 reconnaissance survey in a marsh adjacent to the SRWWTP.

Greater Sandhill Crane

The greater sandhill crane occurs in the study area as a winter resident. During winter, greater sandhill cranes feed on grasses, forbs, waste grains, small mammals, amphibians, snakes, and invertebrates. They feed and roost in pastures, flooded and unflooded grain fields, and seasonal wetlands. Greater sandhill cranes may forage in agricultural and pasturelands along the pipeline corridor; however the study area is outside of the species' traditional wintering areas in the Delta. Greater sandhill cranes have not been observed in the study area and would not be expected to forage along the proposed pipeline corridor, which parallels frequently used roadways.

San Joaquin Pocket Mouse

This rodent species lives in semi-arid habitats such as grasslands and oak savannas in and around the Central Valley. They typically occur under the cover of shrubs and generally stay out of open areas. There are no reported occurrences of the San Joaquin pocket mouse within the project area. However, suitable habitat for the species may be present in grasslands at the eastern end of the project area from the FSC to the Mokelumne Aqueducts (FSCC pipeline alignments).

Enlarge Pardee Reservoir

A list of special-status animals that could occur in the enlarge Pardee Reservoir project area was compiled from review of the CNDDB (California Department of Fish and Game 2002), the USFWS species list for the enlarge Pardee Reservoir project area (U.S. Fish and Wildlife Service 2002), and previous biological studies in the project area (Table 8-3). The likelihood of occurrence of these species in the project area was evaluated based on results of previous studies and the reconnaissance survey. Special-status species that have been documented in the project vicinity (Figure 8-3), have been identified in previous studies as potentially present in the project area, or are likely to occur and would likely be affected by the project are discussed in more detail below.

Valley Elderberry Longhorn Beetle

This beetle, federally listed as threatened, occurs primarily in the Central Valley, but has also been found in the Sierra Nevada foothills up to 1,800 feet elevation (BioSystems Analysis 1993, 1994). The closest CNDDB record of this species is in the Ione Valley approximately seven miles northwest of the north arm of Pardee Reservoir (California Department of Fish and Game 2002). The project area does not contain extensive stands of elderberry plants and no evidence of the species was found in the field surveys, but it may be present.

California Tiger Salamander

California tiger salamanders have been documented at several locations southwest of Pardee Reservoir (California Department of Fish and Game 2002). The closest record is approximately five miles southwest of the south arm of the reservoir. Suitable breeding habitat for this species (seasonal ponds or stock ponds) was not observed in the vicinity of the reservoir. Furthermore, the presence of bullfrogs and fish in ponds and streams in the project area (BioSystems Analysis 1993, 1994) reduces the likelihood that California tiger salamanders breed in this area. Grasslands within the project area are not likely to provide upland habitat for this species because no potential breeding ponds are located within dispersal distance of these habitats within the project area. However, the presence of suitable breeding habitat is not ruled out.

California Red-Legged Frog

This frog species, federally listed as threatened, inhabits ponds and quiet stream zones. It prefers areas with relatively deep pools for escape and emergent vegetation for breeding. During winter, it may venture into upland habitats and can use burrows or other protected areas away from water as temporary refuges. There are no records of this species in the project vicinity, and little if any suitable habitat exists for this species in the project area. Some marginal-quality potential habitat for California red-legged frog was previously identified around the Jackson Creek Spillway and South Spillway (BioSystems Analysis 1993, 1994), but these areas were small in extent and no other suitable habitat was observed during the 2002 survey. Therefore, the California red-legged frog is not likely to occur in the project area.

Foothill Yellow-Legged Frog

The foothill yellow-legged frog inhabits rocky streams with riffles and pools, and surrounding vegetation. No occurrence of this species has been documented in the project vicinity. Potentially suitable habitat for foothill yellow-legged frog was observed in some of the upstream drainages near the main arm of the reservoir, including Rich Gulch, Grapevine Gulch, and Poorman Gulch.

Western Spadefoot

The CNDDB (2002) documents one occurrence of western spadefoot approximately nine miles southwest of Pardee Reservoir. Shallow, temporary ponds in the project vicinity could provide breeding habitat for western spadefoot, but no suitable breeding habitat was observed in the project area. However, the presence of suitable breeding habitat is not ruled out.

Western Pond Turtle

This species has been observed in the project area and vicinity, including in scour ponds adjacent to the South Spillway, in a pond in the Mexican Gulch drainage, and in wetlands associated with drainages that feed into Pardee Reservoir (BioSystems Analysis 1994). While these areas may provide suitable foraging habitat and cover, the steep rocky slopes adjacent to these ponds and around the reservoir in general do not provide suitable breeding habitat for western pond turtles. However, the presence of suitable breeding habitat is not ruled out.

Table 8-3. Special-Status Wildlife Species That Could Potentially Occur in the Enlarge Pardee Reservoir Area

Species	Status (Fed./State)[1]	Habitat	Potential Occurrence in Project Area
Invertebrates			
Vernal pool fairy shrimp *Branchinecta lynchi*	T/--	Vernal pools and ephemeral pools in sandstone rock outcrops	No occurrences documented in vicinity and no habitat present in project area.
Vernal pool tadpole shrimp *Lepidurus packardi*	E/--	Vernal pools and ephemeral ponds	No occurrences documented and no habitat seen in project area.
California linderiella *Linderiella occidentalis*	SC/--	Vernal pools and ephemeral ponds	No occurrences documented and no habitat seen in project area.
Valley elderberry longhorn beetle *Desmocerus californicus dimorphus*	T/--	Restricted to elderberry shrubs in riparian and oak savanna habitats	Occurrence documented in Ione Valley seven miles northwest of project area; no suitable breeding habitat seen in the project area or immediate vicinity.
Amphibians			
California tiger salamander *Ambystoma californiense*	C/SC	Breeds in seasonal ponds in grassland and oak woodland; uses burrows in upland habitats for summer dormancy	Occurrences documented southwest of project area; no suitable breeding habitat seen in project area or immediate vicinity but may be present.
Western spadefoot *Spea hammondii*	SC/SC	Breeds in ephemeral pools and seasonal ponds in grassland habitats; burrows underground for most of the year	One occurrence documented southwest of reservoir; no suitable breeding habitat seen in project area but may be present.
California red-legged frog *Rana aurora draytonii*	T/SC	Ponds with emergent vegetation and quiet pools in permanent streams.	No occurrences documented in vicinity and potential habitat very limited. Not expected to occur in project area.
Foothill yellow-legged frog *Rana boylii*	SC/SC	Rocky stream zones with riffles and pools.	Not known to occur in project area, but potential habitat present in Rich Gulch and other side drainages off the main arm of the reservoir.
Reptiles			
Western pond turtle *Clemmys marmorata*	SC/SC	Ponds, marshes, streams, and irrigation canals with aquatic vegetation in woodland and grassland communities; nests in adjacent, well-exposed, permeable soils	Documented in scour ponds below South Spillway. No suitable breeding habitat observed in project area but may be present.

Species	Status (Fed./State)[1]	Habitat	Potential Occurrence in Project Area
California horned lizard *Phrynosoma coronatum frontale*	SC/SC	Annual grassland, oak savanna, and open pine/oak woodland; ranges up to 4,000 feet elevation	Likely to occur.
Giant garter snake *Thamnophis gigas*	T/T	Freshwater marshes, sloughs, and canals with emergent vegetation; requires high ground above water for winter dormancy	No suitable habitat seen. Project is probably out of species' range.
Birds			
Common loon *Gavia immer*	SC/SC	Inland lakes, bays and ocean.	Observed on reservoir.
Double-crested cormorant *Phalacrocorax auritus*	--/SC	Inland lakes, rivers, and ocean.	Common on reservoir.
Osprey *Pandion haliaetus*	--/SC	Forages in lakes, bays, rivers; nests in large trees and cliffs.	Observed near Jackson Creek Spillway.
White-tailed kite *Elanus leucurus*	SC/FP	Valley grasslands, oak savanna, riparian areas, and marshes near open grassland.	Some potential foraging and nesting habitat present, so could occur in project area.
Bald eagle *Haliaeetus leucocephalus*	T,PD/E	Forages in lakes, bays, rivers, and other open water; nests and roosts in large trees near water.	Observed and documented wintering at Pardee Reservoir. No known nest sites or nesting activity in project area.
Northern harrier *Circus cyaneus*	--/SC	Grasslands, marshes, and seasonal wetlands with tall vegetation cover	Some potential foraging habitat present, so could occur. No nesting habitat seen.
Sharp-shinned hawk *Accipiter striatus*	--/SC	Oak-woodland and coniferous-forest habitats; usually nests in dense conifer stands near water.	Suitable foraging habitat present, but unlikely to nest in project area.
Cooper's hawk *Accipiter cooperii*	--/SC	Riparian-deciduous, oak woodland, and coniferous-forest habitats.	Potential nesting habitat present below Middle Bar and in some side drainages.
Swainson's hawk *Buteo swainsoni*	SC/T	Nests in deciduous trees in riparian areas, forages in grasslands and agricultural fields.	Project area is out of species' breeding and wintering ranges.
Ferruginous hawk *Buteo regalis*	SC/SC	Grasslands, low foothills, sagebrush flats, and desert scrub.	Project area is out of species' breeding and wintering ranges.
Golden eagle *Aquila chrysaetos*	--/SC	Grasslands and oak savanna and other open-canopied woodlands; nests on cliffs and in large trees.	Potential foraging habitat present in grassland and other open habitats in project area.

Species	Status (Fed./State)[1]	Habitat	Potential Occurrence in Project Area
Merlin *Falco columbarius*	--/SC	Frequents a range of habitats, from grasslands to hardwood-conifer forests below 5,000 feet elevation.	Observed in project area.
American peregrine falcon *Falco peregrinus anatum*	D,SC/E	Nests near water in woodland, forest and coastal habitats; riparian and wetland habitats important year-round.	Potential foraging and nesting habitat in project area.
Prairie falcon *Falco mexicanus*	--/SC	Perennial grasslands, savannas, rangeland, and desert scrub; nests on cliffs over open areas.	Potential foraging and nesting habitat in project area.
Mountain plover *Charadrius montanus*	PT/SC	Short grasslands, plowed fields, and foothill valleys below 3,300 feet elev.	Project area is out of species' breeding and wintering ranges.
Long-billed curlew *Numenius americanus*	SC/SC	Estuaries, upland herbaceous areas, and croplands; casual breeder on prairies in northeastern California.	Very low potential to occur; project area is at edge of wintering range and lacks quality foraging habitat.
California gull *Larus californicus*	--/SC	Lakes and rivers; non-breeder on west slope of Sierra Nevada.	Observed in project area, common on reservoir.
Western yellow-billed cuckoo *Coccyzus americanus occidentalis*	C/E	Valley foothills and desert riparian habitats in scattered locations; breeds near water.	No occurrences recorded in vicinity and no habitat present in project area.
Western burrowing owl *Athene cunicularia hypugaea*	SC/SC	Inhabits rodent burrows in open grasslands, deserts, and agricultural fields.	No suitable habitat observed.
Long-eared owl *Asio otus*	--/SC	Breeds in oak woodlands and ponderosa pine/black oak habitats; forages in riparian areas.	No occurrences recorded in project vicinity but might occur in riparian groves.
Short-eared owl *Asio flammeus*	SC/SC	Forages in open areas: grasslands, prairies, meadows, dunes, irrigated lands, and emergent wetlands.	No occurrences recorded in project vicinity but might forage in marshy areas around reservoir.
Lewis's woodpecker *Melanerpes lewis*	SC/--	Foothill pine/oak and open riparian woodlands, isolated groves.	Abundant around reservoir. Wintering habitat present but not known to nest in the area.
Red-breasted sapsucker *Sphyrapicus ruber*	SC/--	Lowland woodlands, parks, gardens, exotic tree plantations.	Seen at Middle Bar. Wintering habitat present but does not nest in area.
Nuttall's woodpecker *Picoides nuttallii*	SLC/--	Oak, streamside, and pine-oak woodlands.	Observed and nesting habitat present in project area.
Little willow flycatcher *Empidonax traillii brewsteri*	SC/E	Nests in willow shrubs in riparian areas.	Not known to occur in area, potential migration habitat present around Middle Bar.

Species	Status (Fed./State)[1]	Habitat	Potential Occurrence in Project Area
Loggerhead shrike *Lanius ludovicianus*	SC/SC	Forages in open areas of lowlands and foothills; nests on branch of shrub or tree in dense foliage.	May occur at low density.
Purple martin *Progne subis*	--/SC	Valley foothills, montane hardwood and conifer forests, and riparian habitats; nests mostly in secondary cavities.	May occur in project area but no suitable nesting sites observed.
Bank swallow *Riparia riparia*	SC/T	Nests colonially in cavities in vertical river banks, bluffs and cliffs with sandy substrate.	No nesting habitat seen in project area.
Oak titmouse *Baeolophus inornatus*	SLC/--	Mixed oak woodlands, riparian woodlands, residential plantings.	Abundant around reservoir and nesting habitat present in project area.
California thrasher *Toxostoma redivivum*	SC/--	Nests and forages in chaparral habitats and riparian thickets.	Likely to occur and suitable nesting habitat present in project area.
California yellow warbler *Dendroica petechia brewsteri*	--/SC	Breeds in lowland riparian woodlands and isolated willow stands.	Could occur in project area; suitable habitat present around Middle Bar.
Yellow-breasted chat *Icteria virens*	--/SC	Coastal, valley-foothill riparian, and desert riparian habitats; nests in dense shrubs along a river or stream.	Could occur in project area; suitable habitat present around Middle Bar.
Bell's sage sparrow *Amphispiza belli belli*	SC/SC	Nests and forages in sagebrush, chaparral, and scrub habitats.	Likely to occur and suitable nesting habitat present in project area.
Tricolored blackbird *Agelaius tricolor*	SC/SC	Nests in dense colonies in marshes and moist uplands with dense vegetation; forages in marshes, pastures, and fields.	No good habitat present in project area.
American white pelican *Pelecanus erythrorhynchos*	--/SSC	Freshwater lakes with islands for breeding; inhabits river sloughs, freshwater marshes, salt ponds, and coastal bays during the rest of the year.	Outside of the species known breeding range. Suitable winter foraging habitat is present in the study area.
Mammals			
Yuma myotis *Myotis yumanensis*	SC/--	Wide variety of habitats; roosts in buildings, mines, caves and under bridges, often forages over water.	Likely to occur in project area. Bats previously documented around Jackson Creek Spillway siphons likely this species but identification not confirmed.
Pacific western big-eared bat *Corynorhinus townsendii townsendii*	SC/SC	Occurs throughout California in all habitats but subalpine and alpine; most abundant in mesic habitats.	May occur in project area.

Species	Status (Fed./State)[1]	Habitat	Potential Occurrence in Project Area
Pallid bat *Antrozous pallidus*	--/SC	Inhabits grasslands, shrublands, woodlands, and forests; most common in open, dry habitats with rocky areas.	Likely to occur in project area; very suitable habitat present around reservoir.
California mastiff bat *Eumops perotis californicus*	SC/SC	Woodlands, coastal scrub, chaparral, grasslands, desert scrub and urban habitats.	May occur in project area.
Riparian brush rabbit *Sylvilagus bachmani riparius*	E/E	Dense riparian shrubs with adjacent herbaceous vegetation or meadows for foraging.	Known only from limited localities in the Central Valley. Project area is probably out of species' range.
Ringtail *Bassariscus astutus*	--/FP	Inhabits forest and shrub habitats at low to middle elevations; nests in recesses, abandoned burrows and woodrat houses.	Likely to occur in project area; woodrat houses seen in Cave Gulch.

[1] Wildlife status definitions and governing agencies are as follows:

Federal (U.S. Fish and Wildlife Service)

E = listed as Endangered under the Federal Endangered Species Act

T = listed as Threatened under the Federal Endangered Species Act

PT = Proposed for listing as Threatened

C = Candidate for listing as Threatened or Endangered

D = Delisted, formerly listed as Threatened or Endangered

PD = Proposed for delisting

SC = U.S. Fish and Wildlife Service "species of concern"

SLC = U.S. Fish and Wildlife Service "species of local concern"

State (California Department of Fish and Game)

E = listed as Endangered under the California Endangered Species Act

T = listed as Threatened under the California Endangered Species Act

SC = California Department of Fish and Game Special Concern species

FP = California Department of Fish and Game Fully Protected species

[2] Status designations based on California Department of Fish and Game Special Animals list, July 2002.

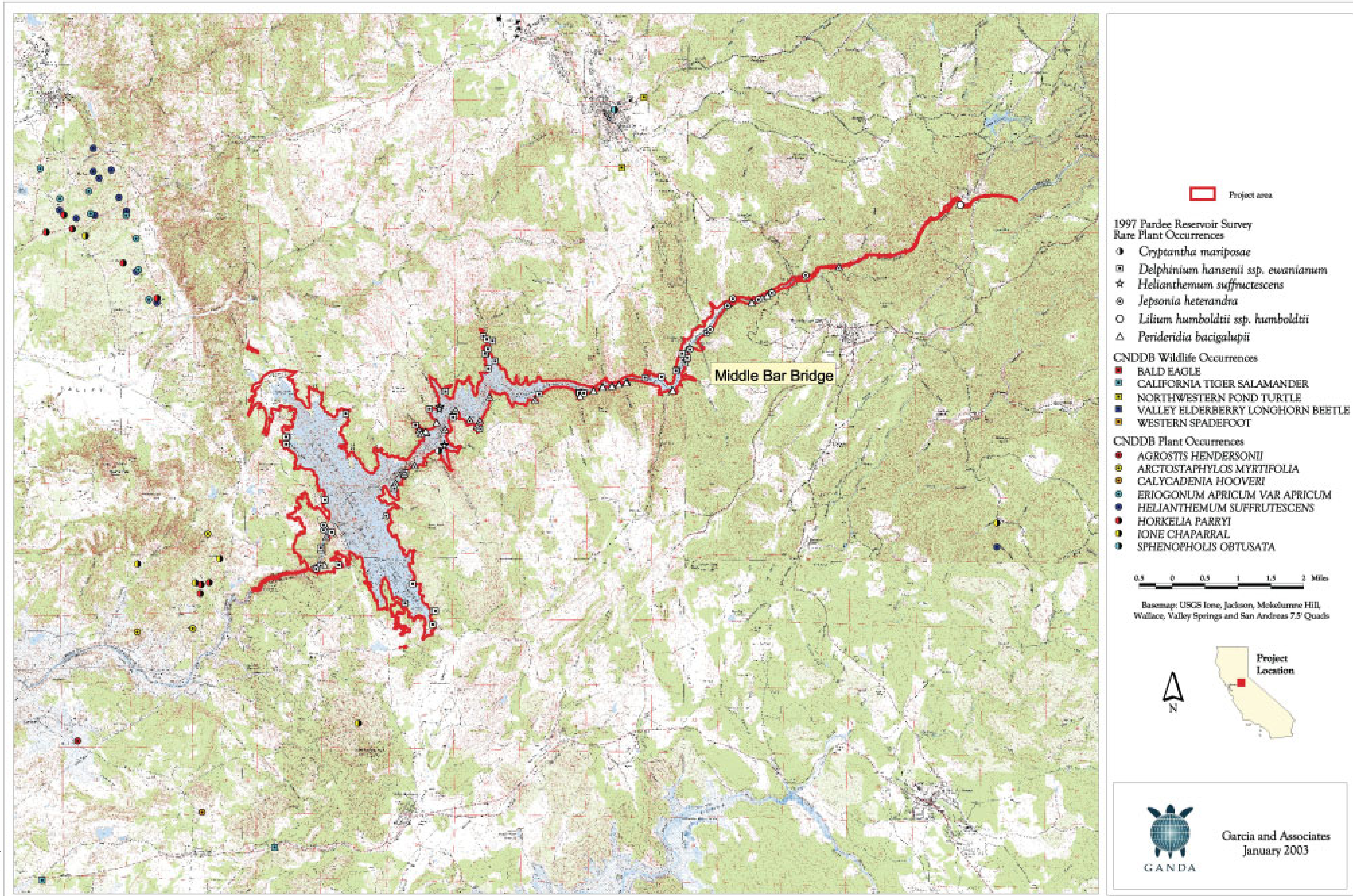

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Figure 8-3
Known Populations of Special Status Species
Enlarged Pardee Reservoir

Cooper's Hawk

This raptor species inhabits riparian, oak woodland, and coniferous forest habitats. Potential nesting and foraging habitat for Cooper's hawk is present around Middle Bar in some of the side drainages that contain riparian woodland and dense oak woodland vegetation.

Bald Eagle

This species is federally listed as threatened and is known to winter at Pardee Reservoir. Population surveys conducted at Pardee Reservoir during the fall and winter of 1996–1997 documented a total of 62 bald eagle detections in 12 surveys (maximum of 10 eagles in one survey) (Entrix 1998). Bald eagles were observed perching at Pardee Reservoir, on the middle Mokelumne River below Pardee Dam, and on the upper Mokelumne River above the reservoir. Areas of high eagle concentration included the middle Mokelumne River for approximately one mile below Pardee Dam, the upper Mokelumne River around Middle Bar Bridge, and several locations around Pardee Reservoir. Bald eagles perched mostly near the tops of trees, such as foothill pine, and showed a preference for open habitats, such as foothill pine/chaparral, for perching. Waterfowl such as mallard, American coot, grebes, and gulls are an important food source for bald eagles and are abundant at Pardee Reservoir in winter. There are no records of bald eagles nesting in the immediate area, but their population and breeding range are increasing in California, and they could potentially nest in the area in the future.

California Thrasher

This species inhabits dense chaparral and riparian thickets. This species has not been documented in the project vicinity, but abundant suitable habitat exists in the project area. The California thrasher is likely to occur and nest in chaparral habitat in the project area.

California Yellow Warbler

The California yellow warbler forages and nests in lowland riparian woodland and isolated willow stands. There are no records of this species in the project vicinity, but suitable habitat for the California yellow warbler is present in the riparian areas around Middle Bar.

Bell's Sage Sparrow

Bell's sage sparrow nests in sagebrush, chaparral, and scrub habitats. This species has not been documented in the project vicinity, but abundant suitable habitat exists in the project area. It is likely to occur and nest in chaparral and scrub habitats in the project area.

Yellow-Breasted Chat

This species inhabits valley foothill riparian habitat and nests in dense shrubs along rivers and streams. There are no records of yellow-breasted chat in the project vicinity, but riparian areas around Middle Bar provide suitable nesting habitat for this species.

Oak Titmouse

Oak titmouse occurs in mixed oak and riparian woodland habitats. It typically nests in secondary cavities in trees. This species of local concern was observed in the project area during the 2002 survey and is an abundant, year-round resident around Pardee Reservoir.

Nuttall's Woodpecker

Nuttall's woodpecker inhabits oak and pine-oak woodlands and streamsides, and nests in cavities in trees. This species of local concern was observed during the 2002 survey and is a year-round resident in the project area.

Pallid Bat

This species occurs in a variety of habitats, but is most commonly found in dry, open habitats with rocky areas for roosting. There are no records of pallid bat in the project vicinity, but there is abundant suitable habitat and it is likely to occur in the project area.

Yuma Myotis

Yuma myotis occurs in a variety of habitats. It prefers to forage over water and roosts in buildings, caves, mines, and under bridges and other structures. Bats thought to be Yuma myotis were documented roosting in the siphons of Jackson Creek Spillway (BioSystems Analysis 1993). Evidence of bat presence (i.e., guano) was also observed around Jackson Creek Spillway in the 2002 survey, although species identification was not confirmed. Yuma myotis is likely to occur in the project area and may roost in existing or future structures.

Regulatory Setting

In addition to the State CEQA Guidelines (discussed in the following section), the following federal, state, and local laws, regulations, and policies pertain to protection of wildlife resources.

- ESA prohibits take of any wildlife species listed as threatened or endangered, including the destruction of habitat that prevents species recovery. *Take* is defined as *harass, harm, pursue, hunt, wound, shoot, kill, trap, capture, collect, or attempt to engage in any such conduct*.
- The Migratory Bird Treaty Act prohibits pursuing, hunting, taking, capturing, or killing any migratory bird, without a permit issued by the U.S. Department of the Interior.
- CESA prohibits take of state-listed endangered and threatened wildlife species, but habitat destruction is not included in the state's definition of take.
- California Fish and Game Code Sections 1600–1607 require issuance of a streambed alteration agreement for any activity that would alter the channel, bed, or bank of a lake, river, or stream. Protection of biological resources is usually one condition of streambed alteration agreements.
- California Fish and Game Code 3503.5 prohibits removal of raptor nests.

Environmental Consequences

Significance Criteria

The criteria used for determining the significance of an impact on wildlife resources are based on Appendix G of the State CEQA Guidelines (Environmental Checklist) and professional standards and practices. Impacts on biological resources may be considered significant if implementation of an alternative would:

- have a substantial adverse effect, either directly or through habitat modifications, on any wildlife species identified as a candidate, sensitive or special-status species in local or regional plans, policies, or regulations, or by DFG or USFWS;
- interfere substantially with the movement of any resident or migratory wildlife species;
- conflict with any local policies or ordinances protecting wildlife resources; or

- conflict with the provisions of an adopted habitat conservation plan, natural community conservation plan, or other approved local, regional, or state habitat conservation plan.

Methods and Assumptions

Freeport Intake Facility to Mokelumne Aqueducts

Direct impacts on wildlife include mortality, injury, disturbance, and displacement of individual animals, and permanent losses of wildlife habitat that occur as a result of project construction. Indirect impacts on wildlife include changes in habitat suitability and other effects on wildlife populations that occur after completion of the project and that result indirectly from project implementation (e.g., increased human population, vehicle traffic or other disturbance).

Because the exact location and extent of disturbances related to pipeline installation and equipment and material staging areas and haul routes cannot be precisely determined at this time, impacts are described qualitatively. The following assumptions were made regarding project-related impacts on wildlife resources:

- All wildlife and wildlife habitats within the 130-foot-wide construction corridor could be adversely affected during construction.
- All wildlife and wildlife habitats within the footprint of permanent facilities would be permanently removed.

Enlarge Pardee Reservoir

Direct impacts on wildlife include mortality, injury, and disturbance of individual animals during construction activities and vegetation clearing, and permanent losses of wildlife habitat due to inundation as the reservoir level rises following construction. The risk of mortality or injury to individual animals is assumed to be greatest within the footprint of the proposed new facilities. Removal of trees and other vegetation around the existing reservoir perimeter could directly harm individual animals, such as nesting birds, depending on the seasonal timing of these activities. Demolition of existing structures within the inundation zone could also directly affect wildlife that use these structures for roosting or nesting.

Inundation from the rising reservoir would permanently remove terrestrial wildlife habitats between the existing reservoir shoreline and the 601-foot elevation contour behind the new dam. Conversely, open water and shoreline habitats would increase in this area, which could benefit waterfowl and other water birds, and species that prey on them. Habitat conditions within the flood zone between 601 and 614 feet would likely be altered, and habitat value diminished somewhat, depending on the frequency, depth, and duration of inundation during high water periods. Wildlife habitats between 614 and 617 feet would be subject to very infrequent flooding during high runoff events, and probably would not be substantially affected.

To some extent, riparian and wetland habitats that would be removed by the project would become re-established eventually at higher elevations adjacent to the new shoreline. However, the hydrological regime of a fluctuating reservoir would be less conducive to sustaining riparian habitats than the existing hydrology in the riparian areas that would be inundated. Therefore, habitats for riparian-nesting birds, amphibians, and other wildlife associated with these habitats would be expected to decrease around and upstream of the reservoir. Conversely, riparian habitat downstream of the new dam could potentially be increased after the project, depending on the quantity and timing of regulated water releases below the new dam.

Indirect impacts on wildlife include changes in habitat suitability and other effects on wildlife populations that occur after completion of the project and that result indirectly from project implementation (e.g., increased recreational use and development, increased vehicle traffic, and other human disturbances).

The following assumptions were made regarding project-related impacts on wildlife resources:

- Wildlife habitats within the construction footprint of new facilities, such as the main dam, saddle dams, spillways, roads, parking areas, marinas, and other recreational facilities, would be removed permanently by the project.
- Terrestrial wildlife habitats would be removed permanently between the existing reservoir shoreline (568 feet mean sea level [ft msl]) and the 601-foot elevation contour upstream of the new dam site.
- Terrestrial wildlife habitats between 601 and 614 ft msl upstream of the new dam site would be altered to some extent, depending on the frequency, depth and duration of inundation during high water periods.
- Open water habitat and shoreline area would increase permanently upstream of the new dam site to the 601-foot elevation contour, and would increase seasonally between 601 and 614 ft msl.

Less-than-Significant Impacts

Alternative 1

Alternative 1 would have no impact on wildlife resources associated with construction of FRWP facilities within any of the affected counties.

Alternatives 2–5

Impact 8-1: Loss of or Disturbance to Developed and Agricultural Land and Associated Wildlife Habitats

Developed land, including individual trees and ornamental vegetation along the proposed alignments, provides very limited habitat value for wildlife. Agricultural fields can provide foraging habitat for birds and small mammals; however, the total area affected would be relatively small, and most effects in these areas would be temporary. Therefore, this effect is not significant. No mitigation is required.

Impact 8-2: Temporary Loss or Alteration of Swainson's Hawk Foraging Habitat

Temporary disturbance of agricultural land along the pipeline corridor could result in temporary loss of Swainson's hawk foraging habitat. These temporary losses will not substantially reduce available foraging habitat for Swainson's hawk. Permanent conversion of agricultural land to annual grassland along some segments of the corridor could affect the value of these areas as foraging habitat for Swainson's hawk. Because the affected areas would be small in comparison to overall foraging habitat available for this species in the area, and because grassland habitats can still provide some foraging benefits for Swainson's hawk, this impact is less than significant. No mitigation is required.

Impact 8-3: Temporary Loss of San Joaquin Pocket Mouse Habitat

Impacts on annual grassland could result in temporary loss of San Joaquin pocket mouse habitat. The temporary loss of annual grassland during construction will not significantly affect habitat for the San Joaquin pocket mouse. Because the affected areas would be small compared with the overall habitat available for pocket mice, and because habitat will recover following installation of the pipeline, this impact is less than significant. No mitigation is required.

Alternative 6

In addition to the impacts previously identified for Alternatives 2–5, the following impacts could occur under Alternative 6.

Impact 8-4: Loss of Developed Areas and Associated Wildlife Habitats

Developed areas, such as existing recreational facilities and paved roads, provide relatively low habitat value for wildlife, and would be replaced by construction of new, similar facilities. Therefore, this impact is less than significant. No mitigation is required.

Impact 8-5: Loss of Grassland Habitats for Wildlife

Grassland habitats are common and widespread in the project vicinity. While these habitats provide moderate habitat value for wildlife, including potential foraging areas for raptors, the total area of grassland affected would represent a small fraction of available grassland foraging habitat in the project region. No special-status species are known to breed in these habitats in the project area. Therefore, this impact is less than significant. No mitigation is required.

Impact 8-6: Loss of Chaparral-Type Habitats for Wildlife

Removal of chaparral and sage scrub vegetation would displace resident wildlife and reduce the extent of these habitats within the project area. Two avian species of concern, Bell's sage sparrow and California thrasher, have high potential to occur and nest in these habitats. While chaparral communities provide moderately high value for wildlife, they are common and widespread in the region. The amount of chaparral and sage scrub affected by the project would represent a small fraction of the total chaparral habitat available for wildlife in the project vicinity. Furthermore, from a regional standpoint, chaparral habitat for wildlife is not likely to decrease substantially in the future. Therefore, this impact is less than significant. No mitigation is required.

Impact 8-7: Loss of Upland Woodland Wildlife Habitats

Removal of blue oak and other upland woodlands would displace resident wildlife and reduce the extent of these habitats within the project area. Two avian species of concern, the oak titmouse and Nuttall's woodpecker, are known to occur and would lose nesting habitat, and other species of concern such as Cooper's hawk have a high potential to occur and could lose nesting habitat. While woodland habitats provide high value for wildlife, the open woodlands characteristic of the project area are common and widespread in the region. The amount of upland woodland habitat affected by the project would represent a small fraction of the total amount of this habitat available for wildlife in the project vicinity. Therefore, this impact is less than significant. No mitigation is required.

Impact 8-8: Loss of Perching Habitat for Bald Eagles

Clearing of vegetation between the existing reservoir shoreline and the 601-foot elevation contour would remove trees that provide perching sites for wintering bald eagles. The remaining oaks and foothill pines above the new reservoir level would provide ample perching sites for eagles. Moreover, the increase in reservoir surface area would increase the area of open water foraging habitat, and could increase prey abundance, which would benefit bald eagles. Therefore, this impact is less than significant. No mitigation is required.

Impact 8-9: Increase in Open Water and Shoreline Habitat for Waterfowl, Waterbirds, and Associated Species

The increase in surface area and shoreline perimeter of Pardee Reservoir would increase habitat area for waterfowl and waterbirds, including special-status species such as common loon, double-breasted cormorant, and California gull. If this were to result in increased populations of waterbirds at the reservoir, it could also increase prey availability for species, such as peregrine falcon and merlin, which prey on waterbirds. This is a beneficial impact. No mitigation is required.

Significant Impacts and Mitigation Measures

Alternatives 2–5

Impact 8-10: Loss or Alteration of Vernal Pools, Vernal Swales, and Other Temporary Ponds that Could Provide Habitat for Vernal Pool Fairy Shrimp, Vernal Pool Tadpole Shrimp, Midvalley Fairy Shrimp, and California Linderiella

Excavation during construction could remove or substantially alter vernal pools that are occupied by the federally listed vernal pool fairy shrimp and vernal pool tadpole shrimp. Trenching through vernal pools would destroy the hardpan forming these pools and consequently their hydrology. This impact is considered significant because it could cause direct mortality of these listed species and permanent loss of their habitat.

Similarly, removal of occupied habitat of the midvalley fairy shrimp, a federal species of concern, is considered significant because this species has a limited range and the project area is near the known limit of its range.

Removal of a relatively small amount of occupied habitat of the California linderiella is a less-than-significant impact because this species is more common and widespread than the other three species, and the project would not substantially reduce available habitat for California linderiella in the region. However, this species often occurs in vernal pool habitats in association with other rare animal and plant species for which project-related impacts would be significant.

Implementation of Mitigation Measure 8-1 would reduce the impact on these vernal pool crustacean species to a less-than-significant level.

Mitigation Measure 8-1: Conduct Surveys and Develop a Mitigation Plan for Vernal Pool Fairy Shrimp and Vernal Pool Tadpole Shrimp

Before construction begins, a qualified biologist with authorization from the USFWS should conduct protocol-level surveys to determine whether vernal pool fairy shrimp, vernal pool tadpole shrimp, or other special-status crustacean species are present in the pipeline construction corridor or water treatment plant construction footprint. If a listed species is found, compliance with the ESA, including consultation with the USFWS, would be required if occupied habitat cannot be avoided and would be adversely affected.

Compliance with the ESA will likely require development of a compensation plan that includes preservation of existing habitat and creation or enhancement of compensatory habitat.

If the midvalley fairy shrimp is found, impacts on occupied habitat should be minimized, and removal of occupied habitat mitigated as described above for vernal pool fairy shrimp and vernal pool tadpole shrimp. If midvalley fairy shrimp is the only species affected, authorization by the USFWS pursuant to the ESA would not be required. If California linderiella is found, impacts on occupied habitat should be minimized, but no further mitigation for this species would be required, provided no listed plant or animal species occupy those sites.

Alternatively, FRWA could assume all habitat identified as “vernal pools and swales” in Chapter 7, “Vegetation and Wetland Resources,” is occupied by vernal pool fairy shrimp or vernal pool tadpole shrimp and develop mitigation plans based on that assumption. In this case, protocol-level surveys would not be required, but consultation with the USFWS and development of a compensation plan would be required to ensure that the project would not jeopardize these species.

Impact 8-11: Potential Mortality of, Disturbance to, or Removal of Habitat of the Valley Elderberry Longhorn Beetle during Construction

Construction in riparian areas that contain elderberry plants could result in mortality of, or disturbance to, the valley elderberry longhorn beetle (VELB) or removal of its habitat. Because this beetle is a federally listed species, this impact would be significant. Implementation of Mitigation Measure 8-2 would reduce this impact to a less-than-significant level.

Mitigation Measure 8-2: Conduct Preconstruction Surveys for Valley Elderberry Longhorn Beetle and Avoid or Compensate for Loss of Habitat

Before construction begins, a qualified biologist should survey the alignment corridor and document the extent of habitat for the VELB. The information gathered in this survey would include the number of elderberry stems greater than 1 inch in diameter and the number of emergence holes in these stems for each elderberry shrub encountered.

FRWA then would implement the USFWS guidelines for avoiding impacts on the VELB by avoiding construction activities within 100 ft of any elderberry shrub where feasible. Where avoidance is not feasible, FRWA would obtain authorization from the USFWS pursuant to the ESA, and prepare and implement a mitigation plan consistent with USFWS guidelines to compensate for impacts on the VELB and loss of habitat.

USFWS guidelines call for avoidance of VELB habitat wherever possible. When avoidance is not possible, the guidelines direct that all elderberry plants be transplanted to an appropriate site when feasible, and that all stems 1 inch or greater in diameter be replaced by planting replacement plants at appropriate locations in the project vicinity determined in consultation with the resource agencies. The replacement ratio depends on the percentage of affected elderberry shrubs that have beetle emergence holes. The guidelines require the project proponent to monitor the transplanted shrubs and replacement plants for 10 years from the date of transplanting to monitor the success of the mitigation efforts.

Impact 8-12: Potential Mortality to, Disturbance of, or Loss of Habitat for Giant Garter Snake and Western Pond Turtle

Construction in areas within or adjacent to aquatic habitats such as ponds, marshes, streams, flood control channels, and irrigation ditches could cause direct mortality of, or remove habitat for, the giant garter snake and western pond turtle. Most habitat effects would be temporary because most of the affected pond and stream habitats would be restored following the pipeline installation. However, direct impacts on individuals of these species could occur during construction. Because the giant garter snake is a federally and state-listed species, this impact would be significant. Implementation of Mitigation Measure 8-3 would reduce this impact to a less-than-significant level.

Mitigation Measure 8-3: Avoid, Minimize, and Compensate for Unavoidable Impacts on Jurisdictional Waters of the United States, Including Wetlands, and Implement Associated Wildlife Protection and Compensation Measures

Impacts on wetlands and other jurisdictional waters will be mitigated by implementation of Mitigation Measures 7-9 through 7-11 in Chapter 7, “Vegetation.” Where impacts on wetland and aquatic habitats cannot be avoided, the area of effect will be kept to the minimum possible. Loss of, or impacts on, these habitats will be compensated for as part of compliance with the state and federal wetland permitting process described in Mitigation Measure 7-11.

To provide specific protection for giant garter snake and western pond turtle, a survey should be conducted by a qualified biologist prior to excavation and construction in aquatic habitats. If temporary dams are to be installed and construction areas dewatered before excavation, a qualified biologist with authorization from the USFWS and DFG should be present to survey for these species during the dewatering operation. If any giant garter snakes or western pond turtles are found, work should cease in that area and authorization should be obtained from the USFWS and DFG to relocate the animals to safe areas before resuming work. In addition, if giant garter snakes are found and would be affected, compliance with the ESA and CESA would be required, and additional habitat compensation or species protection measures may be developed in consultation with the USFWS and DFG.

Impact 8-13: Potential Mortality to, Disturbance of, or Loss of Habitat for California Tiger Salamander and Western Spadefoot

Construction in areas containing vernal pools, ephemeral ponds, or other seasonal wetlands or in grasslands adjacent to these habitats could cause direct mortality to California tiger salamander or western spadefoot, or remove habitat for these species. The potential is relatively low for these species to exist within most of the project area, but they have been recorded in the vicinity of the FSCC pipeline, eastern portion of the intake facility to Zone 40 Surface WTP/FSC pipeline, and areas surrounding Pardee Reservoir. If these species are present in the construction corridor, excavation could cause their direct mortality. This impact is significant. Implementation of Mitigation Measure 8-4 would reduce this impact to a less-than-significant level.

Mitigation Measure 8-4: Conduct Preconstruction Surveys and Compensate for Loss of California Tiger Salamander and Western Spadefoot Habitat if These Species Are Present

Preconstruction surveys should be conducted by a qualified biologist in vernal pool and seasonal wetland habitats as well as grassland habitats within 0.6 mile of potential breeding pools. Aquatic surveys can be conducted from March 15 to May 15 for larvae of these species; nocturnal surveys for adult and juvenile California tiger salamander can be conducted in terrestrial habitats during winter rains from November through March. The DFG guidelines for California tiger salamander surveys specify two consecutive years of aquatic surveys combined with a winter nocturnal survey consisting of five visits to demonstrate absence of this species. Alternatively, FRWA can assume these species are present in the affected areas and not perform the surveys.

If these species are found or assumed to be present, and impacts on their habitat cannot be avoided, FRWA would coordinate with USFWS and DFG to determine the appropriate mitigation strategy to compensate for loss of habitat. Habitat loss could be compensated for by implementation of Mitigation Measure 7-11 for vernal pool and other seasonal wetland habitats. In addition, specific management measures for California tiger salamander and western spadefoot could be developed as part of the compensation plan in coordination with USFWS and DFG.

Impact 8-14: Loss of or Disturbance to Active Raptor Nests or Tricolored Blackbird Nests

Construction could result in loss or disturbance of raptor (e.g., white-tailed kite, northern harrier, red-shouldered hawk, American peregrine falcon, prairie falcon) or tricolored blackbird nests. Because disturbance of an active raptor nest would violate Sections 3503 and 3503.5 of the California Fish and Game Code, and because tricolored blackbirds are a federal and state species of concern, this impact is significant. Implementation of Mitigation Measure 8-5 would reduce this impact to a less-than-significant level.

Mitigation Measure 8-5: Conduct Surveys for Nesting Raptors and Tricolored Blackbirds

Monthly surveys should be conducted by a qualified biologist during the spring and early summer (March–July) along the entire pipeline corridor before the start of each phase of construction activities near any suitable nest tree or emergent marsh area. If an active raptor or tricolored blackbird nest is located within 500 ft of a construction area, construction within 500 ft of the nest tree or nesting colony should be avoided or minimized during the nesting season (March 1–June 15) until the young have fledged. If a nest tree or marsh nesting area cannot be avoided, removal of a nesting tree or disturbance of the marsh can occur outside of the nesting season.

Impact 8-15: Disturbance of Nesting Swainson’s Hawks

Construction activities could disturb Swainson’s hawks nesting in the project vicinity, which could result in nest abandonment or force early fledging, which could cause death of nestlings. Because Swainson’s hawk is a state- listed species, this impact is considered significant. Implementation of Mitigation Measures 8-5 and 8-6 would reduce this impact to a less-than-significant level.

Mitigation Measure 8-6: Consult with California Department of Fish and Game If Swanson’s Hawks Are Present and Follow Mitigation Guidelines to Avoid Disturbance of Nesting Swainson’s Hawks

If an active Swainson’s hawk nest is found during preconstruction surveys or reported to exist within 0.5 mile of the pipeline corridor, DFG should be consulted if construction is scheduled during the nesting season (March 1–June 15). DFG mitigation guidelines for Swainson’s hawk recommend a 0.5-mile radius of no disturbance around active nests between March 1 and completion of the fledging period (approximately August 15). If a nest tree must be removed, it can be done outside of the nesting and fledging season.

Impact 8-16: Loss of Swainson's Hawk Foraging Habitat

Installation of the proposed water treatment plant could result in loss of agricultural land that provides foraging habitat for Swainson's hawk. Because Swainson's hawk is a state-listed species, this impact is significant. Implementation of Mitigation Measure 8-7 would reduce this impact to a less-than-significant level.

Mitigation Measure 8-7: Consult with Department of Fish and Game and Sacramento County and Compensate for Loss of Foraging Habitat
If agricultural habitat is removed within 10 miles of a known, active Swainson's hawk nest, DFG should be consulted to determine appropriate compensation to replace lost foraging habitat. Habitat compensation ratios would depend on the distance of the affected habitat from known, active nests, as specified in DFG and Sacramento County mitigation guidelines for Swainson's hawks.

Impact 8-17: Loss of, or Disturbance to, Nesting Western Burrowing Owls

Construction in areas containing occupied burrowing owl burrows could cause direct mortality of burrowing owls or disturb nesting birds, which could result in nest abandonment. Because the burrowing owl is a state species of special concern and a federal species of concern, this impact is significant. Implementation of Mitigation Measures 8-5 and 8-8 would reduce this impact to a less-than-significant level.

Mitigation Measure 8-8: Consult with California Department of Fish and Game and Follow the Burrowing Owl Mitigation Guidelines
If an active burrowing owl burrow is found during the raptor surveys (see Mitigation Measure 8-5) or is reported to exist within 500 feet of the pipeline construction corridor, DFG should be consulted. DFG mitigation guidelines for burrowing owl recommend a no-disturbance buffer area of 160 ft surrounding occupied burrows during the nonbreeding season (September 1–January 31) and 250 ft during the breeding season (February 1–August 31).

If an active burrowing owl burrow cannot be avoided during construction, FRWA should consult with DFG regarding the appropriate mitigation measures. DFG's guidelines recommend providing artificial burrows near the existing burrows at a 2:1 replacement ratio for each burrow destroyed. After installation of the artificial burrows, the owls can be moved away from the affected area approximately two weeks before construction by passive relocation, as described in the mitigation guidelines.

Impact 8-18: Potential Loss of Habitat for Sacramento Anthicid Beetle and Sacramento Valley Tiger Beetle

Construction at stream crossings could remove habitat for the Sacramento anthicid beetle and Sacramento Valley tiger beetle. Because these beetles are rare and are federal species of concern, loss of potential habitat is a significant impact. Implementation of Mitigation Measures 7-7 and 7-8 in Chapter 7, “Vegetation and Wetland Resources,” which specify measures to avoid, minimize, and compensate for impacts on riparian habitats, would reduce this impact to a less-than significant level.

Alternative 6

In addition to the impacts previously identified for Alternatives 2–5, the following impacts could occur under Alternative 6.

Impact 8-19: Loss of or Alteration to Riparian Wildlife Habitat

Clearing and inundation of riparian vegetation along the upper Mokelumne River would reduce potential habitat for riparian-dependent wildlife species, including amphibian species of concern, such as foothill yellow-legged frog, and avian species of concern, such as yellow warbler and yellow-breasted chat. Riparian habitats provide high value for wildlife, are relatively scarce, and have been substantially diminished in the project region as a result of historical water impoundments and diversions. Unaffected riparian habitats in the vicinity are likely to be at or near carrying capacity for resident wildlife species. Therefore, populations of riparian-dependent species would be adversely affected in the project area. This impact is significant. Implementation of Mitigation Measures 7-15 and 7-8 in Chapter 7 would reduce this impact to a less-than-significant level.

Impact 8-20: Potential Mortality to or Disturbance of Nesting Cliff Swallows

Construction activities, including demolition of existing structures, could destroy or disturb active cliff swallow nests located on the South Spillway buttress. Because cliff swallows are protected under the Migratory Bird Treaty Act, mortality to cliff swallows or disturbance of active nests would be a significant impact. Implementation of Mitigation Measures 8-9 and 8-10 would reduce this impact to a less-than-significant level.

Mitigation Measure 8-9: Conduct Preconstruction Surveys for Nesting Birds

In areas where construction activities would occur during the nesting season (February 1–July 31), a qualified biologist should perform preconstruction surveys for nesting birds at an appropriate time during or just prior to the nesting season to determine occupancy status. If nesting migratory or special-status bird species are present, implement Mitigation Measure 8-10 to avoid direct impacts on nesting birds or disturbance of active nests.

Mitigation Measure 8-10: Avoid Active Nests during the Breeding Season

If any nesting migratory or special-status birds are identified during preconstruction surveys, avoid activities, such as tree removal or demolition of structures, that would destroy active nests until nesting is completed and the young have fledged. Where active nests are located, an appropriate species- and site-specific buffer zone (25–100 feet) should be established around the nests to avoid disturbance of nesting birds. Nest avoidance buffers should be determined and marked with flagging by a qualified biologist, and construction personnel should be informed to avoid these areas during the nesting season.

Impact 8-21: Mortality to or Disturbance of Nesting Birds in the Vegetation Clearance and Inundation Zone

Removal of trees and shrubs between the existing shoreline and 601-foot elevation contour could destroy or disturb active bird nests, including those of migratory birds and other special-status species, such as California thrasher, Bell's sage sparrow, oak titmouse, Nuttall's woodpecker, and Cooper's hawk. If tree removal activities occur during the nesting season, birds could be crushed by equipment, nests may be abandoned, or the young may be forced to fledge early, which could reduce survivorship. Because avian species of concern could be adversely affected, and several other species that nest in the area are protected under the Migratory Bird Treaty Act, this would be a significant impact. Implementation of Mitigation Measure 8-11 would reduce this impact to a less-than-significant level.

Mitigation Measure 8-11: Avoid Removal of Trees and Other Vegetation during the Bird Breeding Season

Removal of trees and other vegetation should be avoided during the nesting season (February 1–July 31) in all portions of the inundation zone between the proposed new dam site and the 601-foot elevation contour, with the exception of areas within the immediate footprint of construction activities. Within the construction footprint for project facilities, Mitigation Measures 8-9 and 8-10 may be implemented as described above.

Impact 8-22: Potential Mortality to Roosting Bat Species of Concern

Demolition of existing structures, such as buildings, bridges, siphons or overhangs, or removal of trees could injure or entrap bat species of concern, such as Yuma myotis and pallid bat, which may be roosting in these sites. Mortality or injury to bat species of concern would be a significant impact. Implementation of Mitigation Measure 8-12 would reduce this impact to a less-than-significant level.

Mitigation Measure 8-12: Conduct Preconstruction Bat Clearance Surveys

Prior to demolition activities in areas containing structures that could house bats, a qualified biologist should conduct clearance surveys for bats in these structures. If bats are present, the biologist should implement methods approved and authorized by the resource agencies (DFG and/or USFWS) to flush bats from their roosting sites prior to demolition. Metal screening may then be installed if necessary to prevent bats from reoccupying these structures. Before and during removal of trees from the inundation zone, the biologist should survey the area immediately prior to tree removal to identify trees with large cavities that could provide roosting sites for bats. If bats are present, the biologist should implement resource agency–approved methods to flush bats from these trees immediately prior to their removal.

Roost boxes will be installed if active bat colonies are located in structures or trees that will be affected by the project. FRWA will consult with the resource agencies on the appropriate roost boxes for the species affected.

Chapter 9

Geology, Soils, Seismicity, and Groundwater

Chapter 9
Geology, Soils, Seismicity, and Groundwater

Affected Environment

Geology

Freeport Intake Facility to Mokelumne Aqueducts

Sacramento and San Joaquin Counties are in the Central Valley in terrain consisting mainly of low alluvial plains and fans and dissected uplands, with local crossings of river floodplains and channels. This region is characterized by very gently west-sloping terrain of generally low relief except where it is incised by channels of large streams and the American, Sacramento, Cosumnes, and Mokelumne Rivers.

The region has been tectonically stable throughout the Cenozoic age. Erosion and sedimentation are the primary geologic processes in the area. Subsidence may occur in parts of the region where substantial groundwater extraction has lowered the water table extensively. Mineral resources in the project area include local accumulations of sand and gravel suitable for use as aggregate, some remaining placer gold in alluvium derived from gold-bearing source rocks in the foothills to the east, and natural gas (e.g., the Lodi gas field).

Enlarge Pardee Reservoir

Pardee Reservoir area is located in the western Sierra Nevada, near the margin of the Central Valley. Together, the Central Valley and the Sierra Nevada form a single tectonic province termed the *Sierran Block*, which is a block of basement rocks consisting of metamorphosed volcanic and sedimentary rocks of Paleozoic and Mesozoic age that tilts to the west. Bedding, discontinuities, and faults within this block dip in many directions. The bedrock complex of the western Sierra Nevada is separated into three northwest-trending structural blocks by the Melones fault zone and the Bear Mountain fault zone. From east to west, these three structural blocks are the Calaveras Terrane (east of the Melones fault zone), the Placerville Belt, and the Western Belt, which abuts the Bear Mountains fault zone on the west (Figure 9-1).

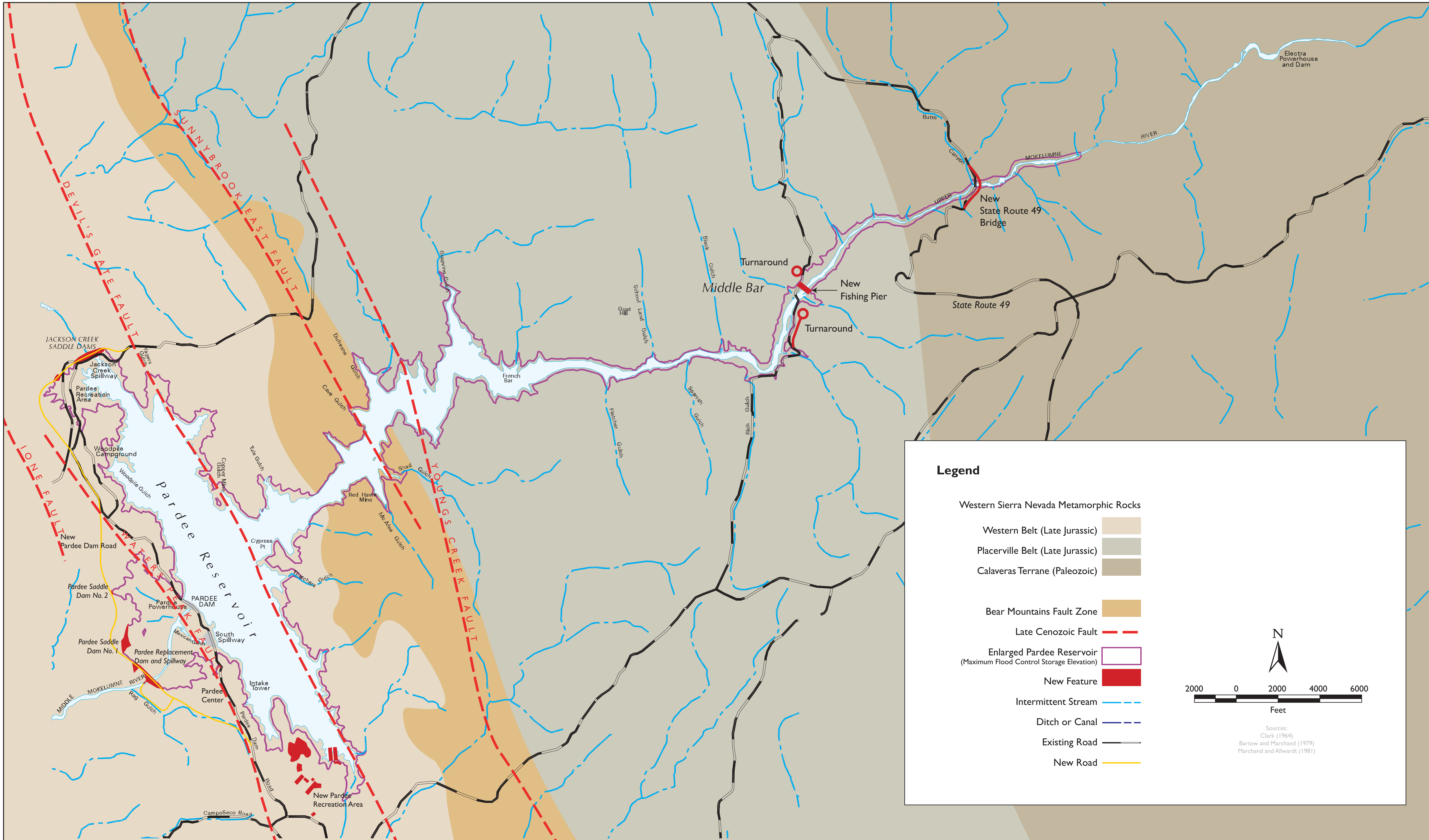
Geologic units at the existing Pardee Dam site include bedrock and overlying surficial materials. The bedrock units are Mesozoic-age, metamorphosed sedimentary and volcanic rocks. Regionally, these rocks are part of a northwest-southeast trending metamorphic belt that extends for a distance of 150 miles. The two bedrock formations present in the vicinity of the Pardee Dam site are the Gopher Ridge Volcanics and Salt Springs Slate. Locally, these formations are overlain by unconsolidated Quaternary stream deposits, landslides, colluvium, and artificial fill. The Gopher Ridge Volcanics is the primary rock unit at the existing Pardee Dam Site and are composed mostly of pyroclastic and flow rocks. The Gopher Ridge Volcanics is in contact with the Salt Springs Slate to the west in Mexican Gulch and in Pardee Reservoir.

The Salt Springs Slate formation underlies most of Pardee Reservoir, where it conformably overlies the Gopher Ridge Volcanics (to the west) and underlies the Copper Hill Volcanics (to the east); it is also exposed from approximately 600 to 3,000 ft west of the reservoir, where it is situated between two separate masses of the Gopher Ridge Volcanics. This pattern of repeated bedrock units along traverses perpendicular to structural trend is common in the Western Belt as a result of intense folding and faulting of these rocks in late Mesozoic time (approximately 150 million years ago).

The proposed dam site is located in the Western Belt, which comprises three bedrock formations: the Copper Hill Volcanics, the Salt Springs Slate, and the Gopher Ridge Volcanics. In particular, the proposed dam site area is in a zone of foliated tuff, which is immediately upstream of a mineralized zone that lies between 4,200 ft and 5,500 ft downstream of the existing Pardee Dam. Uplift and westward tilting of the Sierran Block in the past 5 million years or so has been accompanied by geologically recent faulting along pre-existing zones of weakness that are relics of earlier deformation.

According to the Preliminary Design Summary Technical Report (HCG 1998a), the bedrock at the proposed dam site is suitable for a concrete gravity dam foundation and is of generally higher quality than the bedrock at the existing Pardee Dam.

Active landslides were identified by HCG (1998b) in the Salt Springs Slate along the banks of Mexican Gulch. The landslides take the form of both rock toppling and translational failures. HCG (1998b) also identified a few wedge-type slope failures in the Gopher Ridge Volcanics (greenstone) on the steep slopes above the Mokelumne River between the existing dam and Mexican Gulch. Additionally, debris flows and earth flows were also identified (but not mapped by HCG 1998b) along the shoreline of the reservoir. Slopes surrounding the existing Pardee Dam range from approximately 30 to 50%. Along the shoreline of the Pardee Reservoir within the proposed inundation area, slopes range from approximately 3 to 50% (Sketchley 1965), with the shallowest slopes in the northern end of the reservoir and the steepest upstream of French Bar. At the proposed new dam site, the slopes range from approximately 30 to 70%. At proposed saddle dams 1 and 2, the slopes range from approximately 30 to 50%.



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Jones & Stokes

Figure 9-1
Geology and Soils

Sediments and Soils

Freeport Intake Facility to Mokelumne Aqueducts

Sediments in Sacramento and San Joaquin Counties are characterized by a succession of underlying Tertiary and Quaternary formations and by the residual and alluvial soils that mantle the ground surface throughout the region. The Tertiary formations range from the Eocene (40 million years ago) for the Ione Formation, the oldest basal unit, to the Pliocene (2 million years ago) for the youngest, the Laguna Formation. The complete Tertiary succession consists of the Ione, Valley Springs, Mehrten, and Laguna formations. This Tertiary sequence is overlain by the Quaternary Riverbank and Modesto formations and by younger alluvial accumulations of varying age.

The project features, including the intake facility, Zone 40 Surface WTP, terminal facility, canal pumping plant, and pipeline alignments from the intake facility to the Zone 40 Surface WTP/FSC are underlain by the Riverbank and Laguna formations. Review of the Natural Resources Conservation Service's (NRCS's) Soil Survey Geographic Data Base indicates that about half of each alignment traverses soils that are highly corrosive to steel, and about half have an erosion hazard rating above slight. About a third of the soils traversed by the alignment are designated as having moderate to high shrink/swell potential, and about a third are designated as having low strength.

Most of the proposed pipeline alignments, water treatment plant, and pumping stations are on gentle slopes and therefore a relatively low erosion hazard. Erosion hazard is highest in and near streams and rivers.

Enlarge Pardee Reservoir

Surficial deposits occur in the general area in the form of landslide deposits, artificial fill, stream deposits, and colluvium. Areas of active landsliding have been identified in the Salt Springs Slate along the banks of Mexican Gulch (about 600 ft downstream from the existing dam site, about 3,600 ft upstream from the proposed dam site) and a few small wedge failures in the Gopher Ridge Volcanics (greenstone) in the steep slopes above the Mokelumne River. Artificial fill is present around Pardee Dam and in the vicinity of abutments, the powerhouse, spillway, roads, and benches. Colluvium, which is prone to landsliding and downslope creep during periods of heavy rainfall, has accumulated on the lower hillslopes and drainage swales overlying bedrock.

Based on the Soil Conservation Service (SCS) soil survey of the Amador area (Sketchley 1965), the soils within the proposed inundation area, at the proposed new dam, and at proposed saddle dams are generally very shallow to shallow over hard, fractured rock or weathered rock of the Auburn and Exchequer series.[1] The surface soil texture is generally rocky to very rocky loam or silt loam, and the subsoil (where present) is generally clay loam. In some areas, no appreciable soil material exists; such areas are mapped by the SCS as Rock land or Serpentine rock land. The soils have a surficial erosion hazard ranging from moderate to very severe. The soils' permeability is moderate to moderately slow, they are well drained or somewhat excessively drained, and their runoff rates are medium to very rapid.

Seismicity

Freeport Intake Facility to Mokelumne Aqueducts

Historically, little seismic activity has occurred in Sacramento and San Joaquin Counties, and no earthquakes exceeding magnitude 3.0 on the Richter scale have been recorded within an approximate 20-mile radius of this portion of the project area (CH2M Hill and Montgomery Watson 1996). The region is underlain by crystalline basement rock and overlying Cenozoic-age strata that have shown no evidence of local faulting for more than 40 million years.

The epicenters of most recorded earthquakes stronger than Richter magnitude 3.0 felt in Sacramento and San Joaquin Counties are coincident with the major faults in the San Francisco Bay Area. Major seismic sources (i.e., faults and fault systems) located in the immediate vicinity that could create moderate to strong ground shaking in the area, their corresponding maximum credible earthquakes (defined as the largest earthquake that a fault segment is considered capable of generating under the current tectonic setting and based on current knowledge.), and approximate distance and direction from the project area are shown in Table 9-1. The maximum credible earthquakes with the potential to have the greatest effect on the project area are a magnitude 7.0 event occurring on the Coast Ranges–Sierran Block fault and a 6.5 event occurring in the Prairie Creek–Spenceville-Dentman system. These seismic systems are projected to cause peak ground accelerations in the project area of between 0.1 and 0.2 g (California Department of Transportation 1996). (One g is equal to the force of gravity.)

[1] No detailed soil survey mapping is available for the Calaveras County part of the project area. However, because the geologic formations, topography, and vegetation there are similar to the Amador County part, it is reasonable to assume that the range of soil characteristics in the Calaveras County part are similar to those in Amador County.

Table 9-1. Major Seismic Sources with Potential to Affect Project Components from the Freeport Intake Facility to the Mokelumne Aqueducts

Seismic Source (Fault/Fault System)	MCE	Approximate Distance from Alignments (miles)	General Direction from Project Area
Big Bend–Wolf Creek–Maidu–Bear Mountain	6.50	18–25	Northeast
Coast Ranges–Sierran Block	7.00	23–43	Southwest
Dunnigan Hills	6.50	26–61	Northwest
Forest Hill–Melones	6.50	18–37	Northeast
Prairie Creek–Spenceville-Dentman	6.50	12–28	Northeast

MCE = Maximum Credible Earthquake, Richter magnitude

Water-saturated alluvium along the Sacramento River and some smaller streams could be subject to liquefaction if exposed to seismic ground shaking. (Liquefaction is the rapid loss of soil/sediment-bearing strength by ground shaking. Sediments and soils most subject to liquefaction are low cohesion, and silty or sandy materials saturated by groundwater within 50 feet of the surface.)

The liquefaction hazard at the proposed water treatment plants and the proposed pumping station sites is inferred to be low, based on their location on old terraces, plateaus, or hills, where the sediments or rocks are consolidated and the groundwater deep.

Enlarge Pardee Reservoir

Bedrock in the western Sierra Nevada is sheared and faulted as a result of deformation that most likely occurred during the Mesozoic age (143–163 million years ago). Two known fault zones exist in the proposed Pardee Dam area. The Melones and Bear Mountains fault zones, trending north-south, lie just to the east of the existing Pardee Dam site and northeast of the proposed dam site (Figure 9-1). Youngs Creek Fault, Devils Gate Fault, Waters Peak fault, and Ione Fault are all relatively near the existing dam and the proposed dam site. The closest known fault exposed near the existing and proposed dam sites is the Waters Peak fault zone. The Waters Peak fault zone crosses the Mokelumne River gorge approximately 550 ft downstream from the existing dam (about 3,650 ft upstream from the proposed dam site), crossing the South Spillway channel approximately 200 ft downstream from the spillway and 0.6 mile from the proposed dam site. The largest peak acceleration within the proposed dam site area is between 0.3 and 0.4 g (California Department of Transportation 1996). Table 9-2 illustrates the distance of the proposed dam site from each fault and the estimated maximum credible earthquake on each fault (HCG 1998b).

Table 9-2. Major Seismic Sources with Potential to Affect the Enlarge Pardee Reservoir Component

Fault	MCE	Approximate Distance from Proposed Dam Site (miles)	General Direction from Project Area
Youngs Creek	6.4	2.9	East
Devils Gate	6.4	1.3	East
Waters Peak	6.3	0.6	Northeast
Ione	6.4	1.0	Northwest

Note:

MCE = Maximum Credible Earthquake, Richter magnitude

Source: HCG 1998c.

Because of the absence of silty or sandy unconsolidated sediments, the liquefaction hazard at the proposed new dam site and saddle dams is expected to be low.

Reservoir-Induced Seismicity

In 1945, a relationship was recognized between the level of water impounded at Hoover Dam and the frequency of earthquakes at Lake Mead. The relationship between reservoirs and earthquakes is referred to as *reservoir-induced seismicity* (RIS). Since 1945, approximately 120 cases of RIS have been reported from the approximately 30,000 reservoirs worldwide.

RIS can be influenced by many factors, including reservoir size, reservoir geology, operation and filling characteristics, and preexisting tectonic stresses (stresses in the surface of the earth's crust). Seasonal water-level fluctuations and reservoir filling rates are two factors that influence tectonic stress changes beneath a reservoir, but reservoir-induced stresses alone are not sufficient to cause earthquakes. Under certain conditions, however, the stress changes caused by reservoir loading could trigger a seismic event in regions where stress conditions are already close to causing an earthquake. The majority of significant cases of RIS are associated with reservoirs that are very large or deep. In addition, as discussed below, most RIS events are of small magnitude and often occur unnoticed.

Reservoirs modify the tectonic stress regime by increasing elastic stress during reservoir filling and increasing subsurface pore pressures. For any particular site, the interaction between a reservoir and the geologic environment depends on local geologic and hydrologic conditions.

Groundwater

This section describes groundwater conditions in the geographic areas where the project alternatives would be constructed and areas where project implementation may have secondary impacts. Chapter 18, "Programmatic Evaluation of a Groundwater Banking/Exchange Component to the Freeport Regional Water Project," contains a detailed discussion of the potential benefits and impacts of groundwater banking and exchange in the Sacramento area.

Freeport Intake Facility to Mokelumne Aqueducts

The project area overlies parts of the Sacramento County and eastern San Joaquin County groundwater basins. These basins consist of an upper unconfined water table within the unconsolidated Quaternary deposits and a series of deeper confined or semi-confined aquifers in the Laguna and Mehrten formations. The upper unconfined aquifer ranges in thickness from 200 ft to more than 1,000 ft and averages about 800 ft. It is recharged partly by direct infiltration of precipitation and agricultural irrigation and partly by underflow from the channels of the larger streams, especially the Cosumnes River, Dry Creek, and the Mokelumne River.

Groundwater levels in the vicinity of the proposed pipeline alignments and other project components from the intake facility to the Zone 40 Surface WTP/FSC were measured between about 18 and 106 ft below the land surface in 2000, with the shallowest depths near the Sacramento River and the deepest near the FSC. Depths to groundwater were greater in the vicinity of the alignments and other project components from the FSC to the Mokelumne Aqueducts (FSCC pipeline alignment), ranging between about 143 and 168 ft below the land surface (California Department of Water Resources 2002).

Groundwater conditions are expected to vary along the pipeline alignments; groundwater levels near rivers and streams would be affected by in-channel flow levels and would fluctuate seasonally. The water table would likely be deeper in areas distant from surface channels or water bodies; however, local perched groundwater could be present in some areas along the pipeline alignments (CH2M Hill and Montgomery Watson 1996).

Enlarge Pardee Reservoir

Groundwater was detected by HCG (1998d) at a depth of 5 ft in borings located along the channel of the Mokelumne River beneath the proposed new dam. This shallow depth is expected to be directly associated with the river water. However, in other borings located beneath the dam site on the slopes above the river canyon, groundwater was at 85 ft to more than 135 feet below grade.

At proposed saddle dam 1, a boring located adjacent to a drainage swale detected groundwater at a depth of 2.5 feet below grade (HCG 1998d); the depth to groundwater on the higher slopes beneath the proposed saddle dam is expected to be considerably deeper.

No information is readily available on groundwater at the proposed saddle dam 2 site; however, based on topography and depths to groundwater at the other saddle dam sites, it is expected to be similar to or deeper than at saddle dam 1.

At the proposed Jackson Creek saddle dams, groundwater was observed at a depth of approximately 8 feet below grade in the lower elevation areas near the reservoir water surface (HCG 1998e). It is deeper on the higher elevations.

South-of-Delta Agricultural Lands

Groundwater is used for irrigation by several CVP agricultural contractors, most notably those in agricultural areas south of the Sacramento—San Joaquin Delta such as San Joaquin River, Tulare Lake, and South Coast hydrologic regions. Groundwater conditions in these regions are generally characterized by alluvial aquifer systems that support significant groundwater development. The California Water Plan Update Bulletin 160-98 estimates for 1995 level groundwater supplies in these regions are shown in Table 9-3.

Table 9-3. Estimated 1995 Level Groundwater Supplies for Selected Hydrologic Regions (af)

Region	Average	Drought
South Coast	1,177,000	1,371,000
San Joaquin River	2,195,000	2,900,000
Tulare Lake	4,340,000	5,970,000

In these hydrologic regions, water users frequently take advantage of surface water available in wet years to recharge groundwater basins. In drought years when surface water is not available, water users increase groundwater pumping. Groundwater overdraft, which occurs in the San Joaquin River and Tulare Lake regions, is expected to decline by 2020 as a result of reduced irrigated acreage in drainage problem areas (California Department of Water Resources 1998).

Environmental Consequences

Methods and Assumptions

The evaluation of impacts related to geology, soils, seismicity, and groundwater was based on consideration of construction procedures and project design provided by the project engineers and review of available data and information, including publications of the USGS, NRCS, DWR, and other relevant sources.

Significance Criteria

According to Appendix G of the State CEQA Guidelines, a significant impact normally would result if the project would:

- expose people or structures to potential substantial adverse effects, including the risk of loss, injury, or death involving:
    - rupture of a known earthquake fault,
    - strong seismic ground shaking,
    - seismic-related ground failure, including liquefaction, and
    - landslides;
- result in substantial soil erosion or loss of topsoil;
- be located on a geologic unit or soil that is unstable, or that would become unstable as a result of the project, and potentially result in on- and off-site landslide, lateral spreading, subsidence, liquefaction or collapse; or
- be located on expansive soil, creating substantial risks to life or property;
- substantially deplete groundwater supplies or interfere substantially with groundwater recharge.

Less-than-Significant Impacts

Alternative 1

No FRWP facilities would be constructed under Alternative 1. No construction-related or operation-related impacts are associated with this alternative.

Alternatives 2–5

Alternatives 2 through 5 differ only in the pipeline alignments from the Freeport intake facility to the FSC. Project construction and operation for Alternatives 2 through 5 are very similar. Impacts related to geology, soils, seismicity, and groundwater for each alternative differ only slightly from each other; therefore, the results for Alternatives 2 through 5 are presented together but are representative of each individual alternative, unless otherwise noted.

Construction-Related Impacts

Impact 9-1: Localized Erosion and Sedimentation

Construction of the project components would require cut-and-fill operations, grading for site preparation and access, trenching, boring, and removal of vegetation. Most of the proposed pipeline alignments from the intake facility to the Zone 40 Surface WTP/FSC and the FSCC alignment are on gentle slopes; a few pipeline segments have steeper slopes, as do some of the pumping plant and treatment facilities. Accordingly, there is overall minimal potential for substantial slope failure and surficial erosion during and after construction.

The potential for erosion and sedimentation could be high at the intake facility site on the Sacramento River, where soils within the river channel would be disturbed. Sediment could also be directly introduced into Dry Creek from trenching across the channel. Additionally, drilling fluids and sediment could be introduced into the Mokelumne River during boring operations from “frac-outs” (seepage of drilling fluids from the bore alignment up to the bed of the river) and releases at the bore pit sites on both sides of the river.

The project would need to comply with the RWQCB’s requirements for discharges from general construction activity and trench dewatering in accordance with the NPDES. These requirements call for implementation of a SWPPP identifying the BMPs to be employed during and following construction to control soil erosion and possible waste discharges into waterways. BMPs may include, but would not be limited to, construction of berms and runoff diversion ditches, construction of temporary cofferdams to dewater work areas, hydroseeding, use of sediment retention devices, monitoring the Mokelumne River channel for frac-outs, and similar measures. The SWPPP also would specify measures for removing sediment from water pumped for trench dewatering before the water is released to waterways. The project would also include implementation of an erosion control plan that complies with all applicable city and county regulatory requirements for construction.

Given the duration of construction and the area covered by the project, the RWQCB could require specific pollution control measures through the issuance of waste discharge requirements pursuant to the state Porter-Cologne Water Quality Control Act. Long-term BMPs, such as revegetation of exposed soil, would also be implemented to minimize erosion after construction.

Erosion and sedimentation would be minimized because construction practices would be conducted in accordance with the SWPPP, erosion control plan, and all applicable NPDES and local agency requirements. The impact associated with localized erosion and sedimentation is considered less than significant because of the nearly level slopes on which project facilities would be located and the implementation of RWQCB requirements. No mitigation is required.

Impact 9-2: Hydrologic Hazards

Trench dewatering would be required in areas where the soil is saturated with surface water or shallow groundwater. Dewatering could temporarily interrupt natural hydrology or induce local soil subsidence. These effects would be avoided or minimized through standard engineering procedures that will be developed after the project geotechnical investigations have been completed. This impact is less than significant. No mitigation is required.

Impact 9-3: Destruction of Unique Geologic Features

No unique geologic features that could be adversely affected by project construction are known to exist along the alignments or near other project components. No impact would occur.

Operation-Related Impacts

Impact 9-4: Ground Shaking and Fault Rupture

No known faults exist in Sacramento and San Joaquin Counties in areas where the intake facility to Zone 40 Surface WTP/FSC or FSCC pipeline alignments and other project components would be constructed. Accordingly, there is a low hazard of surface fault rupture. Strong seismic activity is not anticipated in the pipeline or pumping plant area (see Table 9-1). For all project components, seismic safety measures would be incorporated into design and construction procedures. This impact is less than significant. No mitigation is required.

Impact 9-5: Increased Groundwater Pumping and Associated Subsidence South of the Delta

As described in Chapter 3, “Hydrology, Water Supply, and Power,” and Sections 3.4 and 3.5 in the Modeling Technical Appendix (Volume 3 in this EIR/EIS), the hydrologic modeling for the FRWP alternatives indicates that CVP agricultural contractors south of the Delta (primarily in the San Joaquin Valley) may experience slight reductions in water deliveries as a result of implementation of these alternatives. The modeling indicates that these reductions are expected to average approximately 2,900 af per year during all years, and approximately 5,600 af per year during the dry years. During these periods, average annual deliveries to CVP south of Delta agricultural contractors are approximately 1,080,000 af per year (average years), and 310,000 af per year (dry years), representing a –0.3% and –1.8% change in deliveries, respectively. No change in deliveries is expected for other CVP contractors.

Average annual deliveries to SWP contractors are expected to be slightly reduced (approximately 2,800 af per year total). However, during dry periods, average annual deliveries are expected to increase by approximately 11,000 af per year. During these periods, total SWP deliveries are approximately 2,950,000 af per year (average years) and 1,900,000 af per year (dry years), representing a –0.1% and +1.0% change, respectively.

Although the response of water purveyors and individual water users is not possible to predict accurately, the potential minor reductions in water deliveries could conceivably result in a response by affected water purveyors and individuals to pump additional groundwater to meet water needs in the San Joaquin Valley and coastal southern California. Currently, groundwater pumping in the San Joaquin Valley is estimated at between approximately 2,100,000 (average years) and 2,900,000 af per year (dry years), depending on year type. Within the coastal southern California area (where most SWP water is used), groundwater pumping is currently estimated to range between about 1,200,000 (average years) and 1,400,000 af per year (dry years) (California Department of Water Resources 1998).

Under a very conservative assumption that any reductions in deliveries would lead directly to a proportional increase in groundwater use, the FRWP alternatives may result in an increase in groundwater use in the San Joaquin Valley during dry years of approximately 0.2%. Making a similar assumption, average annual reductions in deliveries to SWP contractors could lead to increased groundwater use of approximately 0.3%. However, this conservative assumption does not reflect actual responses to any minor reductions in deliveries. Water purveyors and individuals would likely have independent responses to changes in water supply. The range of responses could include not planting crops on a portion of land, changing crop patterns, increasing irrigation efficiencies or accepting reduced yields, acquiring water from other sources, and water conservation, in addition to increased groundwater pumping.

Based on this information, any potential impact would be less than significant. Even under extremely conservative assumptions, any increase in groundwater pumping would be much less than 1% of existing levels, and there is no evidence to suggest that such a minor increase in the already large volume of groundwater pumping would have any effect on groundwater levels, availability, quality, or surface subsidence. It is not possible to predict how each water purveyor and individual would respond to minor reduction in one water supply source. This impact is considered speculative. No further analysis is required.

Alternative 6

As described in Chapter 2, “Project Description,” Alternative 6 consists of enlarging Pardee Reservoir and conveying water from the Sacramento River. Alternative 6 includes the following project components: enlarge Pardee Reservoir (which includes additional components), Freeport intake facility, pipeline from intake facility to the Zone 40 Surface WTP, and the Zone 40 Surface WTP. Though slightly different in size, the Freeport intake facility, pipeline from the intake facility to the Zone 40 Surface WTP, and the Zone 40 Surface WTP project components, are the same as those that make up Alternative 5. Therefore, several of the impacts associated with Alternative 5 (described above) are also associated with Alternative 6 and are restated below. Additionally, impacts associated with the enlarge Pardee Reservoir component of this alternative are described below.

Construction-Related Impacts

Impact 9-6: Localized Construction-Related Erosion and Sedimentation

Impacts associated with the project components from the Freeport intake facility to the Zone 40 Surface WTP would be the same as for Alternatives 2–5, described above.

Construction of the new replacement dam and saddle dams and extraction of borrow material would require removal of vegetation and grading for site preparation and access and for cut-and-fill operations. Because slopes are generally steep and the soils erodible in these areas, substantial shallow slope failure and accelerated erosion and sedimentation could occur if measures are not implemented to control such processes. However, as described above for Alternatives 2–5, the project would need to comply with the RWQCB's requirements for discharges from general construction activity in accordance with the NPDES. The impact associated with accelerated erosion and sedimentation is considered less than significant because the BMPs are expected to effectively control the erosion to the point that there is not a substantial increase in erosion rates. This impact is less than significant. No mitigation is required.

Impact 9-7: Hydrologic Hazards

Trench dewatering impacts associated with construction of the project components from the Freeport intake facility to the Zone 40 Surface WTP would be similar to those described in Alternatives 2–5. In areas where the soil is saturated with surface water or shallow groundwater, trench dewatering would be required and could temporarily interrupt natural hydrology or induce local soil subsidence. These effects would be avoided or minimized through standard engineering procedures that will be developed after the project geotechnical investigations have been completed. This impact is less than significant. No mitigation is required.

Impact 9-8: Destruction of Unique Geologic Features

As mentioned above in Alternatives 2–5, no unique geologic features that could be adversely affected by project construction are known to exist near the project components from the Freeport intake facility to the Zone 40 Surface WTP. Also, no unique geologic features would be adversely affected by construction of the enlarge-Pardee-Reservoir component. No impact would occur.

Operation-Related Impacts

Impact 9-9: Ground Shaking and Fault Rupture

Impacts associated with the project components from the Freeport intake facility to the Zone 40 Surface WTP would be the same as for Alternatives 2–5, described above.

No faults are known to underlie the new replacement dam site; therefore, surface fault rupture is not expected. However, a potential exists for ground shaking from a seismic event, which could affect the replacement dam. The replacement dam will be designed for the Maximum Credible Earthquake (MCE). The Division of Safety of Dams (DOSD) uses the MCE for developing dam design ground motions. The MCE magnitude, distance from the source fault to the replacement dam site, and appropriate statistical level of ground shaking are considered in computing design ground motions. The four faults that have been considered in the seismic design of the dam (i.e., Youngs Creek, Devils Gate, Waters Peak, and Ione faults) have an MCE of 6.3 to 6.4 (see Table 9-2). The replacement dam would be designed so that seismically induced damage would be accessible to inspection and would be repairable. All foundations would be designed to remain elastic when subjected to the MCE, allowing inelastic behavior to occur only above the level of 2.0 (HCG 1998c). For all project components, seismic safety measures would be incorporated into construction procedures, and applicable Uniform Building Code requirements would be met. This impact is less than significant. No mitigation is required.

Impact 9-10: Potential for Reservoir-Induced Seismic Event

The probability of a reservoir-induced earthquake occurring as a result of impounding water in the enlarged Pardee Reservoir is low. Reservoir impoundment is capable of causing an earthquake only along critically stressed faults that are already close to the point at which an earthquake would naturally occur. If RIS were to occur, the most probable activity would be small-magnitude earthquakes. The maximum magnitude of an earthquake is determined by the geometry and size of the rupture area. Because the enlarged Pardee Reservoir would not alter these physical dimensions, the maximum reservoir-induced earthquake would not exceed the MCE for a given fault.

The timing of possible RIS events cannot be accurately predicted. Based on observations of other reservoirs in California, however, such events would be most likely to occur during periods when reservoir water levels fluctuate rapidly or during reservoir filling. Rapid reservoir water-level fluctuations, which could enhance the possibility of a seismic event, would be unlikely at the enlarged Pardee Reservoir because the proposed reservoir would have a relatively high volume-to-depth ratio; large reservoir releases would result only in minor decreases in reservoir depth, thus minimizing tectonic stress changes beneath the reservoir.

The potential for RIS associated with the enlarged Pardee Reservoir is considered to have a very low probability of occurrence. No seismic activity has been associated with either Pardee Reservoir or Camanche Reservoir. There is no evidence to suggest that an enlarged Pardee Reservoir would result in RIS. This potential impact is speculative. No further analysis is warranted.

Impact 9-11: Erosion and Sedimentation within the Expanded Reservoir Inundation Zone from Reservoir Operations

Reservoir operation-related effects (i.e., raised water levels and subsequent lowering) may result in accelerated rates of soil erosion and soil mass movement along the shoreline of the reservoir. Among reservoirs in general, such effects may occur in the form of three primary mechanisms or types: (1) sheet erosion caused by the lack of vegetation cover from clearing or inundation; (2) mass movement (i.e., mass wasting or landsliding) caused by reduction of soil shear strength from saturation and rapid water level drawdown and by lowered soil shear resistance caused by mortality of deep-rooted, woody vegetation; and (3) erosion of areas particularly subject to wave action. Mass movements may be triggered by earthquake-induced ground shaking or occur in the absence of ground shaking. Further, undercutting of slopes by wave action may undermine areas prone to mass movement, thereby increasing the potential for this type of erosion to occur.

Factors that control whether one or more of these mechanisms of shoreline erosion occurs can be categorized as activating or passive (Reid 1993). Activating factors are those that trigger erosion. In the context of Alternative 6, possible activating factors are raindrop impact, sheetflow runoff, inundation, and rapid drawdown. Passive factors are properties inherent in the slope material or in the geometry of the slope. They exist all or most of the time and cause the slope to be relatively susceptible to activating factors (Reid 1993).

Passive factors include soils with high clay content (particularly expansive clays), alternating weak and strong beds of sediments with adverse bedding plane orientation, high moisture content, steep slopes, and lack of vegetation from wind-driven waves (Reid 1993). Along the shoreline of Pardee Reservoir, existing passive factors are limited to steep slopes and lack of vegetation (the latter as a result of vegetation clearing).

Based on the water surface elevation model, described in the Modeling Technical Appendix (Volume 3), the water level of the reservoir would almost always be at 601 ft elevation (i.e., up to the level of vegetation clearing). Accordingly, the removal of vegetation between 568 and 601 ft is expected to result in the loss of most of the soil above the more resistant bedrock within this zone and probably some of the soil slightly above it, the latter a result of undermining of the soil below it. Additionally, root systems of vegetation above 601 ft. may be disrupted from the clearing operation, making the soils more prone to slippage. According to Chapter 7, “Vegetation and Wetland Resources,” vegetation clearing will be conducted over an approximate 963-acre area; consequently, loss of soil into the reservoir would occur over this same (and possibly a greater) area. In areas with steep slopes that are subject to significant wave run-up, wave action may undermine the soils slightly above 601 ft elevation.

The eroded soil would enter the reservoir and increase its turbidity. The coarser sediments will tend to settle to the bottom and the finer sediments (i.e., clay- and silt-sized particles) may be suspended long enough to be carried over the reservoir spillway. The volume of the eroded soil relative to the volume of sediment that enters the reservoir under existing conditions is unknown. Most of the shoreline slope soil erosion is expected to occur within the first 5–10 years following project construction, until the slope/soil above 601 ft reaches a stable angle of repose. The effects of this sedimentation are described in Chapter 5, "Fish," Chapter 3, "Hydrology," and Chapter 4, "Water Quality," and determined to be less than significant.

The water surface elevation model also shows that the water level may be raised from 601 to 614 ft to accommodate very infrequent inflow events (i.e., less frequent than every 100 years on average), after which the level is expected to return to 601 ft within 7 days. Accordingly, vegetation above 601 ft elevation is not likely to be significantly adversely affected to the point that soil cover is lost to the extent that accelerated erosion occurs. In the event that it does occur, the potential impact is addressed in Chapter 7, "Vegetation and Wetland Resources." In Chapter 7, mitigation measure 7-8 implements a monitoring and adaptive management program that would monitor conditions over the life of the project, identify any impacts, and mitigate according to Mitigation Measure 7-7. Mitigation Measure 7-7 compensates for the loss of riparian vegetation.

However, rapid drawdown of the water level to 601 ft following a high inflow event may cause localized mass movement within the zone from 601 ft to above the elevated water level. Because the soils that fringe the reservoir shoreline are generally shallow over bedrock, the depth of the mass movement would probably be less than 3 ft. Because any mass movement would tend to be localized and shallow and occur infrequently, the impact is less than significant. No mitigation is required.

Impact 9-12: Increased Groundwater Pumping and Associated Subsidence South of the Delta

As described in Chapter 3, "Hydrology, Water Supply, and Power," and Sections 3.4 and 3.5 in the Modeling Technical Appendix (Volume 3), the hydrologic modeling for the FRWP alternatives indicates that CVP agricultural contractors south of the Delta (primarily in the San Joaquin Valley) may experience small changes in water deliveries as a result of implementation of this alternative. The modeling indicates that these changes are expected to result in an annual average increase of approximately 1,100 af per year during all years, and an annual average reduction of approximately 2,000 af per year during dry years. During these periods, average annual deliveries to CVP south of Delta agricultural contractors are approximately 1,080,000 af per year (average years), and 310,000 af per year (dry years), representing a +0.1% and –0.2% change in deliveries, respectively. No change in deliveries is expected for other CVP contractors.

Average annual deliveries to SWP contractors are expected to be slightly reduced (approximately 3,000 af per year total). During the dry period, average annual deliveries are expected to be reduced by approximately 6,900 af per year. During these periods, total SWP deliveries are approximately 2,950,000 af per year (average years) and 1,900,000 af per year (dry years), representing a –0.2% and + 0.6% change, respectively.

Although the response of water purveyors and individual water users is not possible to predict accurately, the potential minor reductions in water deliveries could conceivably result in a response by affected water purveyors and individuals to pump additional groundwater to meet water needs in the San

Joaquin Valley and coastal southern California. Currently, groundwater pumping within the San Joaquin Valley is estimated at between approximately 2,100,000 (average years) and 2,900,000 af per year (dry years), depending on year type. Within the coastal southern California area (where most SWP water is used), groundwater pumping is currently estimated to range between about 1,200,000 (average years) and 1,400,000 af per year (dry years) (California Department of Water Resources 1998).

Under a very conservative assumption that any reductions in deliveries would lead directly to a proportional increase in groundwater use, the FRWP alternatives may result in an increase in groundwater use in the San Joaquin Valley during dry years of approximately 0.1%. Making a similar assumption, long-term average annual reductions in deliveries to SWP contractors could lead to increased groundwater use of approximately 0.3%. However, this conservative assumption does not reflect actual responses to any minor reductions in deliveries. Water purveyors and individuals would likely have independent responses to changes in water supply. The range of responses could include not planting crops on a portion of land, changing crop patterns, increasing irrigation efficiencies or accepting reduced yields, acquiring water from other sources, and water conservation, in addition to increased groundwater pumping.

Based on this information, any potential impact would be less than significant. Even under extremely conservative assumptions, any increase in groundwater pumping would be much less than 1% of existing levels, and there is no evidence to suggest that such a minor increase in the already large volume of groundwater pumping would have any effect on existing groundwater levels, availability, quality, or surface subsidence. It is not possible to predict how each water purveyor and individual would respond to minor reduction in one water supply source. This impact is considered speculative. No further analysis is required.

Significant Impacts and Mitigation Measures

Alternatives 2–5

Alternatives 2–5 would not result in significant construction-related or operation-related impacts related to geology, soils, seismicity, and groundwater, and no mitigation measures are necessary.

Alternative 6

Construction-Related Impacts

Impact 9-13: Inadvertent Soil Loss from Clearing Operations

Clearing of vegetation along the shoreline of the reservoir between 568 and 601 ft elevation may result in inadvertent vegetation loss and associated soil disturbance outside this zone, including heavy equipment intrusion beyond work areas. The potential impact is significant.

Mitigation Measure 9-1: Prevent Inadvertent Soil Loss from Clearing Operations

The 601-ft-elevation line should be marked at intervals using surveying equipment to avoid inadvertent clearing of vegetation and soil disturbance. Additionally, heavy equipment access routes should be identified and marked to minimize the extent of vegetation and soil disturbance above 601 ft elevation. This mitigation measure would reduce the impact of unnecessary soil disturbance and associated erosion to a less-than-significant level.

Operation-Related Impacts

There are no significant operation-related impacts on geology, soils, seismicity, and groundwater associated with this alternative.

Chapter 10

Land Use

Chapter 10
Land Use

Affected Environment

The proposed pipeline alignments are within public rights-of-way, private easements, and roadways. Some pipeline alignments cross or extend onto private lands. Other proposed project facilities (e.g., intake facility, water treatment and pumping plants) are on public and/or private lands to be acquired. Land uses near the project facilities and pipeline alignments are listed below:

- Residential uses, including urban and suburban low- and medium-density residential.
- Rural residential uses (i.e., low-density residential uses in nonurbanized settings).
- Agricultural, including farmland (e.g., irrigated crop production, and orchard and vineyard operations) and livestock grazing land.
- Open space, consisting of undeveloped land not currently in agricultural use.
- Urban commercial and industrial uses. In some areas, the various types of urban land uses cannot be readily differentiated and are referred to generically as "urban" land uses. General urbanized uses include a variety of mixed, largely nonresidential uses, such as commercial uses, industrial transportation corridors, public and quasi-public facilities, utilities, institutional facilities, and aggregate mining areas.
- Rural commercial and industrial uses. These uses include aggregate mining areas, animal feedlots, rural truck stops, and convenience stores.
- Recreational uses, including trails, camping and picnic areas, boat launches, parks, and recreational open space.

Freeport Intake Facility to Mokelumne Aqueducts

Existing Land Uses

Four alignments made up of different combinations of segments are being considered for Alternatives 2–5 (see Figures 2-1 and 2-2). All of these alternatives would start at the Sacramento River in Sacramento County, run generally east and south through Sacramento County, and terminate at the Mokelumne Aqueducts in San Joaquin County. The project also includes specific or general sites for other project facilities including the intake facility, Zone 40 Surface WTP, canal pumping plant, and aqueduct pumping plant and pretreatment facility as described in Chapter 2.

Table 10-1 summarizes the pipeline segment and other project facility locations, the agency possessing land use jurisdiction, and existing land uses that would be traversed by each segment or facility. Land uses described in Table 10-1 are based on aerial photography (AirphotoUSA 2001), field reconnaissance visits, and DWR Land Use/Land Cover data (California Department of Water Resources 2000). To the extent possible, segments described in Table 10-1 are ordered from west to east (from the Sacramento River to the FSC) and from north to south (from the FSC to the Mokelumne Aqueducts). The proposed segments from the FSC to the Mokelumne Aqueducts (FSCC pipeline alignment) are also outlined at the end of Table 10-1.

Planned New Land Uses or Projects

At least nine new land uses or projects are planned for areas along the pipeline alignments and project facilities within Sacramento County, as shown in Table 10-2. Planned projects include sewer improvements, transportation system improvements, and community and specific plans. There are no identified planned new land uses in San Joaquin County.

General Plan Land Use Designations

City of Sacramento

The project components parallel or cross the following land use designations within the City of Sacramento:

- Low- and Medium-Density Residential
- County Mixed Residential
- Community/Neighborhood Commercial and Offices
- Regional Commercial and Offices
- Parks–Recreation–Open Space
- Public/Quasi-Public/Miscellaneous
- Transportation/Utilities
- Industrial Employee Intensive
- Special Planning District

Table 10-1. Land Uses by Pipeline Segment from the Freeport Intake Facility to Mokelumne Aqueducts

Pipeline Segments	Segment Alignments, Jurisdictional Coverage, and Existing Land Uses
Pipeline Alignments from Freeport Intake Facility to Zone 40 Surface Water Treatment Plant/Folsom South Canal	
A	The proposed intake facility location is on the east bank of the Sacramento River near Freeport. Segment A would traverse urbanized land uses north and east through the City of Sacramento to a location near the Freeport Blvd/I-5 overcrossing (intersection of Segments B and P).
B	Segment B would traverse rural residential land uses within the City of Sacramento north along Freeport Blvd. to a junction at the intersection of Freeport Blvd. and Meadowview Rd.
C	Segment C would travel along Meadowview Rd. and would pass through low- and medium-density residential and other urbanized land uses within the City of Sacramento.
D	Segment D would pass through urban and rural residential land uses within the City of Sacramento along Meadowview Rd. from the Morrison Creek Bridge to Mack Rd.
E	Segment E would travel east along Mack Rd., crossing over Franklin Blvd., SR 99, and the border of unincorporated Sacramento County and the City of Sacramento, to the intersection of Elsie Ave. and Power Inn Rd. Segment E would pass through low- and medium-density residential, rural residential, and other urbanized land uses within the City of Sacramento and unincorporated Sacramento County.
F	Segment F would travel east from the intersection of Elsie Ave. and Power Inn Rd along Elsie Ave. through low-density residential lands in Sacramento County. At the end of these residential uses, Segment F would make a sharp turn north and travel along Wilbur Way to Gerber Rd. through urbanized lands in Sacramento County.
G	Segment G would travel east on Gerber Rd. (roughly between the intersections of segments F and H) through urbanized land uses within Sacramento County.
H	Segment H would travel east on Gerber Rd. across the Union Pacific Railroad tracks to the intersection of Elk Grove and Florin Rd. and would traverse medium-density residential, rural residential, and other urbanized land uses within Sacramento County.
I	Segment I would travel east on Gerber Rd. between Elk Grove-Florin Rd. and Bradshaw Rd. and would traverse rural residential, open space, and agricultural land uses within Sacramento County.
J	Segment J would extend north along Bradshaw Rd. between Gerber Rd. and Florin Rd. through grazing and urbanized land uses in unincorporated Sacramento County.
K	Segment K would extend east along Florin Rd. between Elk Grove-Florin Rd. and a north-south leg of the FSC and would pass through rural residential, open space, and agricultural lands in unincorporated Sacramento County.
L	Segment L would travel east on Gerber Rd. between Bradshaw Rd. and Vineyard Rd. and would traverse rural residential and agricultural lands within unincorporated Sacramento County.

Pipeline Segments	Segment Alignments, Jurisdictional Coverage, and Existing Land Uses
M	Segment M would travel east on Gerber Rd. from the edge of the area considered for the Zone 40 Surface WTP site and would traverse urbanized (golf course), rural residential, open space, and agricultural lands within unincorporated Sacramento County.
N	Segment N would travel east following the Gerber Rd. extension/right-of-way to the intersection with Grant Line Rd. and would traverse agricultural land uses within unincorporated Sacramento County.
O	Segment O would travel northeast on Grant Line Rd. from the intersection of Gerber Rd. extension/right-of-way to the beginning of the FSC and would pass through agricultural and open space lands within unincorporated Sacramento County.
P	Segment P would start near the intake facility site and head southeast, crossing I-5, and would traverse both urbanized and open space lands in the City of Sacramento.
Q	Segment Q would travel along the eastern side of I-5 in a southeasterly direction and would traverse agricultural lands in the City of Sacramento.
R	Segment R would begin at the eastern side of I-5 at the terminus of Segment Q and would extend generally southeast on a curvilinear path (following the proposed I-5/Cosumnes Blvd. extension) through agricultural lands in the City of Sacramento to the Western Pacific Railroad (WPRR) tracks.
S	Segment S travels from where Morrison Creek meets Cosumnes River Blvd. to the intersection of Franklin Blvd. and would travel east along the border between unincorporated Sacramento County and the City of Sacramento through open space lands (the SRWWTP Bufferlands).
T	Segment T would travel along Cosumnes River Blvd. southeast and east from the intersection of Franklin Blvd. to the intersection of Bruceville Rd. and would traverse urbanized and medium-density residential land (urban) uses in the City of Sacramento.
U	Segment U would begin at the intersection of Cosumnes River Blvd. and Bruceville Rd., proceeding northeast and crossing SR 99 and the border of unincorporated Sacramento County and the City of Sacramento to Power Inn Rd. (just north of the Stockton Rd. intersection), and turning north along Power Inn Rd. to the intersection of Elsie Ave. Segment U would pass through urbanized and medium-density residential land uses.
Option 1	Segment Option 1 would continue southeast along the eastern side of I-5 and would parallel open space and agricultural land uses in the City of Sacramento. Segment Option 1 would head east along the border between unincorporated Sacramento County and the City of Sacramento along the Morrison Creek north-side levee across agricultural land to the Western Pacific Railroad (WPRR) tracks. Adjacent to the SRWWTP, Segment Option 1 would pass through agricultural and open space land uses.
Option 2	Segment Option 2 would pass north on Power Inn Rd. from Elsie Ave. to the intersection of Gerber Rd. and would pass through medium-density urban residential and rural residential land uses within Sacramento County. Segment Option 2 would pass east on Gerber Rd. from the intersection of Power Inn Rd. through medium-density urban residential and other urbanized land uses.

Pipeline Segments	Segment Alignments, Jurisdictional Coverage, and Existing Land Uses
Pipeline Alignments from Folsom South Canal to Mokelumne Aqueducts	
V	Segment V, located within Sacramento County, would extend east to Clay Station Rd. through open space land uses from a new turnout near the southern end of the FSC. Segment V would then turn south and run along Clay Station Rd. through agricultural, rural residential, open space, and commercial lands to the intersection of Angrave Rd.
W	Segment W would begin from the end of Segment V at the intersection of Clay Station Rd. and Angrave Rd. in Sacramento County, heading south along Clay Station Rd., crossing the border of San Joaquin County, and then due east at the Liberty Rd. intersection to a location near the junction of Liberty Rd. and SR 88. Segment W would pass through agricultural, open space, commercial, and rural residential lands in Sacramento and San Joaquin counties and would proceed along roadway rights-of-ways or private easements along the roadway.
X	Segment X would begin at the end of Segments W and Option 3 near the intersection Liberty Rd. and SR 88 and continue southeast along the PG&E right-of-way to Buena Vista Rd., then continue along Buena Vista Rd. for approximately 1,000 feet and pass over the Mokelumne River, continuing southeast across SR12 to Cord Rd. Segment X would then travel south on Cord Rd. before veering southeast to the Mokelumne Aqueducts pumping plant site. Segment X would pass through agricultural, rural residential, commercial, and open space lands in San Joaquin County.
Option 3	Segment Option 3 would extend east along Angrave Rd. in Sacramento County from the end of Segment V at the intersection of Clay Station Rd. and Angrave Rd. to Dry Creek and the border of San Joaquin County. At Dry Creek, Segment Option 2 would turn southeast into San Joaquin County, generally following the Pacific Gas & Electric right-of-way, terminating near the intersection of Liberty Rd. and SR 88 (this corresponds to the endpoint as Segment W). Segment Option 3 would proceed through “cross-country” and pass through agricultural, commercial, and open space lands.
Pipeline Facilities from Freeport Intake to Mokelumne Aqueducts	
Freeport Intake Facility and On-Site Settling Basins	The intake facility would be 6,500 feet upstream of the Freeport Bridge on the left bank of the Sacramento River. The settling basins would be located at the bank intake facility. The intake facility and settling basins would occupy urban land uses.
Zone 40 Surface WTP	The general area for the WTP site is an 80- to 100-acre parcel within the area bounded by Elder Creek Road on the north, Gerber Road on the south, Bradshaw Road on the west, and Excelsior Road on the east. The facility would occupy rural residential and agricultural lands within Sacramento County.
Optional Terminal Facility Settling Basins, Grant Line option	The terminal settling basins would be approximately 30 feet off the side of the Gerber Road right-of-way at the intersection with Grant Line Road for Alternatives 3 and 5. The 16-acre facility would occupy agricultural lands within Sacramento County.

Pipeline Segments	Segment Alignments, Jurisdictional Coverage, and Existing Land Uses
Optional Terminal Facility Settling Basins, Florin Road option	The terminal settling basins would be approximately 30 feet off the side of the Florin Road right-of-way at the FSC for Alternatives 2 and 4. The 16-acre facility would occupy agricultural lands within Sacramento County.
Canal Pumping Plant	This facility would be located near the terminus of the existing FSC where it would connect with the new FSCC pipeline. The 3.2-acre facility would occupy undeveloped lands covered by native vegetation.
Aqueduct Pumping Plant and Pretreatment Facility, Camanche site	This facility would be located on agricultural and open space (native vegetation) lands just west of the Camanche Reservoir dike, on EBMUD property.
Aqueduct Pumping Plant and Pretreatment Facility, optional Brandt site	This facility would be located on agricultural and open space (native vegetation) lands at the terminus of the proposed FSCC pipeline alignment where it connects with the Mokelumne Aqueducts.

Sources:California Department of Water Resources 2000; Airphoto USA 2001, and field reconnaissance.

Table 10-2. Planned New Land Uses, Freeport Intake Facility to Mokelumne Aqueducts

	Projects	Description	Approvals/Docume	Location
1	Sacramento Regional County Sanitation District (SRCSD) Interceptor Master Plan and Lower Northwest Interceptor (LNWI) Project	SRCSD's Interceptor System Master Plan 2000 Update identifies modifications to the sewer conveyance system and SRCSD's service area. The project also includes specific construction plans for the LNWI, identified in Master Plan.	Notice of Preparation (NOP) issued 12/21/01	Q, R, Option 1
2	Interstate 5/Cosumnes River Boulevard Interchange (Cosumnes River Blvd. Extension)	The Federal Highway Administration and Caltrans are proposing to extend Cosumnes River Blvd. west of Franklin Blvd., with an interchange at I-5 and possible extension west to an at-grade intersection with Freeport Blvd.	NOP/Notice of Intent (NOI) released 2/02	Q, R, S, Option 1
3	Light Rail Extension, South Sacramento Phase II Corridor	Sacramento Regional Transit's proposal to extend the Sacramento Light Rail South Line approximately 5-miles from its current terminus. The extension would follow the WPRR right of way south of Meadowview Rd., turn east along the proposed Cosumnes River Blvd. extension to Bruceville Rd., turn south to Cosumnes River College, and turn east, crossing SR 99 and end at a new station at Calvine/Auberry.	NOP issued 3/14/02	C, S, T
4	Florin-Vineyard "Gap" Community Plan	Sacramento County's proposed plan covers approximately 3,450 acres within the Vineyard and South Sacramento communities. The term "gap" refers to the area's location between an existing urban area to the west of Elk Grove–Florin Rd. and a planned urban area to the east (North Vineyard Station and Vineyard Springs).	Plan Initiated 1999 Administrative Draft Development Guidelines for Plan 12/18/02	H, I, J
5	Bradshaw Interceptor	SRCSD's proposed 108-inch sewer line from the corner of Gerber/Elk Grove–Florin, crossing diagonally across to the Bradshaw/Florin intersection, under Elder Creek, with temporary closures of Gerber and Florin Roads.	EIR 4/96 Notice of Determination (NOD) issued	I, J
7	North Vineyard Station Specific Plan	A Sacramento County plan for 1,590 acres within the Vineyard Community Plan Area. Includes 6,339 developed acres, commercial, school, parks and open space.	EIR 7/22/97 NOD 11/10/98	H, I, J
8	Vineyard Springs Comprehensive Plan	Sacramento County's plan provides direction for plans and related General Plan and Community Plan amendments for the 2,560-acre Vineyard Springs Planning Area. Activities include construction of a storm drain outfall to Laguna Creek.	EIR 7/1/98 NOD 12/3/01	H, I, J
9	Dierks Ranch Community Plan Amendment, Rezone, Tentative Subdivision Map, and Special Development Permit	Sacramento County amendments to facilitate subdivision of 61.5 acres into 61 single-family homes.	Neg. Dec. 8/23/00 NOD 5/15/01	Excelsior Rd. between Gerber and Calvine*

* None of the proposed segments would pass through the Dierks Ranch Community Plan area, but buildout of the plan could affect access to the project area.

- Rural Estates
- School

Sacramento County

The project components parallel or cross the following Sacramento County land use designations:

- Low- and Medium-Density Residential
- Agricultural Residential
- Commercial and Office
- Intensive Industrial
- Public and Quasi-Public
- Urban Transit Oriented Development
- Development Area
- Recreation
- Natural Preserve
- General Agriculture (20-acre minimum parcel size)
- General Agriculture (80-acre minimum parcel size)

Land use designations in the area proposed for the Zone 40 Surface WTP locations (area bounded by Gerber Rd. to the south, Bradshaw Rd. to the west, Florin Rd. to the north, and Excelsior Rd. to the east) include Secondary Areas, Neighborhood Transit-Oriented Development, and Open Space. The portion of the Zone 40 Surface WTP site between Vineyard and Bradshaw Roads is located within the North Vineyard Station Specific Plan area. This area is designated primarily for single-family residential uses, with some commercial uses (at Bradshaw and Gerber), as well as stormwater detention basins and parks.

Uses other than agricultural production are not allowed within areas designated General Agriculture for Sacramento County (unless a use permit is granted). A conditional-use permit is required for projects involving utility corridors and related facilities. However, as stated in the Sacramento County Zoning Code, a use permit is not required for “County agency facilities which budgetary responsibility wholly or partly rests with the Sacramento County Board of Supervisors, such as the County Water Agency, County Sanitation District, City/County Housing and Redevelopment Agency, and the facility has already been subject to public hearings for the purpose of allocating funds to purchase the property, to construct the facility, or to commit the property to specific use”. Also, as noted later in this chapter, Sections 53091 and 53096 of the California Government Code exempt public water supply and treatment facilities from regulation under local zoning ordinances.

San Joaquin County

The pipeline alignments within San Joaquin County would cross areas designated General Agriculture (40-acre and 80-acre) and Open Space/Resource Conservation (Riparian Habitat, Significant Vegetation, and Mineral Resources) on the General Plan 2010 map of northeast San Joaquin County. Development in areas designated General Agriculture is restricted to agricultural and related uses; other uses of these areas, such as for utility corridors, generally would require a conditional-use permit. However, public water supply and treatment facilities are exempt from these requirements as set forth in California Government Code Section 53091 (see below).

Chapter 9-1155 of the San Joaquin County Development Title has provisions regarding the underground placement of utilities regarding facility location. The title states that no public utility distribution facilities shall be located outside a public right-of-way or public utility easement except in providing service to the parcel on which they are located. However, as noted later in this chapter, Sections 53091 and 53096 of the California Government Code exempt public water supply and treatment facilities from regulation under local zoning ordinances. Therefore, the proposed project is not subject to the requirements of the Chapter 9 County Development Title, which serves as the County Zoning Code.

Other Relevant General Plan Policies

City of Sacramento

The Conservation and Open Space Element of the City of Sacramento General Plan has an overall goal of achieving and maintaining a balance among the conservation, development, and utilization of planned open space and natural resources. The City of Sacramento General Plan Public Facilities and Services Element has an overall goal of providing and maintaining a high quality of public facilities and services for all areas of the City. A specific goal outlined by the City of Sacramento General Plan relative to water supply states:

> To provide and improve water supply facilities to meet future growth of the City and assure a continued supply of safe, potable water.

Sacramento County

The Sacramento County General Plan Public Facilities Element outlines objectives and policies regarding water treatment and distribution facilities. The Treatment and Distribution Facilities objective states:

> Water treatment and distribution facilities are located to minimize environmental impact and maximize distribution efficiency with respect to point of withdrawal and area to be served.

A specific policy related to this objective states that new water facilities shall be planned to minimize impacts on instream water flow in the Sacramento and American Rivers (Policy PF-1).

The Conservation Element of the Sacramento County General Plan outlines goals and objectives that call for the conjunctive use of surface- and groundwater to provide long-term water supply for Sacramento residents and future residents of unincorporated areas while maintaining river flows and reservoir levels.

San Joaquin County

The Community Development Section (IV) of the San Joaquin County General Plan addresses protection of open space and natural resources. It identifies policies on utility corridors, including electrical transmission and major water lines. Section IV of the San Joaquin County General Plan, Policies 5.1–6, sets forth county objectives for protecting the public from hazards related to utility corridors and for protecting land uses from poorly sited utilities. Section VI of the San Joaquin County General Plan also addresses the protection of resources, including agricultural lands.

Enlarge Pardee Reservoir

Existing Land Uses

All properties below 614 feet msl immediately surrounding the edges of the existing Pardee Reservoir and in the Mokelumne River below the Electra Powerhouse and Dam may be affected by the enlargement of Pardee Reservoir. In addition, an area downstream of the existing dam would be affected by the construction of a new dam (see Figure 2-3).

The majority of the lands immediately adjacent to Pardee Reservoir and the Mokelumne River are owned by EBMUD. At maximum flood-control water level of 614 feet msl, approximately 3,316 acres of EBMUD land would be inundated. Other entities owning land around the reservoir include the Bureau of Land Management (BLM), JVID, PG&E, and private landowners. No BLM or PG&E land would be inundated at maximum flood-control level of 614 feet msl.

At maximum flood-control water level of 614 feet msl, land not owned by EBMUD that would be within the area of inundation would include:

- An area below the existing Pardee Dam, which is owned by the JVID. At maximum flood-control level, approximately 33 acres of JVID land would be inundated.
- The area east of SR 49, adjacent to the Mokelumne River, which is a mixture of private ownership. At maximum flood-control level, approximately 134 acres of privately owned land would be within the maximum flood control water level.

Existing land uses immediately surrounding the Pardee Reservoir consist mainly of grazing, which is carried out on EBMUD lands for fire suppression purposes. Because of the steep topography, grazing is also the primary land use on BLM, JVID, and privately owned lands adjacent to the reservoir. EBMUD maintains a 100- to 300-foot wide, fenced buffer between grazing activities and the reservoir banks.

Some recreational land uses are located at the northwestern edge of the Pardee Reservoir at the Pardee Reservoir Recreation Area, which includes a variety of recreational facilities, such as the Oaks Campground in Woodpile Gulch, a marina, and RV camping. These facilities are owned and operated by EBMUD, although a private concessionaire runs the facilities on a seasonal basis under long-term contract with EBMUD.

Planned Projects

Planned projects in the Pardee Reservoir area are listed in Table 10-3 and include a fish hatchery project and a fish passage improvement program. It should be noted that a variety of habitat improvement projects, mainly focusing on fisheries, are planned or ongoing in the Mokelumne River watershed, but these projects would not affect local land use.

Table 10-3. Planned New Land Uses, Enlarge Pardee Reservoir

	Projects	Description	Approval/ Documents/ Sources	Location Relative to Enlarge Pardee Reservoir Component
1	Rebuild Mokelumne River Fish Hatchery	Hatchery now functional. New fish raceways completed January 2002. First year class of fish raised in hatchery; majority were planted in Bay-Delta system.	Project ongoing.	On Mokelumne River, downstream of Pardee Reservoir
2	Lower Mokelumne River Restoration Program EIR/EIS	The Lower Mokelumne River Restoration Program is a fish passage improvement project. Features include a new fish passage weir, fish ladders and screens, and diversion pipes. A new dam will replace the existing dam.	EIR/EIS 5/16/00 NOD 5/20/02 NOD 7/12/02 NOD 7/15/02	On Mokelumne River, downstream of Pardee Reservoir

General Plan Land Use Designations

Amador County

The Amador County General Plan designates the areas north of the Pardee Reservoir as Agricultural-General, Mineral Resources Zone, and Open-Recreation. Several noncontiguous parcels of lakeside property adjacent to and east of the Pardee Reservoir SR 49 overcrossing, within the area proposed for inundation in Amador County, are owned by BLM (Hummel pers. comm.). The area immediately adjacent to the SR 49 overcrossing north of the reservoir is designated by the County as Open Forest (Grijalva pers. comm.).

Calaveras County

The Calaveras County General Plan Future Land Use Map designates the areas south of the Pardee Reservoir as Timberlands/Mineral Resource Area 2A/Dam Inundation Area; Future Single Family Residential (5–40 acres); and Wildlife Habitats/Botanical Areas. A portion of the project area surrounding the southeastern shore of the Pardee Reservoir is designated as a Bald Eagle Wintering Area.

The Mokelumne Hill Community Plan is incorporated by reference into the Calaveras County General Plan. A portion of the area covered in the Community Plan would be affected by the enlarge-Pardee-Reservoir component of Alternative 6. The Mokelumne Hill Community Plan designates the affected area adjacent to the Pardee Reservoir as Rural Residential and Recreation. The Rural Residential designation requires a minimum parcel size of 1–5 acres.

Other Relevant Policies

Amador County

The Amador County General Plan shows that SR 49 has been proposed for State Scenic Highway status, although it is not yet officially designated. The portion of SR 49 that would be affected by the proposed project in Amador County is included in the State Scenic Highway proposal (California Department of Transportation 1999). No additional Amador County General Plan policies are specifically relevant to the proposed project.

Calaveras County

SR 49 passes through the Mokelumne Hill Community Plan area adjacent to the Pardee Reservoir area. SR 49 has been proposed for State Scenic Highway status, although it is not yet officially designated. The portion of SR 49 that would be affected by the proposed project in Calaveras County is included in the

State Scenic Highway proposal (California Department of Transportation 1999). The Calaveras County General Plan Circulation Element outlines a policy to support identified scenic highway segments in the county for inclusion in the State Scenic Highway Program (Policy III-14A).

The Calaveras County General Plan Circulation Element includes a policy to permit pipelines in public rights-of-way under established conditions (Policy III-19A). The Calaveras County General Plan Conservation Element includes a policy that calls for supporting the development of water projects in the county for use within the county for domestic and irrigation purposes (Policy IV-9A).

Bureau of Land Management

BLM land use policies within Pardee Reservoir area are provided in the Sierra Planning Area Management Framework Plan Amendment (Bureau of Land Management 1988). This document contains only two policies applicable to the project area (Hummel pers. comm.). These policies apply to the Mokelumne River. The policies are to encourage and promote water-based recreation opportunities and to provide for developed recreation areas as warranted by demand for increased water-based recreation (Bureau of Land Management 1988).

Environmental Justice

On February 11, 1994, President Clinton issued Executive Order 12898, "Federal Actions to Address Environmental Justice in Minority and Low-Income Populations." This Executive Order requires each federal agency to identify and address disproportionately high and adverse human health or environmental effects of their actions on minorities and low-income populations and communities. Reclamation policy requires that NEPA documents include a determination of whether a project will have any adverse impacts on minority or low-income populations.

The project components from the intake facility to the Mokelumne Aqueducts pass through the City of Sacramento, Sacramento County, and San Joaquin County, while the enlarge Pardee Reservoir component is in Amador and Calaveras Counties. The project components cross a variety of land uses including residential, commercial, rural, and agriculture. Because of the extent of the project area and the types of land uses crossed, the evaluation was based on the review and comparison of demographic and income data collected during the 2000 U.S. Census and reported at the census tract level.

In 2000, the populations of Sacramento County and San Joaquin County were approximately 1,224,000 and 564,600 residents, respectively. Both counties are ethnically diverse, with the greatest diversity occurring in the urban areas. The median household incomes in Sacramento County and San Joaquin County were

$43,816 and $41,282, respectively (Table 10-4). Median household income tends to be higher in rural areas. Approximately 10% of the families living in Sacramento County and 14 % of the families living in San Joaquin County have incomes below the poverty level (U.S. Census Bureau 2000a and 2000b). Amador and Calaveras Counties have populations of 35,100 and 40,554, respectively, and are not as ethnically diverse as Sacramento and San Joaquin Counties. The median household income in Amador County is $35,100 and in Calaveras County $41,022. Approximately 6% of the families living in Amador County and 9% of the families living in Calaveras County have incomes below the poverty level. (U.S. Census Bureau 2000c and 2000d).

The ethnic composition of the census tracts crossed by the project components also tends to be more diverse in urban areas and less diverse in rural areas. In Sacramento County census tracts, the minority population, expressed as a percentage of total population within a census tract, ranged from a high of 88% in the urban tracts to a low of 16% in the rural tracts. Unlike in Sacramento County, the minority population in any of the census tracts crossed by the pipeline in San Joaquin County was nearly the same, ranging from a high of 30% to a low of 26%. As previously stated, Amador and Calaveras Counties have predominantly a white population. Minorities compose approximately 18% of Amador County and 12% of Calaveras County; demographics near Pardee Reservoir are virtually the same.

Table 10-4. Income and Ethnicity Data for Sacramento County, San Joaquin County, and City of Sacramento, and Census Tracts Crossed by the Project Components from the Freeport Intake Facility to the Mokelumne Aqueducts and the Enlarge Pardee Reservoir Component

Area/Census Tracts	Median Household Income ($)[$]	% White	% African American	% American Indian	% Asian	% Hawaiian or Pacific Islander	% Hispanic or Latino	% Other[#]	Relevant Project Alternative
Sacramento County Average	**43,816**	**58**	**10**	**<1**	**11**	**<1**	**16**	**4**	
42.01 (U)	39,280	32	30	<1	12	1	28	6	2,3
42.02 (U)	27,134	14	27	<1	24	3	25	5	2,3
42.03 (U)	26,835	15	23	<1	18	5	33	6	2,3
43 (U)	27,669	15	26	<1	27	3	23	6	2,3
49.03 (U)	28,687	12	37	<1	23	2	19	7	2,3
49.04 (U)	41,804	44	17	<1	14	<1	22	5	2,3
49.05 (U)	31,168	23	22	<1	11	<1	37	5	2,3
49.06 (U)	39,349	25	24	<1	23	<1	20	7	2,3
50.01 (U)	36,716	27	22	<1	22	<1	21	6	2,3,4,5,6
50.02 (U)	25,498	31	23	<1	22	<1	18	4	2,3,4,5,6
51.01 (U)	36,828	35	18	<1	20	<1	19	7	2,3,4,5,6
51.02 (U)	36,414	50	11	<1	17	<1	16	4	2,3,4,5,6
86 (R)	77,236	84	2	<1	3	<1	7	3	2,3,4,5

Area/Census Tracts	Median Household Income ($)[$]	% White	% African American	% American Indian	% Asian	% Hawaiian or Pacific Islander	% Hispanic or Latino	% Other[#]	Relevant Project Alternative
92 (R)	50,865	60	2	2	15	<1	15	5	2,3,4,5,6
93.11 (R)	63,621	61	6	<1	18	<1	11	4	2,3,4,5,6
93.16 (U)	51,226	45	15	<1	16	<1	17	4	2,3,4,5,6
93.18 (U)	50,383	24	14	<1	38	1	17	6	2,3,4,5,6
93.19 (U)	48,836	29	11	<1	36	2	17	6	2,3,4,5,6
94.06 (R)	68,594	83	<1	<1	2	<1	10	2	2,3,4,5
96.01 (R)	46,652	14	27	<1	31	3	18	7	4,5,6
96.06 (U)	36,351	22	29	<1	16	1	26	5	4,5,6
96.07 (U)	35,216	16	28	<1	21	2	25	7	4,5,6
Study Area Avg.	**40,322**	**33**	**17**	**0**	**19**	**1**	**19**	**5**	
San Joaquin County Average	**41,282**	**47**	**6**	**<1**	**11**	**<1**	**30**	**4**	
46 (R)	49,000	74	<1	<1	3	<1	20	2	2,3,4,5
47.01 (R)	43,494	70	<1	<1	1	<1	26	2	2,3,4,5
47.02 (R)	52,241	71	<1	<1	2	<1	23	2	2,3,4,5
Study Area Avg.	**48,245**	**72**	**<1**	**<1**	**2**	**<1**	**23**	**2**	
Amador County Average	**42,280**	**82**	**4**	**2**	**<1**	**<1**	**9**	**5**	
5 (R)	46,184	89	<1	1	<1	<1	6	4	6
Calaveras County Average	**41,022**	**88**	**<1**	**1**	**<1**	**<1**	**<7**	**4**	
2.10	46,184	83	1	1	<1	<1	10	5	6

Notes:

The population totals do not add to exactly 100% because of rounding and because of the Census data's double-counting of respondents that checked more than one race on their Census form.

$ = 1999 dollars

= Other includes those nationalities not listed in the previous columns or multi-racial groups

U = Urban

R = Rural

Environmental Consequences

Methods and Assumptions

Sections 53091 and 53096 of the California Government Code exempt the "location or construction of facilities for the production, generation, storage, treatment, or transmission of water" from regulation under local zoning ordinances; therefore, inconsistencies between most project facilities and zoning would not be considered, in and of themselves, potential significant impacts in this assessment.

Freeport Intake Facility to Mokelumne Aqueducts

Construction assumptions associated with the project components from the intake facility to the Mokelumne Aqueducts include the following:

- 130-foot-wide right-of-way for all pipeline alignments. The 130-foot-wide right-of-way consists of an 80-foot-wide permanent operation corridor and a 50-foot-wide temporary construction corridor. While there are some pipeline segments that will not require a full 130-foot-wide right-of-way (the FSCC segments in particular), that width is used consistently for purposes of this analysis.
- Agricultural land within the permanent operation corridors would *not* return to agricultural production, but agricultural land uses would be re-established in the temporary 50-foot wide construction corridors, as described in the Agricultural Land Restoration Plan outlined in the project description (see Chapter 2, "Project Description," of this document). This method of analysis considers a worst-case scenario.
- The Zone 40 Surface WTP would be an 80- to 100-acre parcel in the larger area shown on Figure 2-1. For the purposes of impact assessment, it is assumed that the plant could be placed on any part of that larger area. The canal pumping plant is evaluated for the 3.2-acre site described in Chapter 2; land use issues associated with the aqueduct pumping plant and pretreatment facility (Camanche site and optional Brandt site) are evaluated based on the conceptual designs and locations indicated in Chapter 2.
- Alignments following roadways without adequate amounts of unpaved rights-of-way would be constructed within the paved roadway or along its shoulder to the extent feasible. It is likely that private land (using temporary easements and, in limited cases, permanent easements) would be used in some instances for construction and/or long-term maintenance/access purposes. Examples include Gerber and Florin Roads.
- Alignments following parcel boundaries or existing and anticipated rights-of-way would be constructed in a manner that minimizes long-term impacts on private property. Temporary and/or permanent easements would be used for construction and/or long-term maintenance and access purposes. Examples include segments such as Segment Option 1 north of the SRWWTP (east of the Freeport community), and Segment N east of the terminus of Gerber Road.

Enlarge Pardee Reservoir

Several assumptions are associated with construction of the enlarge Pardee Reservoir component of the FRWP. The impact analysis assumes that the downstream replacement dam would be constructed first to allow Pardee Reservoir to continue normal operations during construction, and that no drawdown of the reservoir would be required. Also, FRWA would purchase and secure properties/easements for all public and private non-EBMUD lands surrounding the Pardee Reservoir before project construction.

For construction of the new dam, investigations of local quarry sites have concluded that there is suitable construction material available in the project vicinity. Materials from commercial sources would be transported to stockpiles at the site via local roads. Most staging areas would be located within the inundation zone of the enlarged reservoir. Staging areas that are located outside the inundation zone would avoid sensitive habitats. Materials from on-site quarries, to be located within the inundation zone of the enlarged reservoir, would be transported to dam construction sites using large off-highway haulers operating on dedicated haul roads.

The analysis of impacts related to raising the level of the Pardee Reservoir examines the effects of raising the reservoir to 614 feet msl, the maximum flood-control water level.

Significance Criteria

The criteria used for determining the significance of an impact on existing or planned land uses are based on Appendix G of the CEQA Guidelines (Environmental Checklist) and professional standards and practices. Impacts on land use may be considered significant if implementation of an alternative would:

- physically divide an established community;
- conflict with any applicable land use plan, policy, or regulation of an agency with jurisdiction over the project; or
- conflict with any applicable habitat conservation plan or natural community conservation plan.

Less-than-Significant Impacts

Alternative 1

Under Alternative 1, no FRWP facilities would be constructed, and no construction-related or operation-related land use impacts would occur.

Alternatives 2–5

Alternatives 2 through 5 differ only in the pipeline alignments from the Freeport intake facility to the FSC. Project construction and operation for Alternatives 2 through 5 are very similar. Impacts related to land use for each alternative differ only slightly from each other; therefore, the results for Alternatives 2 through 5 are presented together but are representative of each individual alternative, unless otherwise noted.

Impact 10-1: Construction-Period Conflicts with Residential and Urbanized Land Uses

Land use conflicts from pipelines would consist mainly of combined nuisance effects on local residents and business operations from construction-related traffic, increased noise, and dust from trenching and ground disturbances. Construction of the intake facility, Zone 40 Surface WTP, and canal pumping plant could also expose neighboring land uses to these impacts.

All of the pipelines would be buried. In some sensitive areas and at some major roadway intersections, pipelines would be bored and jacked to minimize conflicts. Temporary construction period impacts related to dust/air quality and noise could result in conflicts with nearby land uses. These impacts and applicable mitigation measures are addressed in those topical sections of this EIR/EIS (Chapters 13 and 14, respectively). Because these nuisance impacts would be temporary and relatively short-term, construction-period land use conflicts with nearby residential and commercial development would be minor and less than significant. No mitigation is required.

Impact 10-2: Postconstruction Conflicts with Residential and Urbanized Land Uses

Within the urbanized portions of the project area, some pipelines would follow existing or proposed roadway corridors and would not impact existing or proposed development after construction is complete. For these pipelines (i.e., those that would generally follow existing roadway corridors or public rights-of-way), potential direct conflicts with existing residential, commercial, and industrial uses are expected to be minimal. In addition, the applicant would adhere to its environmental commitments and continue ongoing coordination with affected municipalities (e.g., City and County of Sacramento, San Joaquin County) to review each pipeline alignment with respect to these potential conflicts (refer to Chapter 2 under Environmental Commitments). For those segments or facilities that would not be within roadways/public rights-of-way, some conflicts with existing urbanized land uses could occur. In these situations, FRWA would adhere to the environmental commitments concerning acquisition of lands and compensation for affected property (refer to Chapter 2 under

Environmental Commitments). Therefore, this impact is less than significant. No mitigation is required.

Impact 10-3: Inconsistency with Local Plans and Policies and Land Use Designations

Construction and operation of the project facilities would be consistent with general plan policies of the City of Sacramento and Sacramento and San Joaquin Counties. Underground water supply pipelines and the associated facilities are generally consistent with the applicable land use designations within the project area. One exception exists within the portion of the Zone 40 Surface WTP siting area between Bradshaw and Vineyard Roads. This area is designated by the North Vineyard Station Specific Plan primarily for single-family residential uses, with a small commercial area at Bradshaw Road. Development of a large (80- to 100-acre) water treatment plant within this area could conflict with these land use designations and the residential and commercial land uses that are developed pursuant to them. However, based on preliminary work being carried out by SCWA staff, the Zone 40 Surface WTP will not likely be located within the North Vineyard Station Specific Plan area. If the treatment plant is developed on the portion of the siting area outside of this Specific Plan area, this potential inconsistency would be avoided.

Therefore, Alternatives 2–5 would not conflict with any general plan designations or policies described in the Affected Environment section above. This impact is less than significant. No mitigation is required.

Impact 10-4: Conflicts with Planned New Land Uses

As outlined in Table 10-2, at least nine projects are currently being planned within the vicinity of the alternative pipeline alignments and associated facilities in Sacramento County. The planned projects range from utility and transportation system extensions to residential projects and planned developments. Because the pipeline alignments generally follow existing roadway/utility corridors, potential direct conflicts with proposed commercial, residential, and office development projects are expected to be minimal. Certain pipeline segments parallel certain proposed project facilities and could potentially create conflicts during construction phases, although some flexibility in the timing of construction at specific sites exists and may be sufficient to minimize such conflicts. In addition, because coordination with City, County, Regional Transit, and SCRSD staff is ongoing and would be an integral component of implementation of Alternatives 2–5, the impacts associated with the pipelines and related facilities are less than significant.

As described under Impact 10-3, above, development of a large (80- to 100-acre) water treatment plant within the North Vineyard Station Specific Plan area could conflict with planned land uses in that area. If the Zone 40 Surface WTP is proposed to be located within the North Vineyard Station Specific Plan area, careful coordination with the Sacramento County planning department would be required to identify and mitigate potential land use conflicts.

No new development is planned in the San Joaquin County portions of the project area.

Therefore, Alternatives 2–5 would not substantially conflict with any planned new land uses. This impact is less than significant. No mitigation is required. (Refer to the various commitments made in the Environmental Commitments section in Chapter 2 for additional information concerning coordination with the County of Sacramento Planning and Community Development Department, the City of Sacramento Department of Planning and Development, the City and County Public Works Departments, Regional Transit, and SCRSD during project planning phases.)

Impact 10-5: Environmental Justice Effects

The median household income and ethnic diversity of each census tract through which the project components from the intake facility to the Mokelumne Aqueducts would pass are shown in Table 10-4. The project components would pass through census tracts that exhibit median household incomes both above and below the median household income reported for each county. Of the 22 census tracts crossed by the project in Sacramento County, 10 exhibit poverty levels greater than the county average (U.S. Census Bureau 2002a). Of the 4 census tracts crossed by the project in San Joaquin County, all exhibit poverty levels lower than the county average (U.S. Census Bureau 2002b). The project components would cross census tracts that exhibit both high and low levels of ethnic diversity. Thirteen census tracts have minority populations that are 50% or more of the total population within the tract.

The construction-related environmental impacts identified for each of the project pipeline alignment alternatives are not expected to result in a disproportionate impact on minority or low-income populations because the pipeline alignments cross an area that is both ethnically diverse and more homogenous than county averages. In addition, the alignment alternatives cross an area that exhibits income levels lower and higher than county averages. Finally, none of the construction-related impacts are unique to any of the census tracts crossed by the pipeline alignment alternatives. Operational impacts would occur at the intake facility, Zone 40 Surface WTP, canal pumping plant, and aqueduct pumping plant and pretreatment facility (Camanche site or optional Brandt site). Only the intake facility would be located within a census tract that exhibits a high level of ethnic diversity and poverty levels greater than the Sacramento County average. However, operating the intake facility is not expected to result in a disproportionate impact on a minority or low income population because of the distance between the facility and residential and commercial areas. In addition, the impacts of operating the intake facility are not expected to affect the socioeconomic characteristics of the surrounding community.

In addition, efforts to minimize social effects were considered as part of the alternative development process. Efforts included an extensive screening analysis that evaluated various alignment alternatives against several criteria, including environmental and technical factors. Alignment alternatives were modified to minimize project impacts, including pipeline construction within city streets, use of trenchless construction methods, and routing through rural areas. Most of the project effects related to construction of the pipelines, including relocating housing and businesses, disrupting surrounding land uses, and disrupting transportation facilities and circulation have been avoided. This impact is less than significant, and no mitigation is required.

Alternative 6

As described in Chapter 2, "Project Description," Alternative 6 consists of enlarging Pardee Reservoir and conveying water from the Sacramento River to the Zone 40 WTP. Alternative 6 includes the following project components: enlarge Pardee Reservoir (which includes additional components), intake facility, pipeline from intake facility to the Zone 40 Surface WTP, and the Zone 40 Surface WTP. Though slightly different in size, the intake facility, pipeline from intake facility to the Zone 40 Surface WTP, and the Zone 40 Surface WTP project components are the same as those that make up Alternative 5. Therefore, several of the impacts associated with Alternative 5 (described above) are also associated with Alternative 6 and are restated below. Additionally, impacts associated with the enlarge Pardee Reservoir component of this alternative are described below.

Impact 10-6: Construction-Period Conflicts with Residential and Urbanized Land Uses

Land use conflicts from pipelines would consist of combined nuisance effects on local residents and business operations from construction-related traffic, increased noise, and dust from trenching and ground disturbances. Additionally, construction of the intake facility and Zone 40 Surface WTP could expose neighboring land uses to these impacts.

All of the pipelines would be buried. In some sensitive areas and at some major roadway intersections, pipelines would be bored and jacked to minimize conflicts. Temporary construction period impacts related to dust/air quality and noise could result in conflicts with nearby land uses. These impacts and applicable mitigation measures are addressed in those topical sections of this EIR/EIS (Chapters 13 and 14, respectively). Because these nuisance impacts would be temporary and relatively short-term, construction-period land use conflicts with nearby residential and commercial development conflicts would be minor and less than significant. No mitigation is required.

Impact 10-7: Postconstruction Conflicts with Residential and Urbanized Land Uses

Within much of the urbanized portions of the project area, pipelines would follow existing or proposed roadway corridors and would not affect existing or proposed development after construction is complete. For these pipelines (i.e., those that would generally follow existing roadway corridors or public rights-of-way), potential direct conflicts with existing residential, commercial, and industrial uses are expected to be minimal. In addition, the project applicant would adhere to its environmental commitments and continue ongoing coordination with affected municipalities (e.g., City and County of Sacramento) to review each pipeline alignment with respect to these potential conflicts (refer to Chapter 2 under Environmental Commitments).

For those pipeline segments not within roadways/public rights-of-way, some conflicts with existing urbanized land uses could occur. In these situations, FRWA would adhere to the environmental commitments concerning acquisition of lands and compensation for affected property (refer to Chapter 2 under Environmental Commitments). Therefore, this impact is less than significant. No mitigation is required.

Impact 10-8: Inconsistency with Local Plans and Policies

As previously described above in Impact 10-3, construction and operation of project facilities would be consistent with general plan policies of the City of Sacramento and Sacramento County. One exception exists within the portion of the Zone 40 Surface WTP siting area between Bradshaw and Vineyard Roads. This area is designated by the North Vineyard Station Specific Plan primarily for single-family residential uses, with a small commercial area at Bradshaw Road. Development of a large (80- to 100-acre) water treatment plant within this area could conflict with these land use designations and the residential and commercial land uses that are developed pursuant to them. However, based on preliminary work being carried out by SCWA staff, the Zone 40 Surface WTP will not likely be located within the North Vineyard Station Specific Plan area. If the treatment plant is developed on the portion of the siting area outside of this Specific Plan area, this potential inconsistency would be avoided.

The Amador County General Plan designates the areas north of the Pardee Reservoir that would be affected by implementation of Alternative 6 as Agricultural-General (A-G); Mineral Resources Zone; and Open-Recreation (Grijalva pers. comm.). The Amador County Zoning Code (Title 19) cites "wells, water storage, and reservoirs, including on-site excavation or removal of materials for construction" as compatible uses within Agricultural areas. The Open-Recreation designation is intended to fully protect and maintain the open and recreational character of the designated area, as well as the natural environmental values. Because the project would include relocation and expansion of the recreational facilities at the Pardee Reservoir Recreation Area to an area within the Open-Recreation land use designation, the proposed project would not be in conflict with the Open-Recreation designation.

In addition, a portion of lakeside property within the project's potential area of effect, but outside the area proposed for inundation (i.e., below 614 feet msl near the SR 49 Pardee Reservoir overcrossing in Amador County, is managed by BLM and is designated in the Amador County General Plan as Open Forest [Grijalva pers. comm.]). The Amador County Open Forest designation is applied to public lands in the county owned by agencies other than the County itself. The County does not have additional jurisdiction on this land (Grijalva pers. comm.).

Construction within BLM lands would need to be completed under a federal license to comply with the BLM specifications for construction in the Sierra Planning area. Once the federal license is issued, if necessary for construction activities and staging, or to establish a new buffer around the reservoir, FRWA would purchase the affected land from the BLM. No additional BLM requirements would be applicable after completion of the land transfer (Hummel pers. comm.).

Expansion of the reservoir would be an allowable use within the Calaveras County Dam Inundation Area. The Calaveras County Rural Residential zoning designation allows for public utility facilities with approval of a conditional use permit. As noted in the Calaveras County Zoning Code (Title 17), all recreational uses are allowed within the Calaveras County Recreation zone, with a conditional use permit required for campgrounds and a planned development permit for planned facilities.

The Wildlife Habitat area surrounding the southeastern shore of the Pardee Reservoir is also designated as a Bald Eagle Wintering Area on the Calaveras County General Plan Significant Wildlife Habitat map. Under General Plan Policy V-1A, Implementation Measure V-1 A-2, the County would require a wildlife assessment and implementation of appropriate mitigation measures, including specifications for the construction period, prior to approval of the development permit for the Pardee Reservoir expansion in the Bald Eagle Wintering area.

Therefore, Alternative 6 would not be inconsistent with any plan designations or policies. This impact is less than significant. No mitigation is required.

Impact 10-9: Inconsistency with Future Planned Land Uses

Several of the proposed project components for Alternative 6 would pass through lands designated for commercial, industrial, and residential uses in the City and County of Sacramento and Calaveras County. Potential conflicts between Alternative 6 and the designated future land uses within the City of Sacramento and the County of Sacramento would be the same as those described above for Alternatives 2 through 5. No significant impacts would occur.

There are no planned new land uses adjacent to Pardee Reservoir in Calaveras or Amador Counties; therefore, there would not be any conflicts with new land uses. However, some land uses adjacent to Pardee Reservoir are designated for Future Single Family Residential (5–40 units per acre) in the Calaveras County General Plan. Additionally, the Mokelumne Hill Community Plan designates a portion of the land uses adjacent to Pardee Reservoir as Rural Residential (1- to 5-acre parcels). These areas are not currently developed with residential land uses but rather contain mainly grazing and open space land. Therefore, this impact is less than significant, and no mitigation is required.

Impact 10-10: Conflict with Proposed Scenic Highway Designation for State Route 49

As described above, SR 49 has been proposed for inclusion in the State Scenic Highway system but this designation has not yet been adopted. Construction of a new bridge over the Mokelumne River would not substantially alter the values for which SR 49 is being considered as a scenic highway. Therefore, this impact is less than significant. No mitigation is necessary.

Impact 10-11: Inundation Associated with Enlarging Pardee Reservoir

Implementation of Alternative 6 would involve raising the level of the Pardee Reservoir and consequently inundating lands between 568 feet msl (existing water surface elevation) and 614 feet msl (maximum future flood-control water surface elevation). As a result, the reservoir inundation area would be increased resulting in the loss of land currently in recreational grazing uses. All on-shore recreational uses would be relocated. The loss of grazing lands would be permanent. However, this loss is an extremely small proportion of grazing land in the area and grazing on these lands is currently very limited because of EBMUD water quality concerns. This minor loss of potential grazing land use is a less than significant impact. No mitigation is required.

Impact 10-12: Conflict with Mineral Resources Zone General Plan Classification

The Amador County Mineral Resources Zone classification is applied to lands “having current mining operations or …identified as having a significant or potentially significant mineral resource deposits.... The purpose of the classification is …prevention of the premature conversion of important mineralized lands to other land uses….” The Amador County General Plan cites public recreation as a compatible use for Mineral Resource Zone designated areas. Based on historic maps and officially listed mine locations (California Division of Mines and Geology 1962), approximately 16 to 23 mines are located within the project inundation area (between 568 feet and 614 feet msl), and up to

25 mines are located within the Pardee Reservoir project area. However, all mines in the project area have been closed. While enlargement of the reservoir will result in the inundation of several mines, these mines are not currently and have not been operational for many years, their relative value as mineral extraction sites is unknown and likely very limited, and inundation of these mines would result in only a very minor impact on available mineral extraction areas. Therefore, this impact is less than significant. No mitigation is required.

Impact 10-13: Environmental Justice Effects

Impacts associated with the project components from the intake facility to the Zone 40 Surface WTP would be the same as for Alternatives 2–5, described above.

The median household income and ethnic diversity of each census tract in which the enlarge Pardee Reservoir component lies are shown in Table 10-4. Both of the two census tracts within which the enlarge Pardee Reservoir component would occur exhibit poverty levels lower than the averages for Amador and Calaveras Counties (U.S. Census Bureau 2002c and 2002d). The enlarge Pardee Reservoir component would occur in an area with low ethnic diversity. The enlarge Pardee Reservoir component would not result in a disproportionate impact to minority or low income groups because the project is located away from urban areas and within census tracts that exhibit income levels above the averages for Amador and Calaveras Counties and a population that is predominantly white. This impact is less than significant, and no mitigation is required.

Significant Impacts and Mitigation Measures

None of the project alternatives would result in significant land use impacts and no mitigation measures are necessary.

Chapter 11
Agricultural Resources

Chapter 11
Agricultural Resources

Affected Environment

Methods and Assumptions

The study area for the following discussion includes Sacramento, San Joaquin, Amador, and Calaveras counties (see Figures 2-1, 2-2, and 2-3). Primary information was gathered from numerous sources. The estimates of acreage of various types of farmland (e.g., Prime Farmland, Farmland of Statewide Importance, Unique Farmland, Local Farmland) within the alignment corridors are based on the California Department of Conservation (CDC) Important Farmland maps for Sacramento, San Joaquin, and Amador counties. There is no CDC Important Farmland map for Calaveras County, so farmland information for that county was obtained from the Calaveras County General Plan and the Calaveras County Agricultural Commissioner's office. The location and extent of crop types are based on the California DWR land use maps. Crop yields and values are based on Sacramento, San Joaquin, Amador, Calaveras, Kings, and Fresno County annual crop reports. The analysis of farmland conversion impacts was performed by calculating farmland acreage within each alignment corridor, calculating corresponding crop yields and values that would be lost because of pipeline construction, and comparing the results with study area totals.

The number of properties currently under Williamson Act contracts was estimated by review of available maps and data provided by Sacramento, San Joaquin, Amador, and Calaveras Counties. The Williamson Act applies only to privately owned lands. Because nearly all land that would be affected within Amador and Calaveras counties is publicly owned, the Williamson Act would not be applicable to these lands.

Freeport Intake Facility to Mokelumne Aqueducts

Agricultural Production

The value of agricultural production for the entire two counties in the Freeport intake facility to the Mokelumne Aqueducts study area is summarized in

Table 11-1. Portions of these counties would be traversed by the project alternatives.

Table 11-1. Estimated Value of Agricultural Production in Sacramento and San Joaquin Counties: 2001

County	Gross Value ($)
Sacramento	294,960,000
San Joaquin	1,389,307,000
Totals	**$1,684,267,000**

Source: Sacramento County Department of Agriculture 2002.
San Joaquin County Department of Agriculture 2002.

Prime Farmland

Prime farmland is defined as land with the best combination of physical and chemical characteristics able to sustain long-term production of agricultural crops (California Department of Conservation 2000a). Prime farmland within the study area is located in southeastern Sacramento County and northeastern San Joaquin County. Prime farmland summaries for the year 2000 for the two counties are presented below.

Sacramento County

In 2000, the County of Sacramento contained an estimated 116,116 acres of Prime Farmland, making up 29.3% of its total agricultural land acreage, a decline of 1% from 1998. The estimated 116,116 acres of Prime Farmland make up 18.3% of Sacramento County's total land base. This acreage also is down approximately 1% from 1998 (California Department of Conservation 2002). Prime farmland exists in parts of Sacramento County that would be traversed by pipeline segments or potentially occupied by the Zone 40 Surface WTP (Tables 11-2 and 11-3). Note that only those pipeline segments that would potentially affect farmland are listed in Table 11-2.

San Joaquin County

In 2000, San Joaquin County contained an estimated 423,158 acres of Prime Farmland, comprising 54.2% of its total agricultural land acreage. This represents a 0.5% decrease from 1998. The 423,158 acres of Prime Farmland estimated in 2000 make up 46% of its total land base, a decline of 0.6% from 1998 (California Department of Conservation 2002). Prime farmland exists

Table 11-2. Pipeline Segments Mileage Paralleling or Crossing Prime or Important, State, Local, and Unique Farmland

Segment[1]	Alternatives Affected	Length of Segment (miles)	Prime	Statewide	Unique	Local	Williamson Act Lands (Miles)	Crop Type Paralleled or Crossed
A	2 to 6	0.23	0	0	0	0	0.0	Urban Uses
C	2, 3	2.60	0	0	0	0.2	0.0	Urban Uses
D	2, 3	0.27	0	0	0	0	0.0	Urban Uses
E	2, 3	0.85	0	0	0	0.35	0.0	Urban Uses
H	2 to 6	1.32	0	0	0	0.25	0	Urban Uses, Native Vegetation
I	2 to 6	2.00	0	0.4	0	0.825	0	Urban Uses, Native Vegetation, Pasture, Truck Crops
J	2, 4	1.01	0	0	0	0.225	0	Urban Uses, Native Vegetation,
K	2, 4	4.93	0	0.6	0.45	1.8	2	Urban Uses, , Native Vegetation, Pasture, Truck Crops, Water
L	3, 5	1.03	0.25	0	0	0.65	0	Urban Uses, , Native Vegetation, Pasture, Water
M	3, 5	0.98	0	0	0	0.25	0	Urban Uses, , Native Vegetation, Pasture
N	3, 5	2.82	0	0.45	0	0.85	2	Urban Uses, Pasture, Native Vegetation, Vineyards, Water
O	3, 5	0.15	0	0.05	0.1	0	0.13	Native Vegetation, Pasture
R	4, 5, 6	1.99	0.9	0.9	0	0.1	0	Native Vegetation, Pasture, Water
S	4, 5, 6	0.92	0	0	0	0.625	0	Urban Uses, Native Vegetation
Option 1	4, 5, 6 (option)	2.47	1.400	0.475	0	0.7	0	Native Vegetation, Water Bodies, Pasture, Urban Uses, Water
Option 2	2 to 5 (option)	0.50	0	0	0	0	0	Urban Uses

Segment[1]	Alternatives Affected	Length of Segment (miles)	Prime	Statewide	Unique	Local	Williamson Act Lands (Miles)	Crop Type Paralleled or Crossed
V	2 to 5	2.89	0	0	0.55	1.1	1	Orchards, Native Vegetation, Semi-Agricultural
W	2 to 5	9.68	0.85	1.65	2.04	3.09	7.8	Orchards, Native Vegetation, Vineyards, Pasture, Field Crops, Semi-Agricultural, Truck Crops, Urban Uses
X	2 to 5	5.91	0.2	0	0	0.5	3.95	Pasture, Native Vegetation, Water Bodies, Urban Uses
Option 3	2 to 5 (option)	7.90	0.9	0.12	3.28	0	6.72	Orchards, Vineyards, Native Vegetation, Riparian Vegetation

Sources: CDC, 1998–2001; California Department of Water Resources, 1996–2000.

Note:

1 Segments listed in this table are only those segments that may be or would be potentially outside roadway rights-of-way and hence could affect Prime, Important, or Unique Farmlands and Williamson Act lands. Inclusion of segments in Table 11-2 was based on land use assumptions provided by Jones & Stokes in November 2002.

Table 11-3. Project Facility Areas Located on Prime or Important, State, Local, and Unique Farmland

Facilities	Alternatives Affected	Area of Facility	Prime	Statewide	Unique	Local	Williamson Act Lands (Acres)	Crop Type
Zone 40 Surface WTP siting area	2 to 6	80–100 acres[1]	35	360	80	847.5	0	Native Vegetation, Pasture, Urban Uses, Truck Crop, Water
Freeport Intake Facility and On-Site Settling Basins	2 to 6	10 acres	0	0	0	0	0	Urban Uses, Riparian Vegetation
Optional Terminal Facility Settling Basins, Grant Line option	3, 5	16 acres	0	1.06	2.14	0	16	Pasture
Optional Terminal Facility Settling Basins, Florin Rd. option	2, 4	16 acres	0	16	0	0	16	Pasture
Canal Pumping Plant	2 to 5	3.2 acres	0	0	0	0	3.2	Native Vegetation
Aqueduct Pumping Plant and Pretreament Facility, Camanche site	2 to 5	25 acres	0	0	0	0	0	Native Vegetation
Aqueduct Pumping Plant and Pretreament Facility, optional Brandt site	2 to 5	25 acres	0	0	0	0	25	Native Vegetation
Inundation Area of Enlarged Pardee Reservoir	6		0	0	0	0	0	Native Vegetation

Sources: CDC, 1998–2001; California Department of Water Resources, 1996–2000.

Note:

[1] Although the Zone 40 Surface WTP would only occupy about 80–100 acres, its location within the siting area (bounded by Elder Creek, Gerber, Bradshaw, and Excelsior roads) has not yet been selected. Acreages of prime, important, and unique lands are for the entire siting area. The actual area affected by the WTP would be less than the acreages listed.

in parts of San Joaquin County that would be traversed by pipeline segments (Tables 11-2 and 11-3).

Important and Unique Farmland

CDC-designated Farmland of Statewide Importance, Farmland of Local Importance, Unique Farmland, and grazing land also occur within the study area. Although these lands do not qualify as Prime Farmland, they are used for production of the state's major crops, such as fruits and vegetables, or are lands that currently support confined and/or grazing livestock. These lands may or may not be irrigated.

Farmland of Statewide Importance, Farmland of Local Importance, and Unique Farmland exist in parts of Sacramento and San Joaquin Counties that would be traversed by pipeline segments or potentially occupied by project facilities (Tables 11-2 and 11-3).

Williamson Act Lands

The California Land Conservation Act (Williamson Act) enables counties and cities to designate agricultural preserves (Williamson Act lands) and offer preferential taxation to private agricultural landowners based on the income-producing value of their property in agricultural use, rather than on the property's assessed market value. In return for the preferential tax rate, the landowner is required to sign a contract with the county or city agreeing not to develop the land for a minimum 10-year period. Contracts are automatically renewed annually unless a party to the contract files for nonrenewal or petitions for cancellation.

Permissible land uses under Williamson Act contracts are governed by Government Code Section 51238.1. Each city and county has the discretion to determine land uses that are or are not compatible with Williamson Act contracts, provided these uses are not prohibited under the Act. Pipelines are not prohibited under the Act.

The County of Sacramento has adopted a standard list of compatible uses in Williamson Act contracted parcels as Exhibit B of the County's Resolution Establishing Agricultural Preserve. This list includes "gas, electric, water, and communication utility facilities." Water pipelines are considered a water facility. However, specific contracts could have differing lists of compatible land uses (Lindsay pers. comm.).

San Joaquin County also has adopted a list of compatible land uses, including Utility Services (San Joaquin County Zoning Code, Chapter 9-1810). Pipelines are one of the compatible Utility Services (Martin pers. comm.).

Enlarge Pardee Reservoir

Agricultural Production in Amador and Calaveras Counties

The value of agricultural production for the two counties in the Pardee Reservoir area is summarized in Table 11-4.

Table 11-4. Estimated Value of Agricultural Production in Amador and Calaveras Counties: 2001

County	Gross Value ($)
Amador	27,168,500
Calaveras	26,453,000
Total:	**$63,621,520**

Sources: Amador County Department of Agriculture 2002.
Calaveras County Department of Agriculture 2002.

Prime Farmland

Prime farmland summaries for Amador and Calaveras Counties are presented below.

Amador County

In 2000, Amador County contained an estimated 3,873 acres of Prime Farmland, making up 1.9% of its total 202,356 agricultural acres. This estimated Prime Farmland acreage makes up an estimated 1.3% of Amador County's total land base. (California Department of Conservation 2002). No Prime Farmland exists in the area of Amador County that potentially would be affected by the enlargement of Pardee Reservoir.

Calaveras County

The CDC does not have Prime Farmland estimates for Calaveras County.

Important and Unique Farmland

No Farmland of Statewide Importance, Farmland of Local Importance, or Unique Farmland exists within the area potentially affected by the enlargement of Pardee

Reservoir. The potentially affected area around the reservoir is native vegetation grazing land.

Williamson Act Lands

There are 95,425 acres of land under Williamson Act contracts in Amador County, about 47% of the county's agricultural lands. Of the 245,116 total farmland acres in Calaveras County, approximately 53% is in Williamson Act Agricultural Preserves (Calaveras County Department of Agriculture 2002). Because the Williamson Act pertains only to privately owned property and most lands adjacent to Pardee Reservoir are publicly owned, few lands in Calaveras or Amador Counties adjacent to Pardee Reservoir are eligible for Williamson Act designation. No lands enrolled in the Williamson Act program would be affected by the enlargement of Pardee Reservoir.

South-of-Delta Agricultural Lands

Agricultural Production in Kings and Fresno Counties

The value of agricultural production for two counties representative of south–of-Delta agricultural lands where secondary impacts may occur is summarized in Table 11-5.

Table 11-5. Estimated Value of Agricultural Production in Kings and Fresno Counties: 2002

County	Gross Value ($)
Kings	951,950,000
Fresno	3,215,185,000
Total:	**$4,167,135,000**

Sources: California Agricultural Statistics Service 2002.

Farmland

In 2002, Kings County contained an estimated 749,100 acres of farmland, and Fresno County contained an estimated 1,204,358 acres of farmland (neither estimate includes grazing land).

Environmental Consequences

Methods and Assumptions

The impact evaluation assumes a 130-foot-wide right-of-way consisting of an 80—foot-wide permanent operation corridor and a 50-foot-wide temporary construction corridor for all pipeline alignments. While there are some pipeline segments that would not require a full 130-foot-wide right-of-way (the FSCC segments in particular), that width is used consistently for purposes of this analysis. The analysis also assumes that all agricultural land within the permanent operation corridors would *not* return to agricultural production, but agricultural land uses would be reestablished in the temporary 50-foot-wide construction corridors, as described in the Agricultural Land Restoration Plan outlined in the Project Description for this project (see Chapter 2 of this document). Certain agricultural uses, including nonirrigated crops and pasture, would likely be able to resume within permanent pipeline rights-of-way following construction; however, the evaluation method used in this analysis provides a worst-case estimate of the amount of agricultural land permanently converted. Short-term withdrawal from agricultural use of lands in the temporary construction corridor is identified but not considered a significant impact because it would revert back to agricultural use within one growing season.

The impacts analysis also includes an evaluation of impacts on agricultural lands associated with the canal pumping plant, the aqueduct pumping plant and pretreatment facility, power transmission facilities, and pipeline construction staging areas. In addition, the impacts on agricultural lands associated with the Zone 40 Surface WTP site area are included in this analysis. Conversion of agricultural land as a result of construction of the various project facilities is considered permanent. The pipeline construction staging areas would be small and would be restored to their original uses following construction. Thus, they would not contribute to long-term impacts on agricultural production or loss of Prime Farmland. Although the exact number and locations of construction staging areas have not yet been determined, these areas are accounted for in this conservative analysis.

The number of properties and total mileage traversed by project alternatives on lands currently under Williamson Act contracts is estimated by review of available maps, data provided by Sacramento and San Joaquin counties, and data provided by the CDC.

The segments and mileage figures in Table 11-2 and used for the impacts analysis reflect only those segments that parallel farmland and include the following assumptions:

- Alignments following roadways without adequate amounts of unpaved rights-of-way would be constructed within the paved roadway or along its shoulder to the extent feasible. It is likely that private land (using temporary easements and, in limited cases, permanent easements) will be used in some instances for construction and/or long-term maintenance/access purposes.

- Alignments following parcel boundaries or existing and anticipated rights-of-way would be constructed in a manner that minimizes long-term impacts on private property. Temporary and/or permanent easements will be used for construction and/or long term maintenance and access purposes.

Significance Criteria

The criteria used for determining the significance of an impact on agricultural resources are based on Appendix G of the CEQA Guidelines (Environmental Checklist), Sacramento County's specific adopted criteria of significance, and professional standards and practices. Impacts on agricultural resources may be considered significant if implementation of an alternative would:

- convert a substantial amount of Prime Farmland, Unique Farmland, or Farmland of Statewide Importance (collectively "Farmland"), as shown on CDC maps, to nonagricultural use;
- conflict with existing zoning for agricultural use or convert a substantial amount of land under a Williamson Act contract; or
- involve other changes in the existing environment, which, because of their location or nature, could result in substantial conversion of farmland to nonagricultural use or substantial loss of production value of specific crops relative to the total production value in the study area.

Sacramento County has adopted a significance threshold of conversion of over 50 acres of Prime Farmland or Farmland of Statewide Importance to nonagricultural uses (Policy CO-55 in the Conservation Element of the General Plan). Therefore, a 50-acre threshold is used in determining the level of significance for these categories of farmland within any single county.

Less-than-Significant Impacts

Alternative 1

Alternative 1 would have no construction-related or operation-related impacts on farmland or crop production associated with construction of FRWP facilities within any of the affected counties.

Alternatives 2–5

Alternatives 2 through 5 differ only in the pipeline alignments from the intake facility to the FSC. Project construction and operation for Alternatives 2 through 5 are very similar. Impacts related to agricultural resources for each alternative differ only slightly from each other; therefore, the results for Alternatives 2 through 5 are presented together but are representative of each individual alternative, unless otherwise noted.

Impact 11-1: Loss of Agricultural Production

The permanent conversion of agricultural land for Alternatives 2–5 would be approximately 55.9 to73.4 acres for the pipeline alignments from the intake facility to the Mokelumne Aqueducts. Associated annual losses in annual production value would be approximately $63,000–$118,000 (see Table 11-6). The temporary loss of production because of construction activities occurring within the 50-foot-wide construction corridor would be 35–46 acres in the alignment from the intake facility to the Mokelumne Aqueducts. Associated temporary (1-year) losses in production value would be approximately $39, 250–$73,800. The other project facilities could permanently convert up to 132 additional acres, most of which would occur if the Zone 40 Surface WTP were located on agricultural lands. This would represent an annual loss of approximately $5,000 in agricultural production. The estimated total acreage of agricultural land removed from production represents less than 0.06% of the total agricultural land under production in the study area, and the loss of production from these lands would represent less than 0.02% of the total value of agricultural production in the study area (Table 11-6). The impact of permanent loss of a small percentage of the agricultural production would be less than significant. No mitigation is required.

Along the pipeline alignments, several pipeline segments would cross or affect nearby vineyards. Temporary construction-period impacts related to dust/air quality could result in conflicts with these vineyards. These impacts would be temporary and relatively short-term. In addition, FRWA would adhere to the environmental commitments concerning dust suppression (refer to Environmental Commitments section of Chapter 2). Therefore this impact would be less than significant. No mitigation is required.

Impact 11-2: Nonrenewal or Termination of Williamson Act Contracts

About 414 to 416 acres of land under Williamson Act contracts would be affected under Alternatives 2 through 5, as shown in Table 11-7. Of these affected lands, about 331.8 of these acres are in San Joaquin County, with the remaining affected acres in Sacramento County. The figures represent about 0. 06% of the total 540,925 acres of land under the Williamson Act contracts in San Joaquin County and about 0.24% of the total 176,285 acres of land under the Williamson Act contracts in Sacramento County. In Sacramento County, there would be a permanent loss of approximately 58–59.2acres in the 80-foot-wide operations corridor and an additional temporary loss of 24.2–25 acres during construction. Of the 414–416 acres affected in San Joaquin County, there would

Table 11-6. Estimated Harvest Acreage and Production Values within the Alignment Corridors: Alternatives 2–6 and Facilities (Part 1 of 5)

	Alternative 2: Sacramento County (Freeport to County Line) [a]			Alternative 3: Sacramento County (Freeport to County Line)			Alternative 4: Sacramento County (Freeport to County Line)			Alternative 5: Sacramento County (Freeport to County Line)		
Crop Type	Perm. 80-Foot Ops Corridor	Temporary Construction	Total	Perm. 80-Foot Ops Corridor	Temporary Construction	Total	Perm. 80-Foot Ops Corridor	Temporary Construction	Total	Perm. 80-Foot Ops Corridor	Temporary Construction	Total
Vineyards												
Acres	0	0	0	2.91	1.82	4.73	0	0	0	2.91	1.82	4.73
Value	$0	$0	$0	$10,752	$6,720	$17,472	$0	$0	$0	$10,752	$6,720	$17,472
Pasture/Range												
Acres	10.18	6.36	16.55	16.48	10.3	26.79	13.58	8.48	22.06	19.88	12.42	32.3
Value	$488	$305	$794	$791	$494	$1,285	$651	$407	$1,058	954	596	$1,550
Orchards [b]												
Acres	0	0	0	0	0	0	0	0	0	0	0	0
Value	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Total Acres	10.18	6.36	16.55	19.39	12.12	31.52	13.58	8.48	22.06	22.79	14.24	37.03
Total Value ($) per Alternative	488	305	794	11,543	7,214	18,757	651	407	1,058	11,706	7,316	19,022

Notes:

a This table describes only those alignments that would potentially affect agricultural lands, i.e., those alignments assumed to be outside of roadways and public rights-of-way, as listed in Table 11-2.

b Orchards totals are comprised of all fruit and nut tree crops minus vineyards. Orchards value ($2,700/acre) was calculated by averaging the value of all fruit and nut tree crops minus vineyards.

Sources: 2001 Agricultural Reports for Sacramento, San Joaquin, Amador, and Calaveras Counties; California Dept. of Water Resources Land Use/Land Cover map, 1996-2000.

Table 11-6. Estimated Harvest Acreage and Production Values within the Alignment Corridors: Alternatives 2–6 and Facilities (Part 2 of 5)

	Alternatives 2 through 5: San Joaquin County (County Line to Mokelumne Aqueducts)			Alternative 6: Sacramento County (Freeport to Zone 40 Surface WTP)			Alternative 6: Amador and Calaveras Counties (Pardee Reservoir)
Crop Type	Perm. 80-Foot Ops Corridor	Temporary Construction	Total	Perm. 80-Foot Ops Corridor	Temporary Construction	Total	Total
Vineyards							
Acres	5.92-6.30	3.70-3.94	9.61-10.24	0	0	0	0
Value	$17,242-18,373	$10,776-11,483	$28,019-29,856	$0	$0	$0	$0
Pasture/Range							
Acres	1.65-32.19	1.03-20.12	2.68-52.32	5.82	3.64	9.45	1,225
Value	$46-901	$28-563	$75-1,464	$279	$174	$453	$14,087
Orchards							
Acres	12.12-38.21	7.58-23.88	19.7-62.08	0	0	0	0
Value[b]	$31,830-100,329	$19,893-62,705	$51,724-163,034	$0	$0	$0	$0
Total Acres	45.77-50.62	28.61-31.64	74.38-82.25	5.82	3.64	9.45	1,225
Total Value ($) Per Alt.	51,105-117,617	31,940-73,511	83,045-191,129	297	174	453	14,087

Table 11-6. Estimated Harvest Acreage and Production Values within the Alignment Corridors: Alternatives 2–6 and Facilities (Part 3 of 5)

	Zone 40 Surface WTP: Sacramento County (Alternatives 2-6)		Terminal Settling Basins, Grant Line option: Sacramento County (Alternatives 3 and 5)		Terminal Settling Basins, Florin Rd. option: Sacramento County (Alternatives 2 and 4)	
Crop Type	Perm. 80-Foot Ops Corridor	Total	Perm. 80-Foot Ops Corridor	Total	Perm. 80-Foot Ops Corridor	Total
Vineyards						
Acres	0	0	0	0	0	0
Value	$0	$0	$0	$0	$0	$0
Pasture/Range						
Acres	100	100	16	16	16	16
Value	$4,800	$4,800	$768	$768	$768	$768
Orchards						
Acres	0	0	0	0	0	0
Value[b]	$0	$0	$0	$0	$0	$0
Total Acres	100	100	16	16	16	16
Total Value per Facility	$4,800	$4,800	$768	$768	$768	$768

Table 11-6. Estimated Harvest Average and Production Values within Alignment Corridors: Alternatives 2–6 and Facilities (Part 4 of 5)

Total Harvest Acreage and Production of Alternatives 2 through 6 with Facilities including all Counties										
		Alternative 2 (WTP and Florin Rd Terminal Settling Basin)			Alternative 3 (WTP and Grant Line Terminal Settling Basin)			Alternative 4 (WTP and Florin Rd. Terminal Settling Basin)		
Crop Type		Perm. 80-Foot Ops Corridor	Temporary Construction	Total	Perm. 80-Foot Ops Corridor	Temporary Construction	Total	Perm. 80-Foot Ops Corridor	Temporary Construction	Total
Vineyards	Acres:	5.92-6.30	3.70-3.94	9.61-10.24	8.83-9.21	5.52-5.76	14.34-14.97	5.92-6.30	3.70-3.94	9.61-10.24
	Value:	$17,242.67-18,373.33	$10,776.67-11,483.33	$28,019.33-29,856.67	$27,994.67-29,125.33	$17,496.67-18,203.33	$45,491.33-47,328.67	$17,242.67-18,373.33	$10,776.67-11,483.33	$28,019.33-29,856.67
Pasture/Range	Acres:	127.83-158.37	7.39-26.48	135.23-184.87	134.13-164.67	11.33-30.42	145.47-195.11	131.23-161.77	9.51-28.6	140.74-190.37
	Value:	$6,102.89-6,958.16	$334.30-868.84	$6,437.19-7,827.00	$86,180.76-7,260.70	$523.40-1057.94	$6,928.83-8,318.64	$6,265.80-7,121.07	$436.12-970.66	$6,701.92-8,091.73
Orchards	Acres:	12.12-38.21	7.58-23.88	19.7-62.08	12.12-38.21	7.58-23.88	19.7-62.08	12.12-38.21	7.58-23.88	19.7-62.08
	Values:	$31,830.30-100,329.12	$19,893.94-62,705.70	$51,724.24-163,034.81	$31,830.30-100,329.12	$19,893.94-62,705.70	$51,724.24-163,034.81	$31,830.30-100,329.12	$19,893.94-62,705.70	$51,724.24-163,034.81
Total	Acres:	145.87-202.88	18.67-54.3	164.54-257.19	155.08-212.09	24.43-60.06	179.51-272.16	149.27-206.28	20.79-56.42	170.05-262.69
	Values:	$55,175.86-125,660.61	$31,004.91-75,057.87	$86,180.76-200,718.48	$146,005.73-136,715.15	$37,914.01-81,966.97	$104,144.40-218,682.12	$55,338.77-125,823.52	$31,106.73-75,159.69	$86,445.49-200,983.21

Table 11-6. Estimated Harvest Average and Production Values within Alignment Corridors: Alternatives 2–6 and Facilities (Part 5 of 5)

Total Harvest Acreage and Production of Alternatives 2 through 6 with Facilities including all Counties							
		Alternative 5 (WTP and Grant Line Terminal Settling Basin)			Alternative 6 (WTP)		
Crop Type		Perm. 80-Foot Ops Corridor	Temporary Construction	Total	Perm. 80-Foot Ops Corridor	Temporary Construction	Total
Vineyards	Acres: Values:	8.83-9.21 $27,994.67-29,125.33	5.52-5.76 $17,496.67-18,203.33	14.34-14.97 $45,491.33-47,328.67	0 $0	0 $0	0 $0
Pasture/Range	Acres: Values:	137.53-168.07 $6,568.34-7,423.61	13.45-32.54 $625.21-1,159.75	150.98-200.62 $7,193.56-8,583.37	1330.85 $19,166.27	3.64 $174.55	1334.49 $19,340.82
Orchards	Acres: Values:	12.12-38.21 $31,830.30-100,329.12	7.58-23.88 $19,893.94-62,705.70	19.70-62.08 $51,724.24-163,034.81	0 $0	0 $0	0 $0
Total	Acres: Values:	158.48-215.49 $66,393.31-136,878.06	26.55-62.18 $38,015.82-82,068.78	185.02-277.67 $104,409.13-218,946.85	1330.85 $19166.27	3.64 $174.55	1334.49 $19,340.82

be a permanent loss of approximately 213.8 acres within the 80-foot-wide operations corridor and temporary loss of about 118 acres within the 50-foot-wide construction corridor. This impact is less than significant. No mitigation is required.

Table 11-7. Williamson Act Lands: Alternatives 2–6

County	Alternative	Miles Traversed	Acreage in Permanent 80-Foot Operational Corridor	Acreage in Temporary Construction Corridor	Total Acreage Affected
Sacramento	2 and 4	4	58	24.2	82.2
	3 and 5	4.13	59.2	25	84.2
	6	2	19.4	12.1	31.5
San Joaquin	2–5	19.47	213.8	118	331.8
Amador	6	NA	0	0	0
Calaveras	6	NA	0		0
Countywide Totals of Williamson Act Lands:					
Sacramento	176,285		Amador	95,425	
San Joaquin	540,925		Calaveras	133,635	

Sources: California Department of Conservation 2000a, 2002.

NA = Not applicable.

Impact 11-3: Reduction in Agricultural Productivity within the San Joaquin Valley

As described in Chapter 3, “Hydrology, Water Supply, and Power,” and Sections 3.4 and 3.5 of the Modeling Technical Appendix (Volume 3 of this EIR/EIS), the hydrologic modeling for the FRWP alternatives indicates that CVP agricultural contractors south of the Delta (primarily within the San Joaquin Valley) may experience slight reductions in water deliveries as a result of implementation of the FRWP alternatives. The modeling indicates that these reductions are expected to average approximately 2,900 af per year during all years, and approximately 5,600 af per year during the dry period (defined as the 1928–1934 historical drought period) years. During these periods, average annual deliveries to CVP south-of-Delta agricultural contractors are approximately 1,080,000 af per year (average years), and 310,000 af per year (dry years). These reductions represent a -0.3% and -1.8% change in deliveries, respectively. No change in deliveries is expected for other CVP contractors.

Average annual deliveries to SWP contractors are expected to be slightly reduced (approximately 2,800 af per year total). However, during the dry period, average annual deliveries are expected to increase by approximately 11,000 af per year.

During these periods, total SWP deliveries are approximately 2,950,000 af per year (average years) and 1,950,000 per year (dry years). These changes represent a -0.1% and +0.1% change, respectively.

Westlands Water District is by far the largest CVP agricultural contractor south of the Delta. Recent information provided by Westlands Water District in comments on the SMUD Water Assignment Draft EIR (Rubin pers. comm.) indicates that the average quantity of water needed to produce a crop on land within the district is 2.5 af/acre. Therefore, according to Westlands' comments, for every 1,000 af of water supply reduction, 400 acres of land are removed from agricultural production. Westlands also provided information indicating that the average annual crop value is $1,720 per acre within the district.

Under a very conservative assumption that any reductions in CVP deliveries would lead directly to a proportional decrease in the acreage of land put to agricultural use, the FRWP alternatives may result in a reduction of approximately 15,000 acres during dry years, and 7,500 acres on the average. This represents less than 4% of land within Westlands Water District. However, this is an extremely conservative assumption that does not reflect actual responses to any minor reductions in deliveries. Individual water users would have independent responses to changes in water supply. The range of responses could include not planting crops on a portion of land, changing crop patterns, increasing irrigation efficiencies or accepting reduced yields, acquiring water from other sources, water conservation, and increased groundwater pumping. It is important to note that CVP supplies are supplemental and are not the sole source of water used in Westlands Water District. Landowners within the district also use groundwater as part of their normal operations.

This fact is illustrated by information in Westlands Water District 2000/2001 annual report. Although there is a relationship between Westlands' CVP allocation and the amount of land fallowed, the relationship is not direct and is influenced by a number of other equally important factors. For example, Westlands' CVP allocation in 1995/1996 was 100%, or more than 1,000,000 af. In 2000/2001, the CVP allocation was reduced to approximately 700,000 af, a reduction of 300,000 af. Based on the information above, this reduction in supplies would have led to an increase in fallowed acreage of 120,000 acres. According to Westlands' annual report, however, the amount of land fallowed in 1995/1996 (100% CVP allocation) was approximately 45,000 acres, whereas approximately 51,000 acres were fallowed in 2000/2001 (65% CVP allocation). Additionally, in 1988/1989 and 1989/1990, when CVP allocations to Westlands were roughly 100%, the amount of fallowed acreage averaged approximately 55,000 acres. This information clearly demonstrates the lack of a direct relationship between minor changes in CVP allocations and agricultural production.

Any potential effects of a reduction in SWP deliveries on agricultural production would be much less than described above. The average annual reduction of 3,000 af is very small and would be distributed among all SWP contractors, and SWP deliveries would actually be increased on the average during dry years. In addition, as discussed above, the specific responses of water users to any reductions in deliveries are not predictable and could vary widely.

Based on the information presented above, this potential impact is speculative. To the extent this issue can be meaningfully analyzed, there would be no significant impact. No further analysis is required.

Alternative 6

As described in Chapter 2, "Project Description," Alternative 6 consists of enlarging Pardee Reservoir and conveying water from the Sacramento River. Alternative 6 includes of the following project components: enlarge Pardee Reservoir (which includes additional components), intake facility, pipeline from intake facility to the Zone 40 Surface WTP, and the Zone 40 Surface WTP. Though slightly different in size, the Freeport intake facility, pipeline from the intake facility to the Zone 40 Surface WTP, and the Zone 40 Surface WTP project components are the same as those that make up Alternative 5. Therefore, several of the impacts associated with Alternative 5 (described above) are also associated with Alternative 6 and are restated below. Additionally, impacts associated with the enlarge Pardee Reservoir component of this alternative are described below.

Impact 11-4: Loss of Agricultural Production

The total acreage of agricultural land permanently removed from service under Alternative 6 would be 1,230.8 acres, with associated losses in annual production value of about $14,366. Almost all of this land would be grazing land surrounding Pardee Reservoir. The temporary loss of production because of construction activities occurring within the 50-foot-wide construction corridor would be 3.64 acres, with associated temporary losses in annual production value of $174. The estimated total acreage of agricultural land removed from production represents about 0. 18% of the total agricultural land under production in the study area, and the loss of production from these lands would represent less than 0.01% of the total value of agricultural production in the study area (Table 11-6). This impact is less than significant. No mitigation is required.

Impact 11-5: Nonrenewal or Termination of Williamson Act Contracts

About 31.5 acres of lands under Williamson Act contracts would be affected under Alternative 6 (Table 11-7), all in Sacramento County. These figures represent less than 0.02% of the total 176,285 acres of lands under Williamson Act contracts in Sacramento County.

Of the 31.5 acres affected in Sacramento County, there would be a permanent loss of about 19.4 acres in the 80-foot-wide operations corridors and an additional temporary loss of about 12.1 acres during construction. This impact is less than significant. No mitigation is required.

Impact 11-6: Reduction in Agricultural Productivity within the San Joaquin Valley

As described in Chapter 3, "Hydrology, Water Supply, and Power," and Sections 3.4 and 3.5 of the Modeling Technical Appendix (Volume 3 of this EIR/EIS), the hydrologic modeling for the FRWP alternatives indicates that CVP agricultural contractors south of the Delta (primarily in the San Joaquin Valley) may experience slight changes in water deliveries as a result of implementation of this alternative. The modeling indicates that these changes are expected to result in an average annual increase of approximately 1,100 af per year during all years, and a decrease of approximately 2,000 af per year during dry years. During these periods, average annual deliveries to CVP south of Delta agricultural contractors are approximately 1,080,000 af per year (average years), and 310,000 af per year (dry years). These reductions represent a +0.1% and –0.2% change in deliveries, respectively. No change in deliveries is expected for other CVP contractors.

Average annual deliveries to SWP contractors are expected to be slightly reduced (approximately 3,000 af per year total). During the dry period, average annual deliveries are expected to be reduced by approximately 6,900 af per year. During these periods, total SWP deliveries are approximately 2,950,000 af per year (average years) and 1,900,000 af per year (dry years). These changes represent a -0.2% and +0.6% change, respectively.

Westlands Water District is by far the largest CVP agricultural contractor south of the Delta. Recent information provided by Westlands Water District in comments on the SMUD Water Assignment Draft EIR (Rubin pers. comm.) indicates that the average quantity of water needed to produce a crop on land within the district is 2.5 af/acre. Therefore, according to Westlands comments, for every 1,000 af of water supply reduction, 400 acres of land are removed from agricultural production. Westlands also provided information indicating that the average annual crop value is $1,720 per acre within the district.

Under a very conservative assumption that any changes in CVP deliveries would lead directly to a proportional change in the acreage of land put to agricultural use, this alternative may result in a decrease of approximately 800 acres during dry years, and an increase of approximately 250 acres on the average. This represents approximately -0.04% and +0.01% of agricultural land in Fresno and Kings Counties. However, this conservative assumption does not reflect actual responses to any minor reductions in deliveries. Individual water users would likely have independent responses to changes in water supply. The range of responses could include not planting crops on a portion of land, changing crop patterns, increasing irrigation efficiencies or accepting reduced yields, acquiring water from other sources, water conservation, and increased groundwater pumping. It is important to note that CVP supplies are supplemental and are not the sole source of water used within Westlands Water District. Landowners in the district also use groundwater as part of their normal operations.

As described above, this fact is illustrated by information in Westlands Water District 2000/2001 annual report. Although there is a relationship between Westlands' CVP allocation and the amount of land fallowed, the relationship is not direct and is influenced by a number of other equally important factors. For example, Westlands' CVP allocation in 1995/1996 was 100%, or more than 1,000,000 af. In 2000/2001, the CVP allocation was reduced to approximately 700,000 af, a reduction of 300,000 af. Based on the information above, this reduction in supplies would have led to an increase in fallowed acreage of 120,000 acres. According to Westlands' annual report, however, the amount of land fallowed in 1995/1996 (100% CVP allocation) was approximately 45,000 acres, whereas approximately 51,000 acres were fallowed in 2000/2001 (65% CVP allocation). Additionally, in 1988/1989 and 1989/1990, when CVP allocations to Westlands were roughly 100%, the amount of fallowed acreage averaged approximately 55,000 acres. This information clearly demonstrates the lack of a direct relationship between minor changes in CVP allocations and agricultural production.

Any potential effects of a reduction in SWP deliveries on agricultural production would be much less than described above. The average annual reduction of 3,000 af, and 7,000 af during dry years, is very small and would be distributed among all SWP contractors. In addition, as discussed above, the specific responses of water users to any reductions in deliveries are not predictable and could vary widely.

Based on the information presented above, this potential impact is speculative. To the extent this issue can be meaningfully analyzed, there would be no significant impact. No further analysis is required.

Significant Impacts and Mitigation Measures

Alternatives 2–5

Impact 11-7: Loss or Conversion of Prime Farmland and Farmland of Statewide Importance

Construction of many of the segments of the pipeline from the intake facility to the Mokelumne Aqueducts could be outside of the roadway rights-of-way, as listed in Table 11-2. Project facilities could also affect Prime and Important Farmland (Table 11-3). Potential impacts on Prime and Important Farmland for Alternatives 2 through 5 are presented by county in Table 11-8.

Table 11-8. Estimated Acreage of Affected Prime or Other Important Farmland within Corridors: Alternatives 2–6

Alternative or Facility	County	Miles Traversed	Estimated Acreage of Prime and Important Farmland: Acreage in Permanent 80-Foot Operational Corridor [1]	Acreage in Temporary Construction Corridor [1]	Total Prime and Important Farmland Acres Affected
Alt. 2	Sacramento County (Freeport to County Line)	7.65–8.71	Prime: 0–5.8 Statewide Important: 10.9–20.9 Other: 53.3–67.8	Prime0–3.6 Statewide Important: 6.8–13.0 Other: 33.3–42.4	Prime: 0–9.5 Statewide Important: 17.7–33.9 Other: 86.7–110.1
Alt. 3	Sacramento County (Freeport to County Line)	7.18–8.24	Prime: 2.4–8.2 Statewide Important: 9.9–19.9 Other: 47.3–61.7	Prime: 1.5–5.2 Statewide Important: 6.2–12.4 Other: 29.5–38.6	Prime: 3.9–13.4 Statewide Important: 16.1–32.3 Other: 76.8–100.3
Alt.4	Sacramento County (Freeport to County Line)	12.3–13.36	Prime: 16–21.8 Statewide Important: 15.5–25.5 Other: 77.8–92.3	Prime: 10–13.6 Statewide Important: 9.7–15.9 Other: 48.6–57.7	Prime: 26–35.5 Statewide Important: 2.6–41.4 Other: 126.5–149.9
Alt. 5	Sacramento County (Freeport to County Line)	11.83–12.89	Prime: 18.4–24.2 Statewide Important: 14.5–24.5 Other: 71.8–86.2	Prime: 11.5–15.2 Statewide Important: 9.1–15.3 Other: 44.9–53.9	Prime: 29.9–39.4 Statewide Important: 23.6–39.8 Other: 116.6–140.1
Alts. 2–5	San Joaquin County (County Line to Mokelumne Aqueducts)	2.44–6.88	Prime: 4.9–10.2 Statewide Important: 0–5.3 Other: 18.8–51.2	Prime: 3–6.4 Statewide Important: 0–3.3 Other: 11.8–32	Prime: 7.9–16.6 Statewide Important: 0–8.7 Other: 30.6–83.2
Alt. 6	Sacramento County (Freeport to Zone 40 Surface WTP)	6.05	Prime: 16 Statewide Important: 8.5 Other: 34.4	Prime: 10 Statewide Important: 5.3 Other: 21.5	Prime: 26 Statewide Important: 13.8 Other: 55.9
Zone 40 Surface WTP	Sacramento County		Up to 100	N/A	Up to 100

			Estimated Acreage of Prime and Important Farmland		
Alternative or Facility	County	Miles Traversed	Acreage in Permanent 80-Foot Operational Corridor [1]	Acreage in Temporary Construction Corridor [1]	Total Prime and Important Farmland Acres Affected
Terminal Settling Basins, Grant Line option	Sacramento County		Prime: 0 Statewide Important: 5.3 Other: 10.67	N/A	Prime: 0 Statewide Important: 5.3 Other: 10.67
Terminal Settling Basins, Florin Road option	Sacramento County		Prime: 0 Statewide Important: 16 Other: 0	N/A	Prime: 0 Statewide Important: 16 Other: 0

Total Prime and Important Farmland in County in 2002

Sacramento: 234,120 acres

San Joaquin: 630,990 acres

Notes:

[1] Total acreage of Prime or Important Farmland converted calculated based on mileage listed in Table 11-2 multiplied by 80 feet for the permanent operations corridor and 50 feet for the temporary construction area.

[2] Acreage of Prime and Important Farmland in the entire four-county study area for all six alternatives totaled 1,110,795 acres in 2000.

Source: California Department of Conservation 2000a.

Prime Farmland and Farmland of Statewide Importance potentially affected under Alternatives 2 through 5 would represent less than 0.02% of the total of 865,110 acres of Prime Farmland and Farmland of Statewide Importance in Sacramento and San Joaquin Counties (Table 11-8). There would be a permanent loss of approximately about 12-33 acres in the 80-foot-wide operations corridors and a temporary loss of about 7–30.5 acres in the 50-foot-wide construction corridors. At the Zone 40 Surface WTP, there could be a loss of up to 100 acres of Prime and Important (Statewide) Farmland, depending on the selected location of the Zone 40 Surface WTP. At the terminal settling basins, there could be a loss of 5.3 to 16 acres, again depending on the selected location. These numbers are likely greater than actual acreages, as some of the affected land designated as Prime or Important may- already be urbanized. Additionally, actual losses would likely be far less than indicated because the analysis methodology is based on a worst-case scenario. The conversion of Prime and Important Farmland in San Joaquin County would be less than significant, and no mitigation is required. Because more than 50 acres of Prime and Important Farmland in Sacramento County could be permanently removed from agricultural production, this impact would be significant in Sacramento County. Mitigation Measure 11-1 would reduce this impact to less than significant.

Mitigation Measure 11-1: Comply with Sacramento County General Plan Requirements

The Sacramento County General Plan requires all property owners to participate equitably in any comprehensive open space/agricultural preservation program established by the Board of Supervisors to mitigate the loss of Prime or Important (Statewide) Farmland within the project area. Until such a program is established and approved by the Board of Supervisors, a condition of approval for any project converting more than 50 acres of agricultural land to nonagricultural uses will be required:

"Prior to the approval of the project, the applicant shall implement one of the following options to the satisfaction of the Planning Director, to mitigate for the loss of agricultural land, which will assist in maintaining the integrity of the Urban Service Boundary:

A. For each acre of land being developed by this project, the applicant shall preserve 1.0 acre of agricultural land within the project area, through the purchase of conservation easements or similar instruments that assure the long term protection of that land from urban encroachment; or

B. For each acre of land being developed by this project, the applicant shall contribute an amount to be agreed upon between the project proponents and the Board of Supervisors (through direct contribution or other financing mechanism that results in an equivalent contribution) into a fund to be used to purchase conservation easements or similar instruments within the same geographical area defined in part A, and to provide for the ongoing monitoring and administration of the program (the fund, and program to expend such fund, are to be approved by the Board of Supervisors); or

C. Should the county Board of Supervisors adopt a permanent program to preserve agricultural land in the same geographical area defined in part A, prior to implementation of one of the above measures, and the governing body intends such a permanent program to replace this condition, the applicant shall be subject to that program instead."

Compliance with Sacramento County General Plan requirements would reduce this potential impact to a less-than-significant level.

Alternative 6

Impact 11-8: Loss or Conversion of Prime or Important Farmland

The construction of most pipeline segments from the intake facility to the Zone 40 Surface WTP would be within roadway corridors, although some would not be within roadway rights-of-way, similar to Alternatives 2 through 5, as listed in

Table 11-2. Project facilities could also affect Prime and Important Farmland (Table 11-3). Table 11-8 summarizes the acreages of Prime and Important Farmland in Sacramento County that could be affected by Alternative 6. There is no mapped Prime or Important Farmland in Amador County or Calaveras County that would be affected by the enlargement of Pardee Reservoir; only rangeland would be lost in these counties.

Prime and Important Farmland affected under Alternative 6 (acres) would represent less than 0.001% of the total acreage of Prime and Important Farmland in Sacramento County. A maximum loss of about 24.5 acres would occur in the 80-foot-wide operations corridor, and a temporary loss of 15.3 acres would occur in the 50-foot-wide construction corridor. As discussed above, at the Zone 40 Surface WTP, there could be a loss of up to 100 acres of Prime and Important (Statewide) Farmland, depending on the selected location of the Zone 40 Surface WTP. Because more than 50 acres of Prime and Important Farmland in Sacramento County could be permanently removed from agricultural production, this impact would be significant. Mitigation Measure 11-1 would reduce this impact to a less than significant level.

Mitigation Measure 11-2: Comply with Sacramento County General Plan Requirements

As discussed above under Mitigation Measure 11-1, compliance with Sacramento County General Plan requirements would reduce this potential impact to a less-than-significant level.

Chapter 12

Traffic and Transportation

Chapter 12
Traffic and Transportation

Affected Environment

The project area is located in the southern part of the City of Sacramento, and within the Counties of Sacramento, San Joaquin, Amador, and Calaveras. Major transportation routes—including I-5, SR 99, SR 12, SR 88, Meadowview Road, Mack Road, Franklin Boulevard, Cosumnes River Boulevard, Power Inn Road, and Liberty Road—traverse portions of the project area (see Figures 2-1, 2-2, and 2-3). These routes serve as links for employees and local goods, and/or as links to other parts of California, such as the San Francisco Bay Area. The project area also includes portions of other major arterial, minor arterial, and collector roadways in Sacramento County and San Joaquin County, including Gerber Road, Wilbur Way, Grant Line, Florin Road (east of Power Inn Road), Beach Lake Road, Clay Station Road, Elliott Road, Cord Road, and East Buena Vista Road. The roadway network serving Calaveras and Amador Counties is built around SRs 4, 12, 26, 49, and 88. These routes are functionally classified as minor arterials and interconnect with a network of collector and local streets.

Three north-south railroad tracks, two Union Pacific Railroad (UPRR) and one Central California Traction Railroad (CCTRR), intersect the project area portion of Gerber Road in Sacramento County. An east-west Southern Pacific Railroad (SPRR) track intersects Cord Road in San Joaquin County. The Sacramento Regional Transit South Sacramento Light Rail line intersects Meadowview Road. The proposed project does not fall within the sphere of influence of any airports.

Roadways, railroads, light rail, bus routes, and bikeways that would be crossed by, or may be affected by, the proposed project are described below.

Roadways

Following is a list and brief description of the portions of all roadways that are within the proposed project area and could be affected by the project, either by construction or by truck traffic generated by construction. The roadways are listed by the city or county in which the roadway is found within the project area.

City of Sacramento

- **Freeport Boulevard** is in the City of Sacramento. It is a north-south, 4-lane, urban road in the project area, and the ADT is 5,068 vehicles.
- **Meadowview Road** is in the City of Sacramento. It is an east-west, 4-lane arterial road in the project area, with an ADT of 31,915 vehicles.
- **Franklin Boulevard** is in the City of Sacramento. It is a north-south, 4-lane thoroughfare roadway in the project area.
- **Mack Road** is in the City of Sacramento. It is an east-west, 4-lane, urban road in the project area, and the ADT is 29,325 vehicles near the Brooke Meadow intersection. The segment of Mack Road between Franklin Boulevard and Stockton Boulevard was identified as a location of Most Severe Current Congestion in the Metropolitan Transportation Plan for 2025 prepared by the Sacramento Area Council of Governments (SACOG) in September 2001. Mack Road intersects with Stockton Boulevard, a designated Surface Transportation Assistance Act (STAA) truck route within the project area. (City of Sacramento 2002)
- **Stockton Boulevard** is in the City of Sacramento. It is a north-south, 4-lane roadway in the project area, and the ADT is 33,410 vehicles.
- **I-5** is a north-south freeway that extends through the Sacramento region and beyond. It serves local, regional, interregional, and interstate traffic. In the project area, it is a 6- to 8-lane freeway. In 2001, average daily traffic (ADT) at the intersection with Pocket and Meadowview Roads was 168,000 vehicles. Caltrans has identified both I-5 and SR 99 as High Emphasis Focus Routes, which are of critical importance to the movement of goods in California. The portion of I-5 within the study area is a designated STAA truck route. This STAA portion begins at Freeport Boulevard and ends approximately 1.5 miles south. (California Department of Transportation 2002a)
- **Stonecrest Avenue** is in the City of Sacramento. It is an east-west, 2-lane roadway in the project area.
- **Beach Lake Road** is in the City of Sacramento. It is a north-south, 2-lane roadway in the project area.
- **Cosumnes River Boulevard** is an east-west, 2- to 6-lane arterial roadway. The portion of Cosumnes River Boulevard within the study area is in the City of Sacramento. Cosumnes River Blvd. east of its intersection with Power Inn Road has an ADT of 34,416 vehicles. (Sacramento County 2001)
- **Center Parkway** is in the City of Sacramento. It is a north-south, 2- to 4-lane thoroughfare roadway in the project area.
- **Bruceville Road** is in the City of Sacramento. It is a north-south, 4-lane, urban road in the project area, and the ADT is 6,922 vehicles.
- **Surreywood Way** is in the City of Sacramento. It is an east-west, 2-lane, suburban roadway in the project area.

- **SR 99** is a north-south, 6- to 8-lane highway in the project area, with an ADT of 105,000 vehicles. A portion of SR 99 in the project area is a designated STAA truck route. The portions of this highway within the project area are the on- and off-ramp locations at Mack Road and at Cosumnes River Blvd. ADT on the SR 99 southbound off-ramp at Mack Road was 6,000 in 1999. ADT for the on-ramp to northbound SR 99 at Mack Road was 25,000. (California Department of Transportation and U.S. Department of Transportation 2002)

Sacramento County

- **Elsie Avenue** is in Sacramento County. It is an east-west, 2-lane, urban roadway in the project area, and the ADT is 26,355 vehicles east of the Stockton Boulevard intersection. (Sacramento County 2001)
- **Wilbur Way** is in the Sacramento County. It is a north-south, 2-lane, urban roadway in the project area.
- **Power Inn Road** is in Sacramento County. It is a north-south, 4-lane, arterial roadway in the project area, and the ADT is 31,798 vehicles north of the Gerber Road intersection. (Sacramento County 2002)
- **Gerber Road** is in Sacramento County. It is an east-west, 2- to 4-lane, urban road in the project area, with an ADT of 17,721 west of the Power Inn Road intersection, and 7,349 vehicles west of the Bradshaw Road intersection. A portion of Gerber Road within the project area (beginning at Power Inn Road and ending at Florin Perkins Road to the east) is a designated STAA truck route. (Sacramento County 2001)
- **Elk Grove Florin Road** is in Sacramento County. It is a north-south, 4-lane arterial roadway in the project area, and the ADT is 33,876 vehicles north of the Gerber Road intersection. (Sacramento County 2001)
- **Bradshaw Road** is in the City of Sacramento. It is a north-south, 2-lane arterial roadway in the project area, and the ADT is 20,047 vehicles north of the Florin Road intersection and 12,803 vehicles south of the Gerber Road intersection. (Sacramento County 2001, 2002)
- **Florin Road** is in the County of Sacramento. It is an east-west, 2-lane, rural roadway in the project area, with an ADT of 3,050 vehicles west of the Excelsior Road intersection. The segment of Florin Road between 24th Street and Stockton Boulevard was identified as a location of Most Severe Current Congestion. This segment may be used to transport materials during construction activities. (Sacramento County 1999)
- **Vineyard Road** is in Sacramento County. It is a north-south rural roadway in the project area.
- **Excelsior Road** is in the Sacramento County. It is a north-south rural roadway in the project area, and the ADT is 3,908 vehicles.

- **Grant Line Road** is in Sacramento County. It is a north-south, 2-lane, rural road in the project area, and the ADT is 12,625 vehicles south of the Gerber Road intersection. (Sacramento County 2001)
- **Sunrise Boulevard** is in Sacramento County. It is a north-south, 2-lane, rural road in the project area.
- **Kiefer Boulevard** is in Sacramento County. It is an east-west road that provides access to the Kiefer Landfill for project-related trucks.
- **SR 104** is an east-west, 2-lane, rural road in the project area within Sacramento County.
- **Clay Station Road** is in Sacramento County. It is a north-south, 2- to 4-lane, rural road in the project area.
- **Borden Road** is in Sacramento County. It is an east-west, rural roadway in the project area.
- **Angrave Road** is in Sacramento County. It is an east-west, 2-lane, rural road in the project area.

San Joaquin County

- **Elliot Road** is in San Joaquin County. It is a north-south, 2-lane, rural road in the project area, and extends from Clay Station Road at the Sacramento and San Joaquin County border to Liberty Road.
- **Liberty Road** is in San Joaquin County. It is an east-west, 2-lane, rural roadway in the project area.
- **SR 88** is a north-south highway in the San Joaquin County portion of the project area. In 2001, ADT at the intersection with Liberty Road was 16,200 vehicles. A portion of SR 88 in the project area is a designated STAA truck route. The portion of this highway within the project area is the intersection with SR 12.
- **East Buena Vista Road** is in San Joaquin County. It is an east-west, 2-lane, rural road in the project area.
- **SR 12** is an east-west, 2-lane highway in the San Joaquin County portion of the project area. In 2001, ADT near Clements was 13,800 vehicles. A portion of SR 12 is a designated STAA truck route in the project area. The portion of this highway within the project area is the intersection with Cord Road. (California Department of Transportation 2002b)
- **Cord Road** is in San Joaquin County. It is a north-south, 2-lane, rural road in the project area.
- **Brandt Road** is in San Joaquin County. It is an east-west, 2-lane roadway.

Amador and Calaveras Counties

- **Pardee Dam Road** is within Amador and Calaveras Counties, and begins at Stony Creek Road, extends south across Pardee Dam and its spillway, and intersects Campo Seco Road. It provides access to the Pardee Recreation Area and to Pardee Center. Between Pardee Center and Campo Seco Road, the road is also known as Sandretto Road. The 2-lane, paved road is 24 feet wide, with 3-foot shoulders on each side, but narrows to 18 feet wide when passing over the Pardee Dam spillway. Over Pardee Dam, the road is 16 feet wide with one-way traffic controlled by signals at each end of the dam. EBMUD owns the road, but public access is allowed.
- **Powerhouse Access Road** is in Calaveras County. An extension of the powerhouse access road would be placed approximately 1,000 feet southeast of the left abutment of the new replacement dam, and descend down a steep gradient following Rag Gulch to near its confluence with the Mokelumne River.
- **Stony Creek Road** is in Amador County. It is a north-south and east-west, 2-lane rural road that provides access around the north side of Pardee Reservoir. Stony Creek Road intersects Pardee Dam Road about 1.75 miles north of Pardee Dam, passes the recreation area, crosses Jackson Creek Dam and Spillway, and continues northeast to Jackson.
- **Gwin Mine Road** is in Calaveras County, and is a north-south, 2-lane roadway in the project area.
- **Middle Bar Bridge** is a 1-lane, steel girder bridge, approximately 300 feet long, that spans the upper reaches of the existing Pardee Reservoir between Amador and Calaveras Counties. Because the roadway is used primarily for access to fishing areas, ADT is approximately 0–10 vehicles per day. Built in 1921, the structure is approximately 15 feet above the current maximum water surface of the reservoir. The posted load limit is 13 tons.
- **SR 49 Bridge** is a minor arterial roadway that connects Amador and Calaveras Counties via a 2-lane concrete box girder bridge that measures 30 feet curb to curb as it crosses the Mokelumne River at Big Bar. The 1999 ADT was 5,000 vehicles, composed of 5.5% trucks north of Mokelumne Hill. The approaching paved roadways have two 12-foot lanes with 4-foot shoulders. A portion of SR 49 is a California Legal Network truck route in the project area. (LSC Transportation Consultants 2002).

Railways

A number of rail lines traverse Sacramento and San Joaquin Counties, serving both passengers and freight. The Sacramento area is served directly by two long-distance intercity passenger services and one northern California interregional service, all operated by Amtrak. The Amtrak San Joaquin service provides one daily round trip (RT) between Stockton and Sacramento.

According to estimates of the Draft Statewide Rail Transportation Assessment, between 6 and 30 freight trains, and 1 and 5 passenger trains, pass through the project area daily. UPRR traverses the project area and has a large network connecting California with important rail hubs in other states, as well as routes running the length of California. UPRR occupies two northwest-southeast diagonal track sets within right-of-ways, one between SR 99 and Elk Grove Florin Road, and the other between I-5 and Franklin Boulevard. Burlington Northern Santa Fe Railway Company (BNSF) operates on UPRR tracks with trackage rights.

CCTRR occupies a northwest-southeast diagonal 100-foot right-of-way between Waterman Road and Bradshaw Road, with an at-grade crossing at Gerber Road. The railroad currently runs between Stockton and Lodi Monday through Friday. Service between Stockton and Sacramento through Lodi was discontinued in August 1998.

In addition, two east-west SPRR short lines traverse the project area. One line crosses the FSC at the FSC intersection with SR 104 in Sacramento County. The other SPRR line crosses Cord Road in San Joaquin County.

Light Rail

The Sacramento Regional Transit District light rail transit (LRT) system connects the City of Sacramento downtown office, and commercial and retail district with the I 80 and U.S. Highway 50 (US 50) corridors through northeast and east Sacramento County. Currently the LRT carries an average of approximately 29,400 passengers on weekdays. The Sacramento Regional Transit District has completed the first phase of the South Line Corridor Light Rail Project LRT line. The first phase to Meadowview Road is 6.3 miles long. A Meadowview Station would be located north of Meadowview Road and include an 800-space park-and-ride facility. Eventually, the total line would be 11.2 miles long and extend south from the 16th Street LRT Station in downtown Sacramento to Elk Grove. The south line is set to open in September 2003 and include seven new stations and a bridge over Florin Road.

Phase 2 of the South Line Corridor Light Rail Project LRT line would continue south from Meadowview Road along the Western Pacific Railroad tracks, turn east at Cosumnes River Boulevard, and continue east to Bruceville Road. At Bruceville Road, the LRT line would head southeast to Calvine Road, where it would continue out of the project area. Upon completion, the South Line would add at least 15,000 passengers to the light rail system.

Bikeways

The City of Sacramento Bikeway Master Plan, South Area, and the Sacramento County 2010 Bikeway Master Plan include roadways associated with

Alternatives 2 through 6 of the proposed project. Both Bikeway Plans identify roadways used as bike routes in the project area. Roadways with existing bikeway routes are Freeport Boulevard, Meadowview Road, Mack Road, and Cosumnes Boulevard. Amador, Calaveras, and San Joaquin Counties currently do not have designated bikeways along transportation routes in the project area.

According to the Amador County Regional Transportation Plan, few designated bicycle routes exist in Amador County. The plan includes policies that encourage the development of bicycle facilities. The Amador County Bike Plan identifies a few planned bicycle facilities in the county, one along SR 49. The Calaveras County Bikeway Master Plan Update identifies a Class II bicycle facility planned for SR 49, and a Class III planned for Pardee Road and a portion of Paloma Road in the project area. The Unincorporated San Joaquin County Bikeway Plan identifies Class III bicycle facilities planned for the following segments within the proposed project area: Elliot Road, from Collier Road to SR12; Liberty Road, from Mackville Road to the Amador/San Joaquin County line; SR 12; and SR 88 (McDowell pers. comm.). It should be noted that the San Joaquin County General Plan states that roads identified as scenic routes, such as SR 88 and Liberty Road, shall be considered part of the bicycle route system. Implementation of the planned bicycle facilities is contingent upon funding.

Regulatory Setting

The following policy documents of jurisdictional agencies were reviewed for applicability to the proposed project:

- Sacramento County General Plan
- Sacramento Metropolitan Transportation Plan
- Sacramento County Bikeways Master Plan
- San Joaquin County General Plan
- San Joaquin County Metropolitan Transportation Plan
- Amador County General Plan
- Calaveras County General Plan
- Calaveras County 2001 Regional Transportation Plan
- City of Sacramento General Plan
- City of Sacramento City Code

Besides general construction guidelines and practices, cities and counties maintain specific guidelines for construction activities within their jurisdictions, particularly within streets and roadways. Construction of the project would comply with the necessary city and county guidelines.

Environmental Consequences

Methods and Assumptions

The following methods and assumptions were used to estimate the construction-related and operational impacts associated with the facilities and proposed linear alignments associated with each alternative. Traffic impacts associated with construction and operation of the project were identified by evaluating project activities in the context of local and regional circulation patterns, local and emergency access requirements, and stated policies and goals.

The assumptions used in developing information related to project-component construction activities, including haul routes for construction materials and project personnel, and operation activities, including material deliveries and operating personnel, are based upon professional judgment and the engineering information developed for the project.

The engineering information for the project was estimated based on assumptions regarding a potential construction contractor's means, methods, sequencing of work, and schedule. The criteria for determining the significance of potential impacts are outlined below.

Project Components

The primary components of the project alternatives are the Freeport intake facility, a pipeline to convey water, Zone 40 Surface WTP, terminal facility, FSCC pipeline, canal pumping plant, aqueduct pumping plant and pretreatment facility, and the enlarged Pardee Reservoir. Because components differ considerably, analysis of traffic/transportation impacts was conducted specific to each facility, and in some cases for segments of a facility.

The proposed 15- to-19-mile-long pipeline between the intake facility and the FSC was segregated into three areas hereafter referred to as the west, middle, and east. The west area is defined as the segments stretching from the intake facility on the Sacramento River to Power Inn Road, the middle stretches from Power Inn Road to Bradshaw Road, and the east runs from Bradshaw Road to the FSC. Additional pipeline installation would be required between the FSC and the Mokelumne Aqueducts (FSCC pipeline). Table 12-1 identifies the roadways involved for the pipeline alignment segments of the west, middle, and east areas, and for the FSCC pipeline alignment.

Construction-Related Traffic

Impact Mechanisms

Impacts on traffic and transportation in the project area could result from various types of construction-related activities. Table 12-1 identifies the means by which roadways and railroads could be affected by the proposed project.

Table 12-1. Impact Mechanisms on Transportation Facilities

Roadway/RR	Pipeline Installation within or Adjacent to Roadway	Construction Crosses Roadway or Railroad	Haul Routes	Permanent Roadway Modifications	Applicable Alternative
City of Sacramento					
Freeport Boulevard	X	X	X		2, 3, 4, 5, 6
Meadowview Road	X				2, 3
Franklin Boulevard		X			2, 3, 4, 5, 6
Mack Road	X				2, 3
Stockton Boulevard		X			2, 3, 4, 5, 6
I-5	X	X	X		2, 3, 4, 5, 6
Stonecrest Avenue		X			4, 5, 6
Beach Lake Road	X				4, 5, 6
Cosumnes River Boulevard	X				4, 5, 6
Bruceville Road		X			4, 5, 6
SR 99		X	X		2, 3, 4, 5, 6
Sacramento County					
Elsie Avenue	X				2, 3, 4, 5, 6
Wilbur Way	X				2, 3, 4, 5, 6
Power Inn Road	X	X			2, 3, 4, 5, 6
Gerber Road	X		X		2, 3, 4, 5, 6
Elk Grove-Florin Road		X			2, 3, 4, 5, 6
Bradshaw Road	X	X			2, 3, 4, 5, 6
Florin Road	X		X		2, 3, 4, 5, 6
Grant Line Road	X		X		2, 3, 4, 5, 6
Sunrise Boulevard			X		2, 3, 4, 5, 6
Elder Creek Road			X		2, 3, 4, 5, 6
Kiefer Road			X		2, 3, 4, 5, 6
Clay Station Road	X		X		2, 3, 4, 5,

Roadway/RR	Pipeline Installation within or Adjacent to Roadway	Construction Crosses Roadway or Railroad	Haul Routes	Permanent Roadway Modifications	Applicable Alternative
Angrave Road	X	X	X		2, 3, 4, 5
San Joaquin County					
Elliott Road	X		X		2, 3, 4, 5
Liberty Road	X	X	X		2, 3, 4, 5
SR 88		X	X		2, 3, 4, 5, 6
East Buena Vista Road	X		X		2, 3, 4, 5
SR 12		X	X		2, 3, 4, 5, 6
Cord Road	X		X		2, 3, 4, 5
Amador and Calaveras Counties					
Pardee Dam Road			X	X	6
Powerhouse Access Road				X	6
Stony Creek Road				X	6
Gwin Mine Road				X	6
Middle Bar Road				X	6
SR 49 Bridge				X	6
Railways					
UPRR 1		X			2, 3, 4, 5, 6
UPRR 2		X			2, 3, 4, 5, 6
CCTRR		X			2, 3, 4, 5, 6
SPRR 1		X			2, 3, 4, 5
SPRR 2		X			2, 3, 4, 5

Anticipated Construction Timeline

The total length of time expected to construct the Freeport intake facility, including the on-site settling basins, is 2 years, 6 months. Construction of the pipeline associated with each alternative would take approximately 1 year, 6 months to 2 years if the components were constructed concurrently. The total length of time estimated to construct the Zone 40 Surface WTP is 2 years, 8 months. The terminal facility would take approximately 80 to 100 days to construct (plus an additional 120 to 150 days for the optional terminal facility settling basins). Construction of the canal pumping plant and aqueduct pumping plant and pretreatment facility (Camanche site or optional Brandt site) would take approximately 550 days. The total duration of construction for the enlarge Pardee Reservoir component is estimated to be 3 years, 6 months to 4 years.

Construction Methods

The construction methods associated with the implementation of the FRWP that have greatest potential to result in impacts on traffic/transportation are those related to the installation of pipelines. Portions of the pipelines may be constructed using trenchless technology to minimize disruption to circulation patterns. In areas within urban streets and roadways, the pipeline would be placed within a shored/shielded trench to minimize the width of construction area required. Where feasible, the pipeline segments will be installed outside of existing roadways, and within the parallel rights-of-way, to prevent construction-related traffic delays and/or traffic hazards. Minor city and county roadways would generally be crossed by open-cut methods. Select roadway crossings would be constructed by tunneling. Where feasible, the pipeline would be tunneled under busy intersections, major highways, and railroads to reduce traffic disruptions.

Pipeline construction would involve several steps, including transporting materials to the job site, clearing the right-of-way, and excavating trenches followed by stockpiling excavated materials on site and hauling them off site, placing bedding material, laying pipe, installing backfill material, and restoring the surface. Stockpiling and material staging areas for the pipeline would be located about ½ mile apart to minimize truck traffic hauling to and from the staging area to the trench operation. Depending upon the selected alternative, construction of the pipeline (west, middle, east, and FSCC pipeline areas) would require a total of six to eight construction crews operating concurrently at each of the pipeline areas over an anticipated 1 ½- to 2-year construction period. Certain roadways identified in Table 12-1 would be used for hauling materials.

Construction-Related Materials Transport

During construction, the alternatives would require transporting various materials to and from the construction areas. For all facilities, haul routes would be limited to major roads where feasible. In general, roadways used for hauling construction materials in Sacramento, San Joaquin, Amador, and Calaveras Counties would include Sunrise Boulevard, Florin Road, I-5, Freeport Boulevard, SR 12, SR 88, Liberty Road, Clay Station Road, Elliot Road, Cord Road, and Pardee Dam Road. Excavation of materials for pipeline trenches, pumping plants, and staging areas would produce excess material for disposal. Displaced materials would be hauled to an appropriate off-site disposal location or spread across the right-of-way.

Material quantities for construction purposes depend on the size and type of facilities constructed, and the selected pipeline alignments. Only the local portion of the truck trips (50 miles RT) were accounted for in this analysis. A summary of materials and haul routes specific to the construction and operations of each project component follows.

Freeport Intake Facility

For purposes of accuracy, construction activities for the intake facility, pump station, and on-site settling basins were divided into nine phases: sheet pile installation in river; H-piles and debris boom; riprap and excavation; foundation piles and tremie concrete; structure foundation, walls, and supporting equipment; backfill and sheet pile removal; discharge piping/other structures; mechanical and electrical installation; and testing and grading/cleanup. It was assumed that construction of the onsite settling basins would occur concurrently with construction of the intake facility. It was assumed that truck trips for miscellaneous haul throughout the entire construction period would be approximately six per day.

Imported materials, such as aggregate base, concrete, forming material, reinforcing steel, electrical equipment, pipe zone material, and pavement (asphaltic concrete), are expected to come from gravel pits and batch plants located along Sunrise Boulevard north of Florin Road. Access routes for these materials were assumed to be south along Sunrise Boulevard, then along Florin Road to I-5, then south to Freeport Boulevard. Riprap is expected to be supplied from quarries in the Sierra Nevada foothills. All other imported material deliveries are expected to arrive from I-5, which is located within a mile of the proposed intake facility site.

Excess excavated material from construction would be hauled offsite to the Kiefer Landfill located off Grant Line Road. The haul route is assumed to be along Freeport Blvd., to Florin Road, to Sunrise Boulevard, to Grant Line Road, to Kiefer Boulevard, and ending at the landfill.

Overall, RT truck trips would average 22 per day throughout the duration of construction. The highest number of construction-related truck trips daily would occur during the discharge piping/other structures phase of activities, averaging 120 RTs per day for 5 days duration.

Freeport Intake Facility to Zone 40 Surface Water Treatment Plant/Folsom South Canal Pipeline

The proposed pipeline length varies from 15 to 19 miles, depending upon selected route. The longest alternative route was used to calculate the expected number of construction-related trips in an effort to reflect the highest potential impacts.

For purposes of accuracy in determining impacts, the length of the 19-mile pipeline route was divided into three 33,000-foot (approximate) areas: west, middle, and east. The west area is defined as the segments between the Sacramento River intake site to Power Inn Road; the middle area extends from Power Inn Road to Bradshaw Road; and the east area from Bradshaw Road to the FSC.

Construction-related trip calculations for each area were further segregated into three phases of construction activities: site preparation, installation, and surface restoration. It was assumed that each pipeline construction activity would have miscellaneous material deliveries and that miscellaneous haul would be three trips each day for each activity.

Material to be exported is primarily limited to excavated material and rubble. Stockpile material is considered part of the local work and is not included as a truck trip. Excess excavated material would be hauled offsite to the Kiefer Landfill located off Grant Line Road. The haul route is assumed to be along Florin Road, to Sunrise Boulevard, to Grant Line Road, to Kiefer Boulevard and ending at the landfill.

Imported materials such as aggregate base, controlled low strength material (CLSM), concrete, and pavement are expected to come from gravel pits and batch plants located along Sunrise Boulevard north of Florin Road. Access routes for these materials would be on roadways that coincide with the selected pipeline alignment, typically south along Sunrise, then west following major routes such as Florin Road. All other imported materials are expected to be delivered to the project area from either SR 99 or I-5 and then major surface streets that coincide with the selected pipeline alignment. The other major imported material would be the pipe, which would be delivered from I-5 or SR 99 as described above.

For the west area, site preparation activities are expected to result in a total of 8 to 15 construction-related RT truck trips per day for a period of approximately 40 days. A total of 57 to 165 RT truck trips per day for approximately 105 days is expected for installation activities; 3 to 15 RT truck trips per day for a period of approximately 100 days are expected for surface restoration activities.

For the middle area, site preparation activities are expected to result in a total of 8 to 36 construction-related RT truck trips per day for a period of approximately 72 days. A total of 53 to 172 RT truck trips per day for approximately 290 days is expected for installation activities; 12 to 15 RT truck trips per day for a period of approximately 29 days are expected for surface restoration activities.

For the east area, site preparation activities are expected to result in a total of 11 to 37 construction-related RT truck trips per day for a period of approximately 35 days. A total of 48 to 128 RT truck trips per day for approximately 140 days is expected for installation activities; 3 to 32 RT truck trips per day for a period of approximately 140 days are expected for surface restoration activities.

Zone 40 Surface Water Treatment Plant

For accuracy in calculating truck trips, construction activities for the Zone 40 Surface WTP were divided into eight phases: rough grading/export earth; settling basins; treatment plant components/tanks; control building/corporation yard buildings; mechanical and electrical installation; site improvements; landscaping; and start-up and commissioning. For purposes of this analysis, it was assumed that all excess earth removed from the settling basins would be exported and delivered to the Kiefer Landfill. Other earth that is excavated for various treatment plant components and tanks are expected to be used for fill onsite. The haul route is assumed to be along Florin Road, to Sunrise Boulevard, to Grant Line Road, to Kiefer Boulevard, and ending at the landfill. Imported materials, such as concrete, aggregate base, asphalt concrete, are expected to come from quarries and batch plants around the Sunrise Boulevard/Elder Creek locations.

Other imported materials, such as mechanical and electrical equipment, pipe and pipe appurtenances, structural and architectural materials and other materials, may come from various locations inside or outside the Sacramento vicinity. The local delivery route would likely be from SR 99, via Florin Road to the project site.

The total number of construction-related RT truck trips per day would range from 10 to 126. The greatest amount of truck trips would occur within a 4-month period, approximately 10 months from the beginning of construction.

Terminal Facility

The terminal facility would be constructed at one of two proposed locations: off of Florin Road, on the west side of the FSC; or, at a site west of Grant Line Road and the FSC. General construction access to the project area would be via major routes in the area and various lesser roads, such as Grant Line Road and Florin Road. Imported materials, such as concrete and aggregate base, are expected to come from quarries and batch plants along Sunrise Boulevard north of Florin Road. All other imported materials are expected to be delivered to the project area from I-5 to Grant Line Road and Florin Road. Excess materials would be exported and delivered to the Kiefer Landfill.

Because of the relatively small size of the facility, few trips are anticipated for the small amount of construction materials for clearing, excavation, concrete forms, and backfilling. The highest number of trips daily would occur during excavation activities, averaging 31 RTs per day for 3 days.

Optional Terminal Facility Settling Basins

The optional terminal facility settling basins would be constructed adjacent to the terminal facility and would consist of four concrete-lined basins and chemical facilities. Construction access to these settling basins would be the same as mentioned for the terminal facility above.

The total number of construction-related RT truck trips per day would range from 11 to 70, the highest number of trips occurring during the construction of the pond lining and structures.

Folsom South Canal to Mokelumne Aqueducts Pipeline

This portion of the pipeline would be approximately 16.9 miles long and traverse creek, cross-country, and street settings. A surge tank and rate control valve would be required along the cross-country alignment of this pipeline. For the purposes of analysis, the number of truck trips associated with construction of the pipeline is assumed to be similar to those for the pipeline from the Freeport intake facility to the FSC. The approximate number of RT truck trips generated during construction activities is 92 per day.

Imported materials such as aggregate base, CLSM, concrete, and pavement are expected to come from gravel pits and batch plants located along Sunrise Boulevard north of Florin Road. Access routes for these materials would be south along Sunrise, then typically following major routes, such as Clay Station Road, that coincide with the selected pipeline route.

Other imported materials, such as mechanical and electrical equipment, pipe and pipe appurtenances, and other materials, may come from various locations inside or outside the San Joaquin County vicinity. The local delivery route would likely be from SR 12 to SR 88, and then to Liberty Road to the pipeline alignment segments.

Canal Pumping Plant

General construction access to the project area would be via SR 104 and SR 99 and various lesser roads. Likely routes to and from the plant would be along the FSC levee road to SR 104, west to SR 99. Materials and supplies would likely come from the Stockton vicinity.

The total number of off-haul construction-related RT truck trips for the canal pumping plant over the course of construction would be approximately 405, most occurring over the first half of the construction period. The highest number of trips would occur during concrete pours, averaging 50 to 63 RTs per day for materials and an additional 50 RT truck trips per day for construction personnel.

Aqueduct Pumping Plant and Pretreatment Facility (Camanche Site)

Earth that is excavated for various pumping and treatment plant components and tanks are expected to be used for fill on site; thus, no haul trips off site are anticipated. General construction, operation, and maintenance access to the project area would be via SR 12, SR 88, and various lesser roads that parallel and traverse the alignment. Imported materials, such as concrete, aggregate base, and asphalt concrete, and other supplies, such as mechanical, electrical, and plumbing equipment, would likely come from the Stockton vicinity.

The highest number of trips would occur during concrete pours, averaging 80 to 100 RTs per day for materials, and an additional 100 to 200 RT truck trips per day for construction personnel.

Optional Aqueduct Pumping Plant and Pretreatment Facility (Optional Brandt Site)

The Brandt site is an optional location to the Camanche site. The material sources and supply routes would be very similar to those described for the Camanche site.

The total number of off-haul construction-related RT truck trips for the optional Brandt site over the course of construction would be approximately 11,500. The highest number of trips would occur during concrete pours, averaging 80 to 100 RT per day for materials and an additional 100 to 200 RT truck trips per day for construction personnel.

Enlarge Pardee Reservoir

The proposed dams and concrete abutments for the enlarge Pardee Reservoir component of the project would require substantial amounts of rock fill. McCarty Pit quarry, Goose Hill Rock quarries, and on-site quarries will be accessed for construction materials (Figure 12-1). Haul routes to and from the project area would likely use SR 12 and SR 88, Pardee Dam Road, and other roadways with access to construction areas.

Access Roads

Access roads would be required for access to construction sites and to provide areas for material and equipment storage. The location of some of these facilities cannot be determined at this time. FRWA would require that construction contractors identify such sites early in the construction planning process and would review the proposed location to ensure that sensitive resources are not disturbed or affected. Contractors would be required to contain all activities within the approved sites.

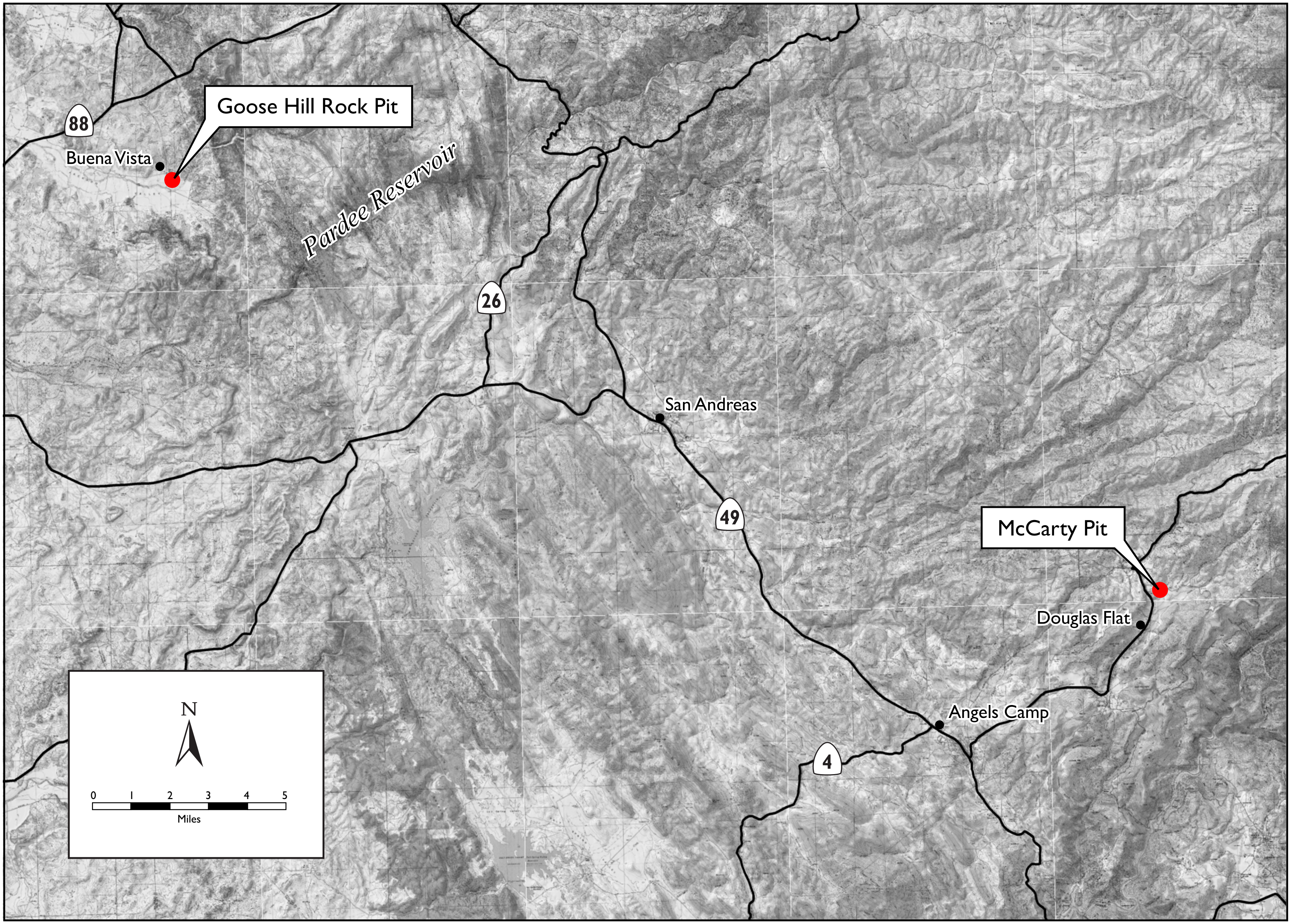
Construction Workforce and Commute Trips

The construction workforce required to construct facilities associated with each alternative most likely would be drawn from the local labor pool in Sacramento, San Joaquin, Calaveras, and Amador counties. Almost all the workforce is anticipated to commute 60 miles one way or less. The alternatives would require a peak construction workforce of about 380 workers during the construction period, which includes both facility and pipeline construction. Substantially fewer construction workers are expected during most of the construction period. The average vehicle occupancy (AVO) for work trips in the SACOG region is about 1.18 persons per vehicle. In general, construction access to each of the project areas would be via major highways in the area and various lesser roads.

Operations-Related Traffic

Sediment Collections and Materials Trips

It is assumed that sediment would accumulate on site from operations at the Freeport intake facility, Zone 40 Surface WTP, the FSC or optional terminal facility settling basins and aqueduct pumping plant and pretreatment facility (Camanche site or optional Brandt site). As such, these facilities would require periodic cleanings consisting of the excavation and hauling of sediment to the Kiefer Landfill. Annual sediment quantities were calculated according to four sediment accumulation scenarios dependent on water delivery circumstances: minimum conditions, median conditions, average conditions, and severe conditions. The haul routes for each facility would be the same as the construction haul routes described previously.



Jones & Stokes

Figure 12-1
Location of Commercial Quarries and Gravel Pits

The number of truck RTs for annual excavations and hauling of sediment from the intake facility to the Kiefer Landfill would vary according to scenario conditions and range between 15 and approximately 200 RT truck trips per year. The number of truck RTs for the Zone 40 Surface WTP would average 16 truck trips per day for a period of 20 days per year. The number of RT truck trips for the FSC or the optional terminal facility settling basins would range between 0 and approximately 1,000 truck trips per year, depending on sediment conditions in the river and amount of water pumped. The number of RT truck trips for excavations and hauling of sediment from the aqueduct pumping plant and pretreatment facility (Camanche site or optional Brandt site) during periods it is in use would be similar to the number of trips required by the Zone 40 Surface WTP.

Once in operation, the intake facility, Zone 40 Surface WTP, and aqueduct pumping plant and pretreatment facility (Camanche site or optional Brandt site) would require continual material deliveries. Deliveries would be confined to major roadways where feasible, generally along the same routes as used for construction-related hauling. Trips generated by material deliveries for the intake facility would be infrequent. The majority of trips to the intake facility from delivery of materials are anticipated to occur on I-5 and Freeport Boulevard. Material or chemical deliveries to the Zone 40 Surface WTP facility would occur approximately five times per day. Roadways used for material deliveries would likely be I-5, SR 99, and possibly Florin Road, Bradshaw Road, Gerber Road, Sunrise Boulevard, and other surface streets in the vicinity. Operation of the aqueduct pumping plant and pretreatment facility (Camanche site or optional Brandt site) would result in approximately 75 to 80 RT truck trips per month for chemical deliveries. The majority of trips from delivery of materials are anticipated to occur on SR 12, SR 88, and various lesser roads that parallel and traverse the alignment.

Commute Trips

Once in operation, the Freeport intake facility, Zone 40 Surface WTP, canal pumping plant, aqueduct pumping plant and pretreatment facility (Camanche site or optional Brandt site), and enlarge Pardee Reservoir components would require full-time on-site personnel.

The operation of the intake facility would require less than five full-time personnel. The estimated number of total trips for the operation of project facilities is two p.m. peak-hour trips and five daily trips. The majority of trips to the intake facility from employee commuting are anticipated to occur on I-5 and Freeport Boulevard.

The operation of the Zone 40 Surface WTP facility, including its use as a corporation yard, would require up to 90 full-time personnel. The estimated number of total trips for the operation of project facilities is 88 p.m. peak-hour trips. Roadways used for commuting would likely be Florin Road, SR 99, Bradshaw Road, and possibly Gerber Road, Sunrise Boulevard, and other surface streets in the vicinity.

The operation of the canal pumping plant facility would require full-time personnel during periods it is in use. Operation and maintenance access to the canal pumping plant would be via SR 104, SR 99 and various lesser roads.

The operation of the aqueduct pumping plant and pretreatment facility (Camanche site) would require up to 7 full-time personnel during periods it is in use. The estimated total number of trips for operation of project facilities is 7 daily RTs. Operation and maintenance access to and from the Camanche site would be via SR 12, SR 88, and various lesser roads that parallel and traverse the alignment, as operators would likely be coming from Pardee Reservoir. The operation of the optional Brandt site would be identical to the Camanche site.

The operation of the enlarged Pardee Reservoir facility would require the same number of fulltime personnel, approximately 64, as is currently required. Proposed operations of the enlarged reservoir would not change from existing operations.

Significance Criteria

Significance criteria for potential traffic and transportation impacts are based upon relevant thresholds of significance established by agencies with jurisdictional authority, and/or applicable laws and regulations. According to the State CEQA Guidelines and professional standards, a project may be considered to have a significant effect on the environment if it would:

- cause an increase in traffic that is substantial in relation to the existing traffic load and capacity of the street system;
- cause a substantial deterioration of the roadway surface due to construction activities;
- substantially increase the traffic delay experienced by drivers;
- substantially alter present patterns of circulation or movement; or
- cause traffic hazards to pedestrians or operators of motor vehicles or bicycles.

The significance of potential impacts on traffic and transportation in the project area was determined by comparing thresholds to anticipated impacts from construction- and operation-related activities. For the purposes of analysis, these project activities were divided into four impact mechanism categories: pipeline installation within or adjacent to roadway, construction crossing of roadways or railroads, haul routes, and the permanent modification of roadways (see Table 12-1). Construction-related impact mechanisms include pipeline installation within or adjacent to roadway, construction crossing roadways or railroads, and haul routes; operational impact mechanisms include haul routes and the permanent modification of roadways.

Due to the short-term nature of construction-related impacts, wide geographical project area, and minimal permanent impacts expected to result from roadway modifications and facility operations, the level of service (LOS) of affected roadways, and potential impacts on LOS, were not included as significance criteria in this analysis.

Less-than-Significant Impacts

Less-than-significant impacts on traffic and circulation that may occur from implementation of the proposed project include the alteration of present patterns of vehicular circulation, changes in local access to homes and businesses, traffic delays, traffic hazards, damage to roadway surfaces, disruption of rail traffic, interference with emergency response routes, and interference with bicycle routes. These impacts are likely to occur under Alternatives 2 through 6. Details of less-than-significant impacts resulting from the implementation of specific alternatives are discussed for each alternative below.

FRWA developed a list of environmental commitments to address specific impacts anticipated to result from the project alternatives. These environmental commitments have been included under the Environmental Commitments section of Chapter 2, "Project Description." The environmental commitments contain specific measures to avoid, minimize, or reduce impacts to less-than-significant levels. The preparation and implementation of a traffic control plan is a component of the environmental commitments. The traffic control plan would reduce construction-related impacts on the roadway system and traffic and circulation patterns. Roadways affected by the implementation of the alternatives are identified in Table 12-1.

Less-than-significant impacts on the transportation system resulting from construction activities are identified and summarized by segment and alternative in Table 12-2. Each segment is shown in Figures 2-1 and 2-2. Less-than-significant impacts related to operation of the project, including worker commute trips, are also included in the impact discussions.

Alternative 1

Under Alternative 1, the present patterns of circulation and movement would continue. Traffic congestion is likely to increase in future years as growth occurs in the Sacramento–San Joaquin Valley.

Construction-Related Impacts

Construction-related impacts on traffic and circulation patterns and roadways as a result of the FRWP would not occur because the project facilities would not be constructed.

Operation-Related Impacts

Under the No-Action alternative, FRWP facilities would not be constructed. Operational impacts would not occur.

Alternatives 2–5

Alternatives 2 through 5 differ only in the pipeline alignments from the Freeport intake facility to the FSC. Project construction and operation for Alternatives 2 through 5 are very similar. Impacts related to traffic and transportation for each alternative differ only slightly from each other; therefore, the results for Alternatives 2 through 5 are presented together but are representative of each individual alternative, unless otherwise noted.

Construction-Related Impacts

Impact 12-1: Alteration of Present Patterns of Vehicular Circulation, Increased Traffic Delay, and Increased Traffic Hazards during Construction of Facilities

Construction of the project components from the intake facility to the Mokelumne Aqueducts and the temporary relocation of roadways could result in lane or road closures, detours, open trenches on bike trails or closure of bike trails, and the addition of construction trucks and equipment on the surrounding roadway system. Table 12-1 identifies the impact mechanisms by which roadways could be affected by the proposed project during construction activities. Impacts according to facility are discussed below.

One primary roadway runs adjacent to the intake facility site: Freeport Boulevard. Construction of the intake facility, including the on-site settling basins, would likely result in temporary traffic delays to this roadway. Roadways used as construction haul routes for the intake facility would include I-5, Florin Road, Sunrise Boulevard, Grant Line Road, and Kiefer Boulevard.

Impacts attributable to the installation of pipelines would affect certain roadways in the City of Sacramento and within Sacramento and San Joaquin Counties. The pipeline alignments under consideration would be in, parallel to, or cross numerous roadways and transportation facilities ranging from 2-lane rural roads to 4-lane arterials in urban, suburban, and rural areas. Some alignments would also intersect railroad tracks, waterways, and freeways. Several of the pipeline

Table 12-2. Discussion of Impacts from Direct Construction Activities

Roadway	Alternative					Impact	Discussion
	2	3	4	5	6		
Freeport Boulevard at Intake Facility	X	X	X	X	X	LS	Freeport Blvd probably tunneled. No public streets would be affected.
Freeport Boulevard to Meadowview Road	X	X				LS	Segment runs within/adjacent to Freeport Blvd. and crosses I-5. An increase in traffic delays is anticipated on Freeport Blvd. Heritage trees located along Freeport Blvd. may limit traffic control options and cause more substantial traffic delays if traffic is narrowed to one lane. Impact will be temporary and addressed by traffic control plan.
Meadowview Road	X	X				LS	Segment runs within/adjacent to Meadowview Road in urbanized area with buildings adjacent to roadway. Construction of segment would cause substantial traffic delays for drivers. Impact will be temporary and addressed by traffic control plan.
Mack Road	X	X				LS	Segment runs within/adjacent to Mack Road, a major thoroughfare, and intersects with other major thoroughfares. Construction within Mack Road would cause substantial traffic delays for drivers. Impact will be temporary and addressed by traffic control plan.
I-5			X	X	X	LS	Segment crosses and runs within/adjacent to I-5 ROW. Assuming that segment will not affect interstate traffic, no traffic delays are anticipated.
Stonecrest Avenue			X	X	X	LS	Segment runs within/adjacent to I-5 ROW. Assuming that segment will not affect the Stonecrest Avenue overpass, no traffic delays are anticipated.
Beach Lake Road			X	X	X	LS	Segment runs within/adjacent to Beach Lake Road, which runs adjacent to I-5. Segment receives very little traffic and delays are not anticipated.
Cosumnes River Boulevard			X	X	X	LS	Segment runs within/adjacent to Cosumnes River Blvd., Unionhouse Creek, and utilities right-of-way. Minimal traffic delays are anticipated. Pipe would be installed beneath planned new two-lane portion of road. Depending on timing, tunneling may be required for the light rail, otherwise the pipeline would be installed before the light rail system and no tunnel would be required. If tunneled, the operation would be set up in the pipe right-of-way and barricaded. For both tunneling and open cut, it is expected that the old two lanes could be left open and shared for one lane in each direction. In any case, one lane in each direction would be provided using traffic control devices.
Surreywood Way			X	X	X	LS	Segment runs within/adjacent to Surreywood Way to the west side of SR 99. This area is open space and residential; minimal traffic delays are anticipated. Impacts will be temporary and addressed by traffic control plan

Roadway	Alternative					Impact	Discussion
	2	3	4	5	6		
SR 99	X	X	X	X	X	LS	Segment runs within/adjacent to Mack Road and will be tunneled under SR 99, including the off-ramp and on-ramp. Another segment runs within/adjacent to Cosumnes River Boulevard and Surrywood Way; pipeline will be tunneled under SR 99, including the off-ramp and on-ramp.. This area is highly urbanized with buildings adjacent to roadway; substantial traffic delays are anticipated. Impacts will be temporary and addressed by traffic control plan.
Power Inn Road	X	X	X	X	X	LS	Segment runs within/adjacent to Power Inn Road and crosses over Beacon Creek. Power Inn Road has a large volume of traffic and substantial traffic delays are anticipated. Impact will be temporary and addressed by traffic control plan.
Power Inn Road (optional alignment)	X	X	X	X	X	LS	Segment runs within/adjacent to Power Inn Road and crosses over Elder Creek. Power Inn Road has a large volume of traffic and substantial traffic delays are anticipated. Impact will be temporary and addressed by traffic control plan
Elsie Avenue	X	X	X	X	X	LS	Segment runs within/adjacent to Elsie Avenue and Wilbur Way. Pipe installed in Elsie Way (except for storm drain special crossing) will probably include a shielded/shored trench and one lane in each direction would be provided using traffic control devices. The special crossing will probably be tunneled, but the operations would be set up in the street and barricaded. A minor disruption to the limited businesses and housing in the northern area is also anticipated. Impacts will be temporary and addressed by traffic control plan. The plans will include the provision of one lane in each direction using traffic control devices, and local business access with flaggers and temporary pathways through the active heading and the tunneling site.
Wilbur Way	X	X	X	X	X	LS	Pipe installed in Wilbur Way will essentially require the road to be closed at the active heading of a few hundred feet at a time. RR spur may need to be tunneled. If so, the operation would be set up in the street and barricaded. The northern segment includes some businesses. A minor disruption to the limited businesses and housing in the area is anticipated. Impacts will be temporary and addressed by traffic control plan. The plans will include the provision of flaggers and temporary pathways through the active heading and the tunneling site for local business access.
Gerber Road (middle)	X	X	X	X	X	LS	Depending on location, pipe will be installed either in the street or in the shoulder on one side. Pipe in the street would probably include a shielded/shored trench. Pipe in the shoulder would probably included a shielded trench only. In either case, it is likely that only a single lane with flaggers for shared use in both directions would be used. It may be possible to provide one lane in each direction using traffic control devices for some of the portions where the pipe is in the shoulder. It is expected that the large diameter SRCSD interceptors would need to be tunneled in the vicinity of Elk Grove/Florin, potentially in two places. The tunneling operations would be set up in the street and barricaded. One lane in each direction would also be provided using traffic control devices.

Roadway	Alternative					Impact	Discussion
	2	3	4	5	6		
Gerber Road (east)		X		X		LS	Segment runs within/adjacent to Gerber Road heading east to more rural area where Gerber Road ends at the intersection with Excelsior Road. Minimal traffic delays expected. Pipe will be installed either in the street or in the shoulder on one side. Pipe in the street would probably include a shielded/shored trench; pipe in the shoulder would probably included a shielded trench only. In either case, it is likely that only a single lane with flaggers for shared use in both directions would be used. It may be possible to provide one lane in each direction using traffic control devices for some of the portions where the pipe is in the shoulder.
Gerber Road (optional alignment)	X	X	X	X	X	LS	Segment runs within/adjacent to Gerber Road off of Power Inn Road. Drivers in the area would experience an increase in traffic delays. Impact will be temporary and addressed by traffic control plan.
Bradshaw Road	X		X			LS	Segment runs within/adjacent to Bradshaw Road in rural area; minimal traffic delays are anticipated. Pipe will generally be installed in the shoulder on one side of the street. Pipe in the shoulder would probably included a shielded trench only. It is likely that only a single lane with flaggers for shared use in both directions would be used, although it may be possible to provide one lane in each direction using traffic control devices for some portions of the segment.
Florin Road	X		X			LS	Segment runs within/adjacent to Florin Road with minimal development. Sacramento County has stated that they may be able to detour traffic from this segment. Pipe will generally be installed in the shoulder on one side of the street. Pipe in the shoulder would probably included a shielded trench only. It is likely that only a single lane with flaggers for shared use in both directions would be used, although it may be possible to provide one lane in each direction using traffic control devices for some portions of the segment.
Grant Line Road		X		X		LS	Segment runs within/adjacent to Grant Line Road to the Folsom South Canal. Right-of-ways are located on both sides of the roadway. Minimal traffic delays are anticipated. Pipe will be installed on one side of the road in a new easement. Some work would probably be staged from the road and the closest lane would be closed. In those cases, at least one lane in each direction would be provided using traffic control devices. For crossing Grant Line (open cut assumed), at least one lane in each direction would be maintained using traffic control devices.
Clay Station Road	X	X	X	X		LS	Segment runs within/adjacent to Clay Station Road continuing to its intersection with Angrave Road. Minimal traffic delays are anticipated.

Roadway	Alternative					Impact	Discussion
	2	3	4	5	6		
Angrave Road	X	X	X	X		LS	The pipeline continues east along Angrave Road to Dry Creek and, south of Dry Creek, continues southeast generally adjacent to a Pacific Gas and Electric Company (PG&E) transmission line right-of-way. The pipeline follows the PG&E line right-of-way to its intersection with SR 88 and then south to Liberty Road. Minimal traffic delays are anticipated.
Liberty Road	X	X	X	X		LS	Segment runs within/adjacent to Clay Station Road and Liberty Road and crosses SR 88. Liberty Road carries a relatively large amount of traffic and delays are expected. Implementation of traffic control plan measures would be necessary to avoid significant impacts.
East Buena Vista Road	X	X	X	X		LS	From Liberty Road, the pipeline continues southeast to East Buena Vista Road, paralleling the road to the east, to EBMUD's property line. Minimal traffic delays are anticipated.
Cord Road	X	X	X	X		LS	From East Buena Vista Road, the pipeline heads south, crossing the Mokelumne River, traversing EBMUD's Camanche Reservoir property to SR 12, crossing SR 12, and following the west side of Cord Road to Acampo Road. Minimal traffic delays are expected.
Pardee Dam Road					X	LS	Approximately 13,728 feet of roadway will be relocated west of the existing alignment. Access to the Pardee Recreation Area and to Pardee Center will not be obstructed. The existing roadway will remain open until new roadway is completed. Pardee Dam Road will be used to transport materials and as access for construction equipment and construction crews to construction sites, resulting in temporary increases of truck traffic. Increases will be temporary and minimal. Differences in the patterns of vehicular circulation following the relocation of Pardee Dam Road will be minimal.
Stony Creek Road					X	LS	Approximately 7,920 feet of roadway would be relocated to cross the crests of the new Jackson Creek Dam and Jackson Creek Saddle Dams. The existing roadway will remain open until new roadway is completed. Stony Creek Road will be used to transport materials to and from construction sites, resulting in temporary increases of truck traffic. Increases will be temporary and minimal. Differences in the patterns of vehicular circulation following the relocation of Stony Creek Road will be minimal.
Gwin Mine Road					X	S	Access to the Middle Bar Bridge would no longer be available and a turnaround area would be constructed at the new north end of Gwin Mine Road. Current uses of the Middle Bar Bridge are limited, and include only recreational fishing access and occasional access to residences on the north side of the Mokelumne River. Recreational fishing access would continue to be accessible at the end of Gwin Mine Road, and SR 49 would continue to provide an access route to the residences on the north side of the river. However, reduced access options for area residents from the removal of the Middle Bar Bridge is assumed to be a significant impact. Implementation of Mitigation Measure 21-1 would reduce this impact to less than significant.

Roadway	Alternative					Impact	Discussion
	2	3	4	5	6		
Middle Bar Road					X	S	Access to the Middle Bar Bridge would no longer be available, and a turnaround area would be constructed at the new south end of Middle Bar Road. Current uses of the Middle Bar Bridge are limited and include only recreational fishing access and occasional access to residences on the north side of the Mokelumne River. Recreational fishing access would continue to be accessible at the end of Middle Bar Road, and SR 49 would continue to provide an access route to the residences on the south side of the river. However, reduced access options for area residents from the removal of the Middle Bar Bridge is assumed to be a significant impact. Implementation of Mitigation Measure 21-1 would reduce this impact to less than significant.
SR 49					X	LS	A new higher bridge structure will be constructed adjacent to the existing bridge, over the Mokelumne River. The existing bridge will remain open and unobstructed until the new bridge is complete. SR 49 will be used to transport materials and as access for construction equipment and construction crews to the construction site, resulting in temporary increases of truck traffic. Increases will be temporary and minimal. Impact will be less than significant.

LS—Less than Significant, S—Significant

segments under consideration are located within urban streets, multilane thoroughfares with heavy commute traffic. Where feasible, the pipeline segments will be installed outside of existing roadways, and within the parallel rights-of-way, to prevent construction-related traffic delays and/or traffic hazards. The methods of pipeline installation, impacts from direct construction activities, and the means of addressing impacts for each roadway affected under Alternatives 2 through 5, are presented in Table 12-2.

Two primary roadways run within the Zone 40 Surface WTP project area: Florin Road and Gerber Road. Construction of the Zone 40 Surface WTP would likely result in temporary traffic delays to these roadways and on some of the other roadways within the project area: Elder Creek Road, Gerber Road, Bradshaw Road, and Excelsior Road. Roadways used as construction haul routes for the Zone 40 Surface WTP would include SR 99, Florin Road, Sunrise Boulevard, Grant Line Road, and Kiefer Boulevard.

For the canal pumping plant, SR 104, SR 99 and various lesser roads would be used as temporary haul routes during construction.

For the aqueduct pumping plant and pretreatment facility, SR 88, SR 12, and various lesser roads that parallel and traverse the project area would be used as temporary haul routes during construction of the Camanche site. SR 88, SR 12, Brandt Road and various lesser roads that parallel and traverse the project area would be used as temporary haul routes during construction of the optional Brandt site.

Construction activities, including the use of trucks for hauling materials, may lead to traffic delays, temporary reductions in roadway level of service, damage to property, or injury. These impacts are addressed by adherence to the project's Environmental Commitments (refer to Chapter 2), which include the development and implementation of a traffic control plan. Other environmental commitments that specifically address this impact are:

- Coordination with planned improvements (e.g., public transit improvements, raised medians, turn lanes, street alignments) to minimize disruptions associated with two or more projects.
- Coordination with the affected jurisdictions on construction hours of operation and lane closures.
- Compliance with local jurisdictional guidelines for road closures caused by construction activities.
- Limiting lane closures during peak commuting hours to the extent possible.
- Installation of traffic control devices as specified in the California Department of Transportation's Manual of Traffic Controls for Construction and Maintenance Works Zones.
- Development of specific measures for each of the facility construction areas through additional community outreach and design after a project is approved.

These measures would be implemented at a site-specific level, as appropriate, depending on the location of construction and surrounding land uses.

Because the project proponent would adhere to the project's Environmental Commitments (as detailed in Chapter 2) and certain project facilities would have only a minimal affect on traffic and transportation, impacts from the proposed project resulting in the alteration of present patterns of vehicular circulation, increased traffic delay, and increased traffic hazards during construction of facilities are less than significant. No mitigation is required.

Impact 12-2: Damage to the Roadway Surface during Construction of Facilities

Construction of the project components from intake facility to Mokelumne Aqueducts may result in damage to the roadway surface from trench excavation and truck traffic. Maintenance of City of Sacramento, and the Counties of Sacramento and San Joaquin truck routes includes periodic inspection to assess structural integrity and need for repairs, followed by implementation of needed repairs. If construction trucks travel on roadways that are not included under this maintenance program, roadway damage such as potholes or minor fractures may occur without subsequent inspection and repair. Damage to roadway surfaces not maintained under such a program will be repaired following construction activities, as mentioned in the Environmental Commitments section of Chapter 2. Additionally, all open trenching of the roadway surface would be repaired as part of standard construction procedures. Impacts would be less than significant. No mitigation is required.

Impact 12-3: Disruption of Rail Traffic during Construction of Facilities

The pipeline alignments traverse numerous railroad tracks. The project proponent will tunnel under railroad tracks to eliminate disturbance to rail service and will coordinate construction with railroad operators and schedule construction activities during periods that would reduce the effects on rail operations. In addition, an encroachment permit for construction within railroad rights-of-way will be obtained from the railroad operators. Therefore, this impact is considered less than significant. No mitigation is required.

Impact 12-4: Interference with Emergency Response Routes

Open-cut construction at roadway crossings and increased truck traffic along haul routes during construction could temporarily increase response times for emergency services, such as fire protection, police, and ambulance along affected roadways. The traffic control plan will include an emergency access plan that provides for access in and adjacent to the construction zone for emergency vehicles. The emergency access plan, which requires coordination with emergency service providers before construction, limits the number and extent of road closures, and effective traffic direction, would substantially reduce the potential for such disruptions to response routes. Adherence to the emergency access plan element of the project's Environmental Commitments (discussed in Chapter 2) will ensure that this impact is less than significant. No mitigation is required.

Impact 12-5: Interference with Bicycle Routes

Construction of the pipeline alignments would occur in the following roadways with existing bikeway routes: Freeport Boulevard, Meadowview Road, Mack Road, and Cosumnes Boulevard. The traffic control plan, referred to in the Environmental Commitments section of Chapter 2,would include the provision of alternate routes for bicyclists and pedestrians during sidewalk or bike lane closures associated with construction of the pipeline. This impact is less than significant. No mitigation is required.

Operation-Related Impacts

Impact 12-6: Congestion of Roadways and the Permanent Alteration of Present Patterns of Vehicular Circulation from Facility Operations

The sediment hauling, delivery of materials, and employee commuting for operations of the intake facility, Zone 40 Surface WTP, FSC or optional terminal facility settling basins, canal pumping plant, and aqueduct pumping plant and pretreatment facility (Camanche site or optional Brandt site) could potentially affect roadways in the vicinity of the proposed facilities by resulting in the congestion of roadways and the permanent alteration of present patterns of vehicular circulation. No permanent traffic impacts would occur on roadways bordering the Zone 40 Surface WTP due to operations. However, some of the smaller roadways within the Zone 40 Surface WTP area may experience permanent traffic impacts through the alteration of present patterns of circulation.

Commuting, sediment hauling, and material delivery trips associated with the operations of the intake facility, Zone 40 Surface WTP, FSC or optional terminal facility settling basins, canal pumping plant, and aqueduct pumping plant and pretreatment facility (Camanche site or optional Brandt site), would occur over a wide geographical area, and contribute to minimal increases in localized roadway use. Once constructed, the pipelines would require minimal intermittent maintenance activities. The permanent alteration of present patterns of vehicular circulation to result from the intake facility would not be significant due to the small number of employees. Furthermore, the site would be adjacent to, and utilize, the high capacity I-5 for commuting and materials deliveries, thereby avoiding impacts on residential and city streets. Because the permanent alteration of present patterns of vehicular circulation for the Zone 40 Surface WTP would occur in a rural area, existing vehicular circulation would not be significantly affected. Operation of the terminal facility would not significantly affect patterns of vehicular circulation because the facility would not require full-time personnel and sediment hauling from the FSC or optional terminal facility settling basins would occur only during periods it is in use. Also, because the permanent alteration of present patterns of vehicular circulation for the canal pumping plant and aqueduct pumping plant and pretreatment facility (Camanche site or optional Brandt site) would occur in rural areas during periods when the facilities are in use, existing vehicular circulation would not be significantly affected. Therefore, impacts from the proposed project resulting in the congestion of roadways and/or the permanent alteration of present patterns of vehicular circulation in the vicinity of the project sites are considered less than significant. No mitigation is required.

Alternative 6

As described in Chapter 2, "Project Description," Alternative 6 consists of enlarging Pardee Reservoir and conveying water from the Sacramento River. Alternative 6 includes the following project components: enlarge Pardee Reservoir (which includes additional components), Freeport intake facility, pipeline from intake facility to the Zone 40 Surface WTP, and the Zone 40 Surface WTP. Though slightly different in size, the Freeport intake facility, pipeline from intake facility to the Zone 40 Surface WTP and the Zone 40 Surface WTP project components are the same as those that make up Alternative 5. Therefore, several of the impacts associated with Alternative 5 (described above) are also associated with Alternative 6 and are restated below. Additionally, impacts associated with the enlarge Pardee Reservoir component of this alternative are described below.

Construction-Related Impacts

Impact 12-7: Alteration of Present Patterns of Vehicular Circulation, Increased Traffic Delay, and Increased Traffic Hazards during Construction of Facilities

Impacts attributable to construction and the temporary relocation of roadways associated with the project components from the Freeport intake facility to the Zone 40 Surface WTP would be the same as for Alternatives 2–5, described above.

Impacts attributable to the construction of new roadway facilities and the modification of existing roadway alignments would affect Pardee Dam Road, Stony Creek Road, and Middle Bar Bridge. The following modifications and new roadways are proposed: relocation of Pardee Dam Road; relocation of Stony Creek Road; replacement of the SR 49 Bridge; removal of the Middle Bar Bridge; and the construction of a new access road to the powerhouse on the south side of the Mokelumne River. Details of each roadway are described below and are illustrated in Figure 2-3. However, impacts associated with the Middle Bar Bridge are discussed under Significant Impacts and Mitigation Measures below.

The new two-lane Pardee Dam Road alignment route would be approximately 2.6 miles long, connecting to the existing road at points approximately 1.2 miles north and 1.2 miles south of the existing reservoir. The two-lane Stony Creek Road would be relocated to the north end of the existing reservoir, at the site of the original Jackson Creek Spillway, and at the second smaller dam, approximately 600 ft west of the left abutment crest of Jackson Creek Saddle Dam No. 1. The existing SR 49 bridge would be replaced with a new higher bridge structure over the Mokelumne River. A new access road (Powerhouse Road) to the powerhouse on the south side of the Mokelumne River would be constructed from Pardee Dam Road at a point approximately 1,000 ft southeast of the left abutment of the dam.

The existing SR 49 Bridge would remain in service during construction of the new two-lane bridge. If it is determined that the existing bridge would be a hazard to navigation, it would be demolished after the new bridge has been constructed and placed in service. Figure 2-3 shows the proposed realignment of SR 49 and the location of the replacement bridge over the Mokelumne River.

Construction activities, including the use of trucks for hauling materials, may lead to the temporary alteration of present patterns of vehicular circulation, temporary traffic delays, damage to property, or increased potential for injury. However, adherence to the project's Environmental Commitments (refer to Chapter 2), which includes the development and implementation of a traffic control plan, would ensure that any impacts are less than significant. No mitigation is required.

Impact 12-8: Damage to the Roadway Surface during Construction of Facilities

Construction of the project components from the intake facility to Zone 40 Surface WTP and the enlarge Pardee Reservoir component may result in damage to the roadway surface from trench excavation and truck traffic. Maintenance of City of Sacramento, and the Counties of Sacramento, Amador, and Calaveras truck routes includes periodic inspection to assess structural integrity and need for repairs, followed by implementation of needed repairs. If construction trucks travel on roadways that are not included under this maintenance program, roadway damage such as potholes or minor fractures may occur without subsequent inspection and repair. Damage to roadway surfaces not maintained under such a program will be repaired following construction activities, as mentioned in the Environmental Commitments section of Chapter 2. Additionally, all open trenching of the roadway surface would be repaired as part of standard construction procedures. Impacts would be less than significant. No mitigation is required.

Impact 12-9: Disruption of Rail Traffic during Construction of Facilities

Impacts on railroad operations associated with the construction and installation of the pipeline would be similar to those described for Alternatives 2–5 above. The pipeline alignment from the Freeport intake facility to the Zone 40 Surface WTP would traverse numerous railroad tracks. The pipeline will be tunneled under railroad tracks, construction will be coordinated with railroad operators, and an encroachment permit within railroad rights-of-way will be obtained. Construction of the enlarge Pardee Reservoir component will not affect any railroads. This impact is less than significant. No mitigation is required.

Impact 12-10: Interference with Emergency Response Routes

Open-cut construction at roadway crossings and increased truck traffic along haul routes during construction of the project components from the intake facility to Zone 40 Surface WTP and the enlarge Pardee Reservoir component could temporarily increase response times for emergency services such as fire protection, police, and ambulance along affected roadways. The traffic control plan would include an emergency access plan for emergency vehicles access in and adjacent to the construction zone. The emergency access plan, which requires coordination with emergency service providers before construction, limits on the number and extent of road closures, and effective traffic direction, would substantially reduce the potential for such disruptions to response routes. Adherence to the emergency access plan element of the project's Environmental Commitments (refer to Chapter 2) would ensure that this impact is less than significant. No mitigation is required.

Impact 12-11: Interference with Bicycle Routes

Impacts on roadways with existing bikeway routes associated with the construction and installation of the pipeline would be similar to those described for Alternatives 2–5 above. The enlarge Pardee Reservoir component will not affect any existing bikeways along transportation routes. The traffic control plan, referred to in the Environmental Commitments section of Chapter 2,would include the provision of alternate routes for bicyclists and pedestrians during sidewalk or bike lane closures associated with construction of the pipeline. This impact is less than significant. No mitigation is required.

Operation-Related Impacts

Impact 12-12: Congestion of Roadways from Facility Operations

Impacts attributable to congestion of roadways associated with the project components from the Freeport intake facility to the Zone 40 Surface WTP would be the same as for Alternatives 2–5, described above.

The operation of the enlarge Pardee Reservoir component would require up to approximately 64 full-time personnel, the same as the number currently required. The new and modified roadways in the Pardee Reservoir area would require only routine roadway maintenance. Proposed operations of the enlarged reservoir would not change from existing operations. Therefore, facility operations are not expected result in impacts that would cause roadway congestion. No mitigation is required.

Impact 12-13: Permanent Alteration of Present Patterns of Vehicular Circulation

Impacts attributable to the permanent alteration of vehicular traffic associated with the project components from the Freeport intake facility to the Zone 40 Surface WTP would be the same as for Alternatives 2–5, described above.

New roadway facilities and modifications to existing roadway alignments would affect traffic circulation patterns along Pardee Dam Road, Stony Creek Road, SR 49, and Middle Bar Bridge in Calaveras and Amador Counties. Alterations to traffic circulation patterns would result from the relocation of Pardee Dam Road and Stony Creek Road, replacement of the SR 49 bridge, removal of the Middle Bar Bridge, and the construction of a new access road to the powerhouse on the south side of the Mokelumne River. Impacts associated with the Middle Bar Bridge are discussed under Significant Impacts and Mitigation Measures below.

New roadways and modifications to existing roadways in the vicinity of Pardee Reservoir are not expected to result in significant impacts because the use of existing roadways (Stony Creek Road, Pardee Dam Road, and SR 49) would continue following implementation. Furthermore, operation of the proposed enlarge Pardee Reservoir component is not expected to affect roadways since materials deliveries and the number of employees commuting would be similar to existing conditions. Therefore, impacts from the proposed project resulting in the permanent alteration of patterns of vehicular circulation in the vicinity of the project sites are considered less than significant. No mitigation is required.

Significant Impacts and Mitigation Measures

Alternatives 1 through 5 would not result in significant construction-related or operation-related impacts related to traffic and transportation.

Alternative 6

Construction-Related Impacts

Impact 12-14: Reduced Access Options for Area Residents

Under Alternative 6, the Middle Bar Bridge would be removed from service and replaced with two turnaround areas, each constructed at the ends of Gwin Mine and Middle Bar roads. The two turnaround areas would be located above the high water level and on both sides of the removed Middle Bar Bridge. The roadway ends would continue to function as recreation areas for fishing and scenic views, but would no longer provide access across the Mokelumne River.

Eight residences are located on the north side of the Middle Bar Bridge, on Middle Bar Road, and three residences are located on the south side of the bridge, on Gwin Mine Road (D'agostini pers. comm.; Kawasaki pers. comm.). Because of the low traffic counts recorded for Middle Bar Bridge (0–10 per day), and the option to use SR 49 as an access route for both the north and south sides, it is unknown whether residents currently use the bridge.

Without additional information, reduced access options for area residents from the removal of the Middle Bar Bridge is assumed to be a significant impact. During construction activities, the existing SR 49 Bridge would remain in service and provide an alternative route to residences on Middle Bar Road. SR 49, Gwin Mine Road, Paloma Road, and SR 26 would also remain in service for access to residences on Gwin Mine Road. Implementation of the following mitigation measure would reduce this impact to less than significant.

Mitigation Measure 12-1: Replace the Middle Bar Bridge with New Bridge

To compensate for the loss of the Middle Bar Bridge as an access option for area residents, a new bridge will be constructed across the enlarged Pardee Reservoir. The new bridge will be higher and longer to accommodate the higher water levels and be placed as close to the original alignment as possible, providing vehicular access to the two sides. The new bridge will be constructed in compliance with all applicable safety design requirements within 2 years of removal of the Middle Bar Bridge. Depending on the final design, the new bridge may negate the need for fishing piers and turnaround areas (the latter two described as part of the project description [Chapter 2]).

Operation-Related Impacts

This alternative would not result in significant operation-related impacts on traffic and transportation.

Chapter 13

Air Quality

Chapter 13
Air Quality

Affected Environment

Regional Climate and Atmospheric Conditions

The project components for Alternatives 2–5, and the project components from the intake facility to Zone 40 Surface WTP for Alternative 6, are located in Sacramento and San Joaquin Counties. These counties are in the south end of the Sacramento Valley and the north end of the San Joaquin Valley, respectively. This area is about 50 miles east-northeast of the Carquinez Strait, a sea-level gap between the Coast Ranges and the Diablo Range. The prevailing winds are from the south and west, primarily because of marine breezes through the Carquinez Strait, although during winter the sea breezes diminish and winds from the north occur more frequently. This portion of the project area has episodes of poor atmospheric mixing caused by inversion layers. Inversion layers form when temperature increases with elevation aboveground or when a mass of warm, dry air settles over a mass of cooler air near the ground. Surface inversions (0–500 feet) are most frequent in winter, and subsidence inversions (1,000–2,000 feet) are most frequent in summer. Inversion layers limit vertical mixing in the atmosphere, trapping pollutants near the surface.

The enlarge-Pardee-Reservoir project component for Alternative 6 is located in Amador and Calaveras Counties. These counties are located within the Mountain Counties Air Basin (MCAB). The enlarge Pardee Reservoir component area, which is located in the foothills area of the MCAB, has climatic conditions that closely approximate those of the Sacramento and San Joaquin Valleys.

Air Pollutants and Ambient Air Quality Standards

Both the State of California and the federal government have established ambient air quality standards for several different pollutants. For some pollutants, separate standards have been set for different periods of the year. Most standards have been set to protect public health, although some standards have been based on other values, such as protection of crops, protection of materials, or avoidance of nuisance conditions. The pollutants of greatest concern in the project area are carbon monoxide (CO), ozone, and inhalable PM10. A summary of state and federal ambient air quality standards is shown in Table 13-1.

Carbon Monoxide

Health Effects

CO levels are a public health concern because when CO combines with hemoglobin, the rate at which oxygen is transported in the bloodstream is reduced. Even low concentrations of CO can significantly affect the blood oxygen concentration because CO binds to hemoglobin 220–245 times more strongly than oxygen. Both the cardiovascular system and the central nervous system can be affected when 25–40% of the hemoglobin in the bloodstream is bound to CO rather than to oxygen. State and federal ambient air quality standards for CO have been set at levels intended to keep CO from combining with more than 15% of the body's hemoglobin.

State and Federal Standards

State and federal CO standards have been set for 1-hour and 8-hour averaging times. As shown in Table 13-1, the state 1-hour CO standard is 20 parts per million (ppm) and the federal 1-hour CO standard is 35 ppm. State and federal standards are both 9 ppm for an 8-hour averaging period. State CO standards are values not to be exceeded; federal CO standards are established as values not to be exceeded more than once per year.

Ozone

Health Effects

Ozone is not emitted directly into the air, but is formed by a photochemical reaction in the atmosphere. Ozone precursors, which include reactive organic gases (ROG) and oxides of nitrogen (NO_x), react in the presence of sunlight in the atmosphere to form ozone. Because photochemical reaction rates depend on the intensity of ultraviolet light and air temperature, ozone is primarily a summer air pollution problem. Ozone is a public health concern because it is a respiratory irritant that increases susceptibility to respiratory infections. Ozone also causes substantial damage to the leaf tissues of crops and natural vegetation and damages many materials by acting as a chemical oxidizing agent.

Table 13-1. Ambient Air Quality Standards Applicable in California

Pollutant	Symbol	Average Time	Standard (parts per million)		Standard (micrograms per cubic meter)		Violation Criteria	
			California	National	California	National	California	National
Ozone	O_3	1 hour	0.09	0.12	180	235	If exceeded	If exceeded on more than 3 days in 3 years
		8 hours	NA	0.08	NA	157	NA	If exceeded on more than 3 days in 3 years
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
(Lake Tahoe only)		8 hours	6	NA	7,000	NA	If equaled or exceeded	NA
Nitrogen dioxide	NO_2	Annual average	NA	0.053	NA	100	NA	If exceeded
		1 hour	0.25	NA	470	NA	If exceeded	
Sulfur dioxide	SO_2	Annual average	NA	0.03	NA	80	NA	If exceeded
		24 hours	0.04	0.14	105	365	If exceeded	If exceeded on more than 1 day per year
		1 hour	0.25	NA	655	NA	NA	NA
Hydrogen sulfide	H_2S	1 hour	0.03	NA	42	NA	If equaled or exceeded	NA
Vinyl chloride	C_2H_3Cl	24 hours	0.010	NA	26	NA	If equaled or exceeded	NA
Inhalable particulate matter	PM10	Annual geometric mean	NA	NA	20	NA	If exceeded	NA
		Annual arithmetic mean	NA	NA	NA	50	NA	If exceeded
		24 hours	NA	NA	50	150	If exceeded	If average 1% over 3 years is exceeded
	PM2.5	Annual geometric mean Annual arithmetic mean	NA	NA	12	NA	If exceeded	NA

Pollutant	Symbol	Average Time	Standard (parts per million) California	Standard (parts per million) National	Standard (micrograms per cubic meter) California	Standard (micrograms per cubic meter) National	Violation Criteria California	Violation Criteria National
		24 hours	NA	NA	NA	15	NA	If exceeded
			NA	NA	NA	65	NA	If average 2% over 3 years is exceeded
Sulfate particles	SO_4	24 hours	NA	NA	24	NA	If equaled or exceeded	NA
Lead particles	Pb	Calendar quarter	NA	NA	NA	1.5	NA	If exceeded no more than 1 day per year
		30 days	NA	NA	1.5	NA	If equaled or exceeded	NA

Notes:

All standards are based on measurements at 25ºC and 1 atmosphere pressure.

National standards shown are the primary (health effects) standards.

NA = not applicable.

State and Federal Standards

State and federal standards for ozone have been set for 1-hour and 8-hour averaging times. As shown in Table 13-1, the state 1-hour ozone standard is 0.09 ppm, not to be exceeded at any time. The federal 1-hour ozone standard is 0.12 ppm, not to be exceeded more than three times in any 3-year period. The federal 8-hour ozone standard of 0.09 ppm is attained when the fourth highest 8-hour concentration in a year, averaged over three years, is equal to or less than the standard.

Particulate Matter

Health Effects

Health concerns associated with suspended particulate matter focus on particles small enough to reach the lungs when inhaled. Few particles larger than 10 microns in diameter reach the lungs. Suspended particles or droplets less than 10 microns in diameter can lodge in the lungs and contribute to respiratory problems. PM10 arises from sources such as road dust, diesel soot, combustion products, abrasion of tires and brakes, construction operations, and dust carried by windstorms. It is also formed in the atmosphere from reactions of nitrogen dioxide (NO_2) and sulfur dioxide (SO_2) with ammonia. Fine particles pose a serious health hazard, alone or in combination with other pollutants. The smallest particles inhaled are deposited in the lungs and can cause permanent lung damage. Fine particles can also have a damaging effect on health by interfering with the body's mechanism for clearing the respiratory tract or by acting as a carrier of absorbed toxic substances.

State and Federal Standards

Both the federal and state air quality standards for particulate matter have been revised to apply only to PM10. State and federal PM10 standards have been set for 24-hour and annual averaging times. As shown in Table 13-1, the state 24-hour PM10 standard is 50 micrograms per cubic meter ($\mu g/m^3$) and the federal 24-hour standard is 150 $\mu g/m^3$. The state annual PM10 standard is 20 $\mu g/m^3$ as an annual geometric mean, whereas the federal annual PM10 standard is 50 $\mu g/m^3$ as an annual arithmetic mean. The Air Resources Board (ARB) and the EPA have recently established air quality standards for particles smaller than 2.5 microns in diameter (PM2.5). This was done to address the health risks associated with breathing these smaller particles, which lodge deeper in the lungs and typically are not exhaled. ARB has established an annual geometric mean of 12 $\mu g/m^3$, whereas EPA has established a 24-hour standard of 65 $\mu g/m^3$ and annual arithmetic mean of 15 $\mu g/m^3$. Federal and state 24-hour PM10 and PM2.5 standards may not be exceeded more than 1 day per year, and annual standards are not to be exceeded.

Existing Air Quality Conditions

Air quality data for 1997–2001 from monitoring stations in Sacramento and San Joaquin Counties are summarized in Tables 13-2 and 13-3. Data from 2001 are the most recently available. Because some monitoring stations do not monitor all pollutants, monitoring stations were chosen for each pollutant that would best represent conditions in the project area. The data show that monitored CO levels have been trending down over the period shown. This downtrend is primarily a result of the use of oxygenated gasoline in winter. The state ozone standard has been exceeded several times each year. The state 24-hour PM10 standard has been exceeded between 2 and 11 times each year. The federal 24-hour PM2.5 standard has been exceeded between 1 and 8 times each year.

Table 13-4 summarizes air quality collected at monitoring stations in Amador and Calaveras Counties from 1997 to 2001. The state ozone standards have been exceeded several times at both the Jackson and San Andreas monitoring stations. Similarly, several violations of the PM10 24-hour standard have been recorded at these monitoring sites.

Alternatives 2–5

Alternatives 2–5 are all in southeastern Sacramento County and northeastern San Joaquin County. These alignments pass near parks; industrial, commercial, and residential areas; and agricultural and open space land. The alignment corridor is subject to high levels of regional pollutants such as ozone and PM10, as well as high levels of localized pollutants such as CO near congested intersections; heavily traveled roadways; and large, heavily used parking lots.

Alternative 6

Alternative 6 is in Sacramento, Amador, and Calaveras Counties. The project components from the intake facility to Zone 40 Surface WTP for Alternative 6, which is in Sacramento County, passes near parks, industrial and residential areas, as well as agricultural and open space land. The results for recent air monitoring near these components are presented in Table 13-2. The enlarge-Pardee-Reservoir component for Alternative 6 is in rural Amador and Calaveras Counties. This project component is not near any congested roadways or intersections or other sources of localized air pollutants. Rural residences are scattered throughout the area. The closest monitoring stations for this component are located in Jackson in Amador County, and at San Andreas in Calaveras County. Recent monitoring results for these stations are summarized in Table 13-4.

Table 13-2. Summary of Carbon Monoxide, Ozone, PM10, and PM2.5 Monitoring Data for Sacramento County

	Yearly Monitoring Data				
	1997	1998	1999	2000	2001
Carbon Monoxide					
Sacramento—13th Street and T Street					
Highest 1-hour concentration (ppm)	7.6	7.9	7.5	5.9	6.7
Highest 8-hour concentration (ppm)	6.0	7.1	5.7	4.4	4.4
Hours above standard [a]	0	0	0	0	0
Days above standard [b]	0	0	0	0	0
Sacramento—El Camino Avenue and Watt Avenue					
Highest 1-hour concentration (ppm)	9.5	7.0	7.7	7.3	5.6
Highest 8-hour concentration (ppm)	7.2	6.1	6.6	6.3	4.8
Hours above standard [a]	0	0	0	0	0
Days above standard [b]	0	0	0	0	0
Ozone					
Sacramento—13th Street and T Street					
1st High (ppm)	0.09	0.14	0.12	0.10	0.11
2nd High (ppm)	0.09	0.12	0.11	0.10	0.11
Days above standard[c]	0	8	6	3	2
Elk Grove—Bruceville Road					
1st High (ppm)	0.12	0.15	0.16	0.10	0.11
2nd High (ppm)	0.10	0.11	0.12	0.10	0.11
Days above standard[c]	5	7	16	3	10
Folsom					
1st High (ppm)	0.13	0.15	0.15	0.13	0.13
2nd High (ppm)	0.12	0.15	0.14	0.12	0.13
Days above standard[c]	19	31	22	17	27
PM10					
Sacramento—13th Street and T Street					
Highest 24-hour concentration (: g/m^3)	108	75	99	64	89
Geometric mean (: g/m^3)	20	19	23	22	22
Arithmetic mean (: g/m^3)	23.2	22.5	28.7	24.6	25.3
Days above state standard [d]	2	3	8	5	5

	Yearly Monitoring Data				
	1997	1998	1999	2000	2001
Sacramento—Branch Center Road					
Highest 24-hour concentration (: g/m^3)	85	81	86	56	70
Geometric mean (: g/m^3)	17	22	29	23	26
Arithmetic mean (: g/m^3)	23.1	27.0	33.1	26.6	31.2
Days above state standard [d]	3	8	11	2	3
Sacramento—Stockton Boulevard					
Highest 24-hour concentration (: g/m^3)	107	79	88	86	N/A
Geometric mean (: g/m^3)	19	19	21	20	N/A
Arithmetic mean (: g/m^3)	22.7	23.6	24.7	24.2	N/A
Days above state standard [d]	2	4	3	2	N/A
PM2.5					
Sacramento—13th Street and T Street					
Highest 24-hour concentration (: g/m^3)	N/A	96	108	67	72
Arithmetic mean (: g/m^3)	N/A	56.0	17.0	12.3	11.6
Days above national standard [e]	N/A	3	8	1	1
Sacramento—Stockton Boulevard					
Highest 24-hour concentration (: g/m^3)	N/A	N/A	86	65	42
Arithmetic mean (: g/m^3)	N/A	N/A	16.2	10.3	8.6
Days above national standard [e]	N/A	N/A	8	0	0

[a] Hours above standard = hours above state 1-hour standard of 20 ppm.

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

[c] Days above standard = days above state 1-hour standard of 0.09 ppm.

[d] Days above state standard = days above state 24-hour standard of 50 : g/m^3

[e] Days above national standard = days above national 24-hour standard of 65 : g/m^3

Sources: California Air Resources Board 2002a; Environmental Protection Agency 2002.

Table 13-3. Summary of Carbon Monoxide, Ozone, PM10, and PM2.5 Monitoring Data for San Joaquin County

	Yearly Monitoring Data				
	1997	1998	1999	2000	2001
Carbon Monoxide					
Stockton-Hazelton Street					
Highest 1-hour concentration (ppm)	7.7	8.9	8.3	6.5	8.4
Highest 8-hour concentration (ppm)	3.6	7.2	5.3	3.9	6.0
Hours above standard[a]	0	0	0	0	0
Days above standard[b]	0	0	0	0	0
Stockton-Claremont Avenue					
Highest 1-hour concentration (ppm)	6.3	10.2	11.3	8.1	N/A
Highest 8-hour concentration (ppm)	4.2	7.9	7.8	6.6	N/A
Hours above standard [a]	0	0	0	0	N/A
Days above standard [b]	0	0	0	0	N/A
Ozone					
Stockton-Hazelton Street					
1st High (ppm)	0.10	0.13	0.14	0.11	0.10
2nd High (ppm)	0.09	0.11	0.13	0.10	0.10
Days above standard[c]	1	10	6	4	5
Stockton-East Mariposa Street					
1st High (ppm)	0.10	0.12	0.14	0.11	0.11
2nd High (ppm)	0.10	0.11	0.11	0.10	0.11
Days above standard[c]	3	9	4	4	5
Tracy-Patterson Pass Road					
1st High (ppm)	0.12	0.12	0.13	0.12	0.11
2nd High (ppm)	0.11	0.12	0.12	0.11	0.11
Days above standard[c]	5	14	16	7	4
PM10					
Stockton-Hazelton Street					
Highest 24-hour concentration (: g/m^3)	98	106	150	91	140
Geometric mean (: g/m^3)	26	24	30	29	30
Arithmetic mean (: g/m^3)	29.7	29.1	36.4	30.8	34.4
Days above state standard[d]	5	8	10	9	10

	Yearly Monitoring Data				
	1997	1998	1999	2000	2001
Stockton–Wagner-Holt School					
Highest 24-hour concentration (: g/m^3)	130	99	118	104	119
Geometric mean (: g/m^3)	22	20	21	24	26
Arithmetic mean (: g/m^3)	26.1	25.7	33.9	29.3	29.2
Days above state standard [d]	4	5	4	9	6
PM2.5					
Stockton-Hazelton Street					
Highest 24-hour concentration (: g/m^3)	N/A	N/A	101	78	76
Arithmetic mean (: g/m^3)	N/A	N/A	19.7	15.5	13.9
Days above national standard [e]	N/A	N/A	5	1	2

[a] Hours above standard = hours above state 1-hour standard of 20 ppm.

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

[c] Days above standard = days above state 1-hour standard of 0.09 ppm.

[d] Days above state standard = days above state 24-hour standard of 50 : g/m^3

[e] Days above national standard = days above national 24-hour standard of 65 : g/m^3

Sources: California Air Resources Board 2002a; Environmental Protection Agency 2002.

Table 13-4. Summary of Ozone, PM10, and PM2.5 Monitoring Data for Amador and Calaveras Counties

	Yearly Monitoring Data				
	1997	1998	1999	2000	2001
Ozone					
Jackson—Clinton Road					
1st High (ppm)	0.135	0.143	0.121	0.121	0.107
2nd High (ppm)	0.117	0.129	0.119	0.118	0.107
Days above state standard [a]	9	30	22	13	4
San Andreas—Gold Strike Road					
1st High (ppm)	0.140	0.134	0.126	0.134	0.120
2nd High (ppm)	0.118	0.124	0.121	0.116	0.115
Days above state standard [a]	6	27	21	16	8
PM10					
San Andreas—Gold Strike Road					
Highest 24-hour concentration (: g/m^3)	112.0	35.0	65.0	35.0	44.0
Geometric mean (: /m^3)	17	13	18	16	17
Arithmetic mean (: g/m^3)	19	15	20	17	19
Days above state standard (calculated) [b]	6	0	12	0	0
PM2.5					
San Andreas—Gold Strike Road					
Highest 24-hour concentration (: g/m^3)	N/A	N/A	33.0	48.0	31.0
Arithmetic mean (: g/m^3)	N/A	N/A	11.0	9.0	8.1
Days above national standard[c]	N/A	N/A	0	0	0

[a] Days above standard = days above state 1-hour standard of 0.09 ppm.

[b] Days above state standard = days above state 24-hour standard of 50 : g/m^3

[c] Days above national standard = days above national 24-hour standard of 65 : g/m^3

Sources: California Air Resources Board 2002a; Environmental Protection Agency 2002.

Regulatory Setting

Air quality management responsibilities exist at local, state, and federal levels of government. Air quality management planning programs were developed during the past decade generally in response to requirements established by the federal Clean Air Act. The enactment of the California Clean Air Act of 1988 (CCAA) produced additional changes in the structure and administration of air quality management programs in California.

Air Quality Management at the Federal Level

The federal Clean Air Act (CAA), passed in 1970 and last amended in 1990, forms the basis for the national air pollution control effort. EPA is responsible for implementing most aspects of CAA. Basic elements of the act include National Ambient Air Quality Standards (NAAQS) for major air pollutants, hazardous air pollutants standards, state attainment plans, motor vehicle emissions standards, stationary source emissions standards and permits, acid rain control measures, stratospheric ozone protection, and enforcement provisions.

CAA requires that EPA establish NAAQS and reassess, at least every 5 years, whether adopted standards are adequate to protect public health based on current scientific evidence. The NAAQS describe acceptable air quality conditions designed to protect the health and welfare of the nation's citizens. NAAQS are shown in Table 13-1.

In November 1990, Congress enacted a series of amendments to the CAA intended to intensify air pollution control efforts across the nation. One of the primary goals of the 1990 amendments to the CAA was an overhaul of the planning provisions for those areas not currently meeting NAAQS. The CAA identifies specific emission reduction goals, requires both a demonstration of reasonable further progress and attainment, and incorporates more stringent sanctions for failure to attain the NAAQS or to meet interim attainment milestones.

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 established an air quality management process that generally parallels the federal process. The CCAA process, however, focuses on attainment of the state ambient air quality standards that, for certain pollutants and averaging periods, are more stringent than the comparable federal standards.

The CCAA requires that an air district prepare an air quality attainment plan if the district violates state air quality standards for CO, SO_2, NO_x, or ozone. No locally prepared attainment plans are required for areas that violate the state PM10 standards. The CCAA requires that the state air quality standards be met as expeditiously as practicable, but it 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 least stringent requirements are set for areas expected to achieve air quality standards by the end of 1994. The most stringent requirements are set for areas that cannot achieve the standards until after 1997.

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 Quality Management in Sacramento County

SMAQMD is responsible for control of stationary- and indirect-source emissions, air monitoring, and preparation of air quality attainment plans in the Sacramento County portion of the Sacramento Valley Air Basin (SVAB). SMAQMD is responsible for preparing and submitting air quality attainment plans to ARB for criteria pollutants for which the Sacramento County portion of the SVAB is not in attainment. ARB must then review these plans and forward them, along with the plans of the other districts throughout the state (collectively called the State Implementation Plan [SIP]), to EPA Region IX for approval. EPA requires a separate compliance plan for each nonattainment pollutant.

The five air districts, including SMAQMD in the southern portion of the SVAB, along with ARB and SACOG, helped prepare the Sacramento Area Regional Ozone Attainment Plan. That plan, which was prepared to fulfill the requirements of the federal Clean Air Act, was submitted to EPA on November 15, 1994, as part of California's SIP.

The SIP consists of adopted measures, commitments to adopt new measures, emission inventories, air quality modeling results, contingency measures, and a demonstration of emission reductions sufficient for attainment and rate-of-progress milestones. The new measures proposed in the plan build on the existing state and local air quality programs.

Based on ozone levels recorded between 1988 and 1991, the Sacramento County portion of the SVAB was classified by the federal Clean Air Act as a severe nonattainment area, with attainment required by 1999. However, no feasible controls could be identified that would provide the needed reductions by 1999. The earliest possible attainment date identified was 2005.

This shift to 2005 requires that several additional controls be implemented in the Sacramento County portion of the SVAB. The emission offset requirement for new and modified sources would be increased from a ratio of 1.2:1 to 1.3:1. To achieve attainment by 2005, the air district has committed to reducing emissions from construction emissions by 2 tons of NO_x per day. Also, the region would be required to establish employer-based trip reduction rules modeled after the Federal Employee Commute Option program.

Sacramento County is also federally designated as a moderate nonattainment area for PM10. Consequently, a PM10 SIP is also required. Monitoring data have verified that no violation of the federal PM10 standards has occurred in the four most recent years for which data are available, allowing SMAQMD to request a redesignation from nonattainment to attainment of the federal standards. SMAQMD is currently working with the EPA in preparing a report for the redesignation from nonattainment to attainment, which is expected to be completed within the next few years.

Air Quality Management in San Joaquin County

SJVUAPCD has jurisdiction over air quality issues throughout the eight-county San Joaquin Valley Air Basin (SJVAB). It administers air quality regulations developed at the federal, state, and local levels.

The State of California has designated the area as being in severe nonattainment for ozone and in nonattainment for particulate matter smaller than or equal to 10 microns in diameter. The SJVUAPCD has adopted an air quality improvement plan that addresses NO_x and ROGs, both of which are ozone precursors and contribute to PM10. The plan specifies that regional air quality standards for ozone and PM10 concentrations can be met through the use of additional source controls and trip reduction strategies. It also establishes emissions budgets for transportation and stationary sources. Those budgets, developed through air quality modeling, reveal how much air pollution can occur in an area before NAAQS are violated.

The SJVAB did not attain the federal 1-hour ozone standards by November 1999; as a result, EPA has redesignated the SJVAB as a severe ozone nonattainment area. The redesignation as a severe nonattainment area gives the SJVUAPCD more time (until 2005) to conform to the health-based standards. However, the redesignation also will require that more stringent and expensive control measures be imposed on industry and will bring thousands of businesses under EPA Title I requirements. If the SJVUAPCD fails to attain the standards by 2005, sanctions and a de facto growth moratorium could be imposed in the air basin.

The SJVUAPCD has also prepared Regulation VIII–Fugitive PM10 Prohibitions. Within Regulation VIII are several rules intended to control PM10 emissions. Rules 8010, 8020, 8030, 8060, and 8070 related to fugitive dust requirements from various sources are applicable to the proposed project.

Air Quality Management in Amador County

The Amador County Air Pollution Control District (ACAPCD) is responsible for air quality management in Amador County. With regard to the state standards, the county is classified as a nonattainment area for ozone and an unclassified area for both CO and PM10. As for the NAAQS, the county is classified as an unclassified/attainment area for both ozone and CO, and an unclassified area for PM10.

Air Quality Management in Calaveras County

The Calaveras County Air Pollution Control District (CCAPCD) is responsible for air quality management in Calaveras County. With regard to the state standards, the county is classified as a nonattainment area for both ozone and PM10, and an unclassified area for CO. As for the NAAQS, the county is classified as an unclassified/attainment area for both ozone and CO, and an unclassified area for PM10.

Environmental Consequences

Methods and Assumptions

Construction of all facilities proposed for construction would generate pollutant emissions from various emission sources and activities. Most phases of project construction would generate air emissions. The phases include project mobilization; site preparation; demolition of existing structures (enlarge Pardee Reservoir component of Alternative 6 only); construction of the pipelines, water supply facilities, the new replacement dam (enlarge Pardee Reservoir component of Alternative 6 only), saddle dams (enlarge Pardee Reservoir component of Alternative 6 only), and powerhouse (enlarge Pardee Reservoir component of Alternative 6 only); and relocation of roads, bridges, and recreational facilities (enlarge Pardee Reservoir component of Alternative 6 only).

The primary pollutant-generating activities associated with these phases include:

- exhaust emissions from
    - off-road construction vehicles and equipment,
    - vehicles used to deliver supplies to the project site or to haul demolished materials from the site,
    - worker commute trips, and
- fugitive dust from
    - demolition activities;
    - equipment operating on exposed earth; and
    - the handling of sand, gravel, aggregate, and associated construction materials.

Several assumptions were made in estimating construction emissions for Alternatives 2–6. The assumptions used in developing information related to project-component construction activities and operation activities are based upon professional judgment and the engineering information developed for the project. Emissions for off-road equipment were made using the following procedure. First, estimates were made of the number and type of off-road construction equipment that would be required for each project phase and the number of hours that each type of equipment would operate each year. Those equipment hours were then multiplied by the equipment horsepower, by the equipment load factor, and by the equipment emission rate to obtain total emissions for each equipment type. Finally, emissions were summed across all equipment types. The emission rates used for off-road equipment were based on the California ARB's off-road model.

Emissions for on-road construction equipment were based on the California ARB's EMFAC2002 model and assumed 100% heavy-heavy duty vehicles traveling at an average speed of 30 mph (California Air Resources Board 2002b). The majority of on-road truck trips associated with Alternatives 2–5 and the project components from the intake facility to Zone 40 Surface WTP of Alternative 6 would be transporting pipeline materials to the sites and removing backfill material from the sites. The majority of on-road truck trips associated with the enlarge Pardee Reservoir component of Alternative 6 would be to and from borrow sites to obtain aggregate, sand, and rock needed for project construction. The number of truck trips was based on the amount of material required and assumed a haul truck volume of 20 cubic yards. The total vehicle miles traveled per year was based on the number of truck trips required and the distance to borrow sites.

For Alternatives 2–5 and the project components from the intake facility to the Zone 40 Surface WTP of Alternative 6, emissions associated with worker commute trips and fugitive dust for pipeline construction, the intake facility, the Zone 40 Surface WTP, the terminal facility, the canal pumping plant, and the aqueduct pumping plant and pretreatment facility (Camanche site or optional Brandt site) were estimated using the assumptions made based upon professional judgment and the engineering information developed for the project.

In addition to the assumptions described above, assumptions were made for the enlarge Pardee Reservoir component for Alternative 6. For the enlargement of Pardee Reservoir, emissions associated with worker commute trips assumed that 350 employees would commute to the project site each day and that the average one-way trip would be 30 miles. The California ARB's EMFAC2002 model was used to estimate worker commute trip emissions (California Air Resources Board 2002b). Fugitive dust emissions assumed that 50 acres would be disturbed per day during each day of construction over a construction period of approximately 4 years (250 construction days per year). An emission rate of 10 pounds of PM10 per acre per day was used (Midwest Research Institute 1996).

Significance Criteria

According to Appendix G checklist of the State CEQA Guidelines, a project may have a significant effect on the environment if it will:

- conflict with or obstruct implementation of applicable air quality plans,
- violate any air quality standard or contribute substantially to an existing or projected air quality violation,
- result in a cumulatively considerable net increase of any criteria pollutant for which the project region is nonattainment under an applicable federal or state ambient air quality standard,
- expose sensitive receptors to substantial pollutant concentrations, or
- create objectionable odors affecting a substantial number of people.

In addition to the criteria detailed above, separate emission thresholds are used for each of the three air basins in which the alternatives would be located. The thresholds shown in Table 13-5 represent applicable construction-related thresholds as the air emissions generated by the project would result primarily from construction activities.

Within the Lower Sacramento Valley Air Basin (which includes Sacramento County), the SMAQMD's Air Quality Thresholds of Significance and EPA's general conformity de minimus thresholds were used in determining project-related air quality impacts. The thresholds are defined by SMAQMD as 85 parts per day (ppd) for NO_x, or exceedance of the state PM10 standard. SMAQMD generally requires construction projects to be modeled to ascertain their impacts on PM10 concentrations. However, for linear pipeline projects, SMAQMD has stated that PM10 effects from construction are considered less than significant for linear construction activities (Jones pers. comm.). The conformity thresholds for Sacramento County equal 25 tons per year for ROG and NO_x and 100 tons per year for PM10 and CO.

The applicable significant thresholds for construction projects in San Joaquin County are summarized in Table 13-5. For the portion of the project within the San Joaquin Valley Air Basin (San Joaquin County), the EPA's general conformity de minimus thresholds were used. The SJVUAPCD does not have any daily or annual significance thresholds for construction activities. The SJVUAPCD does, however, have Regulation VIII, which requires that specific actions be taken to minimize dust generation from construction activities.

Neither Amador nor Calaveras County APCD have developed emission thresholds to evaluate the significance of CEQA or NEPA projects. For the purposes of this analysis, the air quality thresholds of significance used in these counties were based on the general conformity de minimus thresholds established by the EPA for federal maintenance areas. Maintenance areas are geographic areas that previously violated ambient standards but have now come into attainment with federal air quality standards. The federal general conformity de minimus thresholds are designed to maintain existing air quality by limiting air emissions, thereby preventing air quality in maintenance areas from slipping back into nonattainment.

Although neither Amador nor Calaveras Counties are classified as maintenance areas, compliance with the federal general conformity de minimus thresholds would ensure that the enlarge Pardee Reservoir component of Alternative 6 does not substantially increase air quality concentrations in those counties. If emissions exceed the significance thresholds, then this would be considered a significant impact because such emissions could lead to violations of the ambient air quality standards. The federal general conformity de minimus thresholds are 100 tons per year for ROG, NO_x, CO, or PM10. Consequently, construction-related emissions associated with the enlarge Pardee Reservoir component that generate more than 100 tons per year of either of these pollutants would be considered to have a significant impact.

None of the project alternatives is expected to generate substantial odors. Minor levels of odors would be generated by the operation of diesel equipment but the impacts are expected to be negligible.

Table 13-5. Construction-Related Significance Thresholds (tons/year)

	ROG		NO_X		CO		PM10	
Air Basin (County)	Lbs/day	Tons/yr	Lbs/day	Tons/yr	Lbs/day	Tons/yr	Lbs/day	Tons/yr
Lower Sacramento Valley Air Basin (Sacramento)	N/A	25	85	25	N/A	100	N/A	100
San Joaquin Valley Air Basin (San Joaquin)	N/A	25	N/A	25	N/A	100	N/A	70
Mountain Counties Air Basin (Amador/Calaveras)	N/A	100	N/A	100	N/A	100	N/A	100

Less-than-Significant Impacts

Alternative 1

Under Alternative 1, no FRWP facilities would be constructed, and no construction-related or operation-related air quality impacts would occur.

Alternatives 2–5

Alternatives 2 through 5 differ only in the pipeline alignments from the Freeport intake facility to the FSC. Project construction and operation for Alternatives 2 through 5 are very similar. Air emissions generated by each alternative differ only slightly from each other; therefore, the results for Alternatives 2 through 5 are presented together but are representative of each individual alternative, unless otherwise noted.

Construction-Related Impacts

Impact 13-1: Short-Term Increase in ROG and PM10 Emissions in Sacramento County

Construction of Alternatives 2–5 would result in short-term emission levels of ROG and PM10 that are less than daily and annual significance thresholds. Table 13-6 shows construction-related emissions by construction year. Because emissions would be relatively minor and would be less than the significance thresholds established by the SMAQMD, the air quality impacts for these pollutants are less than significant.

Impact 13-2: Short-Term Increase in ROG and CO Emissions in San Joaquin County

Construction of the aqueduct pumping and pretreatment facility (Camanche site or optional Brandt site) and pipeline would also generate emission in San Joaquin County. Table 13-6 shows construction-related emissions by construction year. As shown in Table 13-6, emissions of ROG and CO would be less than the significance thresholds and, consequently, are considered less than significant.

Table 13-6. Summary of Construction Emissions for Alternatives 2–6

	ROG		NO_x		CO		PM10		PM10 Mitigated	
	ppd	tpy	ppd	tpy	ppd	tpy	ppd	tpy	ppd	tpy
Alternatives 2–5										
Sacramento County—Year 1										
Year 1—Intake Facility	47	2	392	16	362	19	36	4	--	--
Year 1—Intake Facility Onsite Settling Basins	25	0	191	3	191	3	19	0	--	--
Year 1—Intake Facility to Zone 40 Surface WTP/FSC Pipeline	77	5	672	40	555	38	110	6	--	--
Year 1—Terminal Facility	20	1	155	8	154	8	24	2	--	--
Year 1—FSC to Mokelumne Aqueducts Pipeline w/in Sacto County	26	2	224	13	185	13	37	2	--	--
Year 1—Canal Pumping Plant	47	2	392	12	362	14	36	3	--	--
Year 1 Total: Sacramento County	242	12	2025	92	1810	94	261	17	--	--
San Joaquin County—Year 1										
Year 1—FSC to Mokelumne Aqueducts Pipeline w/in San Joaquin County (including surge tank)	51	3	448	27	370	25	73	4	--	--

	ROG		NO_x		CO		PM10		PM10 Mitigated	
	ppd	tpy	ppd	tpy	ppd	tpy	ppd	tpy	ppd	tpy
Year 1—Aqueduct Pumping Plant and Pretreatment Facility	51	3	352	19	414	26	44	6	--	--
Year 1 Total: San Joaquin County	102	6	800	46	785	52	118	11	--	--
Sacramento County—Year 2										
Year 2—Intake Facility	47	2	392	16	362	19	36	4	--	--
Year 2—Intake Facility to Zone 40 Surface WTP/FSC Pipeline	77	5	672	40	555	38	110	6	--	--
Year 1—Zone 40 Surface WTP	51	3	352	21	414	26	44	3	--	--
Year 2—FSC to Mokelumne Aqueducts Pipeline w/in Sacramento County	26	2	224	13	185	13	37	2	--	--
Year 2—Canal Pumping Plant	47	2	392	12	362	14	36	3	--	--
Year 2 Total: Sacramento County	247	14	2031	103	1880	109	262	17	--	--
San Joaquin County—Year 2										
Year 2—FSC to Mokelumne Aqueducts Pipeline w/in San Joaquin County (including surge tank)	51	3	448	27	370	25	73	4	--	--
Year 2—Aqueduct Pumping Plant and Pretreatment Facility	51	3	352	19	414	26	44	6	--	--
Year 2 Total: San Joaquin County	102	6	800	46	785	52	118	11	--	--
Sacramento County—Year 3										
Year 3—Intake Facility	47	2	392	16	362	19	36	4	--	--
Year 2—Zone 40 Surface WTP	51	6	352	36	414	52	44	15	--	--
Year 3 Total: Sacramento County	98	8	744	52	777	70	80	19	--	--
Sacramento County—Year 4										
Year 3—Zone 40 Surface WTP	26	3	170	15	225	22	36	6	--	--
Year 4 Total: Sacramento County	26	3	170	15	225	22	36	6	--	--
Sacramento County—Year 5										
Year 4—Zone 40 Surface WTP	15	1	91	4	134	6	33	1	--	--
Year 5 Total: Sacramento County	15	1	91	4	134	6	33	1	--	--
Alternative 6										
Sacramento County—Year 1										
Year 1—Intake Facility	47	2	392	16	362	19	36	4	--	--
Year 1—Intake Facility Onsite Settling Basins	25	0	191	3	191	3	19	0	--	--

	ROG		NO_x		CO		PM10		PM10 Mitigated	
	ppd	tpy	ppd	tpy	ppd	tpy	ppd	tpy	ppd	tpy
Year 1—Intake Facility to Zone 40 Surface WTP/FSC Pipeline	53	4	479	30	378	28	74	4	--	--
Year 1 Total: Sacramento County	125	6	1062	50	931	50	129	8	--	--
Amador/Calaveras Counties—Year 1										
Year 1—Enlarge Pardee Reservoir	N/A	6	N/A	44	N/A	43	N/A	127	N/A	96
Year 1 Total: Amador/Calaveras Counties	N/A	6	N/A	44	N/A	43	N/A	127	N/A	96
Sacramento County—Year 2										
Year 2—Intake Facility	47	2	392	16	362	19	36	4	--	--
Year 2—Intake Facility to Zone 40 Surface WTP/FSC Pipeline	53	4	479	30	378	28	74	4	--	--
Year 1—Zone 40 Surface WTP	51	3	352	21	414	26	44	3	--	--
Year 2 Total: Sacramento County	151	9	1223	68	1155	72	154	11	--	--
Amador/Calaveras Counties—Year 2										
Year 2—Enlarge Pardee Reservoir	N/A	7	N/A	53	N/A	56	N/A	127	N/A	96
Year 2 Total: Amador/Calaveras Counties	N/A	7	N/A	53	N/A	56	N/A	127	N/A	96
Sacramento County—Year 3										
Year 3—Intake Facility	47	2	392	16	362	19	36	4	--	--
Year 2—Zone 40 Surface WTP	51	6	352	36	414	52	44	15	--	--
Year 3 Total: Sacramento County	98	8	744	52	777	70	80	19	--	--
Amador/Calaveras Counties—Year 3										
Year 3—Enlarge Pardee Reservoir	N/A	7	N/A	48	N/A	53	N/A	127	N/A	96
Year 3 Total: Amador/Calaveras Counties	N/A	7	N/A	48	N/A	53	N/A	127	N/A	96
Sacramento County—Year 4										
Year 3—Zone 40 Surface WTP	26	3	170	15	225	22	36	6	--	--
Year 4 Total: Sacramento County	26	3	170	15	225	22	36	6	--	--
Amador/Calaveras Counties—Year 4										
Year 4—Enlarge Pardee Reservoir	N/A	5	N/A	32	N/A	35	N/A	126	N/A	95
Year 4 Total: Amador/Calaveras Counties	N/A	5	N/A	32	N/A	35	N/A	126	N/A	95
Sacramento County—Year 5										
Year 4—Zone 40 Surface WTP	15	1	91	4	134	6	33	1	--	--
Year 5 Total: Sacramento County	15	1	91	4	134	6	33	1	--	--

Notes: PM10 emissions shown for Years 1, 2, 3, and 4 for the enlarge Pardee Reservoir component assume fugitive dust mitigation sufficient to reduce emissions by 50% from uncontrolled levels.

Operation-Related Impacts

Impact 13-3: Long-Term Increase in Emissions in Sacramento and San Joaquin Counties

The sediment hauling, delivery of materials, and employee commuting associated with the operation of the various project components could potentially affect air quality. No other facility operation activities are anticipated to result in air quality impacts. As detailed in Chapter 12, “Traffic and Transportation,” sediment hauling would occur infrequently, and material delivery and commuting would require a minimal number of vehicles. Also, annual excavations and hauling of sediment at the various facilities would adhere to the dust control measures presented in the Environmental Commitments section of Chapter 2.

Alternative 6

As described in Chapter 2, “Project Description,” Alternative 6 consists of enlarging Pardee Reservoir and conveying water from the Sacramento River. Alternative 6 includes the following project components: enlarge Pardee Reservoir (which includes additional components), Freeport intake facility, pipeline from intake facility to the Zone 40 Surface WTP, and the Zone 40 Surface WTP. Though slightly different in size, the Freeport intake facility, pipeline from intake facility to the Zone 40 Surface WTP and the Zone 40 Surface WTP project components are the same as those that make up Alternative 5. Therefore, several of the impacts associated with Alternative 5 (described above) are also associated with Alternative 6 and are restated below. Additionally, impacts associated with the enlarge Pardee Reservoir component of this alternative are described below.

Construction-Related Impacts

Impact 13-4: Short-Term Increase in ROG, CO, and PM10 Emissions in Sacramento County

Table 13-6 summarizes the project components and construction-related emissions that would result from each activity during each year of construction for the project components from the intake facility to the Zone 40 Surface WTP. Construction of the intake facility, pipeline, and the Zone 40 Surface WTP would generate short-term emissions. These emissions would be below the general conformity de minimus thresholds. Therefore, this impact is considered less than significant.

Impact 13-5: Short-Term Increase in ROG, NO_x, and CO Emissions in Amador and Calaveras Counties

Table 13-6 summarizes annual construction emissions that would occur in both Amador and Calaveras Counties for the enlarge-Pardee-Reservoir component of Alternative 6. As shown in this table, construction emissions would be below the general conformity de minimus thresholds for ROG, NO_x, and CO. Therefore, this impact is considered less than significant.

Impact 13-6: Short-Term Blasting at the Existing Pardee Reservoir

The enlarge Pardee Reservoir component of Alternative 6 would require that blasting be conducted intermittently over a two-month period to breach the existing Pardee Dam once construction of the new dam is complete. The frequency of blasting, the size of the blast charge, and the type of explosive to be used are currently unknown. The primary air pollutant emitted during blasting is PM10. Other pollutants, including NO_x and CO, would be released in minor amounts. The impacts from blasting are considered less than significant because blasting is expected to be required fairly infrequently, it would only occur during a two-month time period, and it would occur at a substantial distance from sensitive receptors. In addition, air quality impacts caused by blasting would be much less compared to other construction activities. No mitigation is required.

Operation-Related Impacts

Impact 13-7: Long-Term Increase in Emissions in Sacramento and San Joaquin Counties

The sediment hauling, delivery of materials, and employee commuting associated with the operation of the intake facility and Zone 40 Surface WTP could potentially affect air quality. No other facility operation activities are anticipated to result in air quality impacts. As detailed in Chapter 12, "Traffic and Transportation," sediment hauling would occur infrequently, and material delivery and commuting would require a minimal number of vehicles. Also, annual excavations and hauling of sediment at the various facilities would adhere to the dust control measures presented in the Environmental Commitments section of Chapter 2.

Impact 13-8: Long-Term Increase in Emissions in Amador and Calaveras Counties

As detailed in Chapter 12, "Traffic and Transportation," operation of the enlarge Pardee Reservoir component would require the same number of materials deliveries and personnel as is currently required, and proposed operations of the enlarged reservoir would not change from existing operations. Therefore, operation of the proposed enlarge Pardee Reservoir component is not expected to affect air quality. This impact is considered less than significant. No mitigation is required.

Significant Impacts and Mitigation Measures

Alternatives 2–5

Construction-Related Impacts

Impact 13-6: Short-Term Increase in NO_x and CO Emissions in Sacramento County

As shown in Table 13-6, NO_x emissions would exceed the daily (85 pounds per day) and annual (25 tons per year) significance thresholds in Sacramento County. CO emissions would exceed the annual (100 tons per year) significance threshold in Sacramento County. This is a significant impact. Implementing the following mitigation measure, which includes the purchase of emission offsets for NO_x, would reduce construction-related NO_x and CO emissions, and therefore reduce this impact to a less-than-significant level.

Mitigation Measure 13-1: Include Air Quality Mitigation Measures as Part of the Proposed Project's Construction Management Plan.

The construction contractor shall incorporate measures to address NO_x and CO emissions into the construction management plan for the project. These measures are designed to limit emissions of NO_x and CO as established by the SMAQMD. The plan shall be submitted to SMAQMD and shall include the following measures:

- Require that heavy-duty off-road vehicles to be used in the construction project will achieve a fleet-averaged 20% NO_x reduction and 45% particulate reduction compared to the most recent California Air Resources Board fleet average.
- Submittal of a comprehensive inventory of all off-road construction equipment, equal to or greater than 50 horsepower, as well as the anticipated construction timeline, including start date, and name and phone number of the project manager and on-site foreman.
- Properly maintain all equipment per manufacturers' specifications.
- Require that emissions from all off-road diesel-powered equipment used on the project site not exceed 40% opacity for more than 3 minutes in any one hour. Any equipment found to exceed 40% opacity shall be repaired immediately. A visual survey of all in-operation equipment shall be made at least weekly, and a monthly summary of the visual survey results shall be submitted throughout the duration of the project, except that the monthly summary shall not be required for any 30-day period in which no construction activity occurs. The monthly summary shall include the quantity and type of vehicles surveyed as well as the dates of each survey. Additionally, diesel-powered equipment shall use an alternative fuel acceptable to the local air quality management authority.
- Use equipment powered by electricity where feasible.

- Obtain emission offsets so that the net NO_x emissions from construction activities would be less than the significance thresholds.

Impact 13-7: Short-Term Increase in NO_x Emissions in San Joaquin County

Table 13-6 summarizes the project components and construction-related emissions for San Joaquin County. NO_x emissions would be above the general conformity de minimus threshold of 25 tons per year (tpy). This is a significant impact. Implementing Mitigation Measure 13-1, described above, would reduce construction-related NO_x emissions, and therefore reduce this impact to a less-than-significant level.

Impact 13-8: Short-Term Increase in PM10 Emissions in San Joaquin County

As shown in Table 13-6, construction activities would increase PM10 emissions in San Joaquin County. The SJVUAPCD assumes that all construction projects could have an adverse air quality effect by increasing PM10 emissions and should comply with its Regulation VIII Fugitive PM10 Prohibitions, which includes implementation of all feasible control measures specified in its Guide for Assessing Air Quality Impacts (San Joaquin Valley Unified Air Pollution Control District 2002). The SJVUAPCD has determined that complying with Regulation VIII Fugitive PM10 Prohibitions is sufficient mitigation to minimize adverse air quality effects from construction. Consequently, this air quality analysis assumes that the project applicant would comply with Regulation VIII. It also assumes that this compliance would be sufficient to eliminate any potentially substantial adverse air quality effects generated by construction activities. Regulation VIII control measures are summarized in the following mitigation measure. This impact is considered to be less than significant.

Mitigation Measure 13-2: Regulation VIII Control Measures for Fugitive PM10.

The SJVUAPCD has determined that complying with Regulation VIII Fugitive PM10 Prohibitions is sufficient mitigation to minimize adverse air quality effects from construction. Regulation VIII mitigation measures are described below.

Table 13-7. SJVUAPCD Regulation VIII Control Measures for Construction Emissions of PM10

The following controls are required to be implemented at all construction sites:
All disturbed areas, including storage piles, that are not being actively used for construction purposes, shall be effectively stabilized of dust emissions using water, chemical stabilizer/suppressant, covered with a tarp or other suitable cover or vegetative ground cover.
All on-site unpaved roads and off-site unpaved access roads shall be effectively stabilized of dust emissions using water or chemical stabilizer/suppressant.
All land clearing, grubbing, scraping, excavation, land leveling, grading, cut and fill, and demolition activities shall be effectively controlled of fugitive dust emissions utilizing application of water or by presoaking.
With the demolition of buildings up to six stories in height, all exterior surfaces of the building shall be wetted during demolition.

When materials are transported off-site, all material shall be covered, or effectively wetted to limit visible dust emissions, and at least six inches of freeboard space from the top of the container shall be maintained.

All operations shall limit or expeditiously remove the accumulation of mud or dirt from adjacent public streets at the end of each workday. *(The use of dry rotary brushes is expressly prohibited except where preceded or accompanied by sufficient wetting to limit the visible dust emissions. Use of blower devices is expressly forbidden.)*

Following the addition of materials to, or the removal of materials from, the surface of outdoor storage piles, said piles shall be effectively stabilized of fugitive dust emissions utilizing sufficient water or chemical stabilizer/suppressant.

Within urban areas, trackout shall be immediately removed when it extends 50 or more feet from the site and at the end of each workday.

Any site with 150 or more vehicle trips per day shall prevent carryout and trackout.

Source: San Joaquin Valley Unified Air Pollution Control District 2002.

Operation-Related Impacts

Operation of Alternatives 2–5 are not anticipated to result in any significant air quality impacts.

Alternative 6

Construction-Related Impacts

Impact 13-9: Short-Term Increase in NO_x Emissions in Sacramento County

This impact is similar to the impact described above for Alternatives 2–5. As shown in Table 13-6, NO_x emissions of construction activities associated with the project component from the intake facility to the Zone 40 Surface WTP would exceed the daily (25 pounds per day) and annual (25 tons per year) significance thresholds in Sacramento County. This is a significant impact. Implementing Mitigation Measure 13-1, described above, would reduce construction-related impacts associated with NO_x, and therefore reduce this impact to a less-than-significant level.

Impact 13-10: Short-Term Increase in PM10 Emissions in Amador and Calaveras Counties

Table 13-6 summarizes the PM10 emissions for construction activities associated with the enlarge-Pardee-Reservoir component of Alternative 6 within Amador and Calaveras Counties. As shown in this table, PM10 emissions would exceed the 100 tons per year significance threshold for all four construction years. However, implementing certain measures would reduce PM10 emissions to below threshold levels. Mitigated PM10 emissions are shown on Table 13-6. The following mitigation measure would reduce this impact to a less-than-significant level.

Mitigation Measure 13-3: Implement Dust Control Measures

The following dust control measures should be implemented to minimize the generation of fugitive dust:

- Water all active construction areas daily, or as required to ensure that wind-blown dust does not travel beyond the project's boundaries.
- Cover all on-road trucks hauling soil, sand, and other loose materials or require all trucks to maintain at least 2 feet of freeboard.
- Pave, apply water daily to, or apply (nontoxic) soil stabilizers on, all unpaved access roads, parking areas, and staging areas at construction sites.
- Sweep (with water sweepers) all paved access roads, parking areas, and staging areas at construction sites, as needed.
- Sweep streets (with water sweepers) if soil is visible on adjacent public streets, as needed.
- Hydroseed or apply (nontoxic) soil stabilizers to inactive construction areas (previously graded areas that will be inactive for 30 days or more).
- Enclose, cover, water twice daily, or apply (nontoxic) soil binders to exposed stockpiles (dirt and sand).
- Limit traffic speeds on unpaved roads to 15 mph.
- Install sandbags or other erosion control measures to prevent silt runoff to public roadways.
- Replant vegetation in disturbed areas as quickly as possible.

Operation-Related Impacts

Operation of the various project components of Alternative 6 are not anticipated to result in any significant air quality impacts.

Chapter 14

Noise

Chapter 14

Noise

Affected Environment

Introduction

Background information on environmental acoustics and state and federal noise regulations is provided in Appendix C. The following are brief definitions of acoustical terminology used in this chapter:

- **Sound.** A vibratory disturbance created by a vibrating object, which, when transmitted by pressure waves through a medium such as air, is capable of being detected by a receiving mechanism, such as the human ear or a microphone.
- **Noise.** Sound that is loud, unpleasant, unexpected, or otherwise undesirable.
- **Decibel (dB).** A unitless measure of sound on a logarithmic scale, which indicates the squared ratio of sound pressure amplitude to a reference sound pressure amplitude. The reference pressure is 20 micro-Pascals.
- **A-Weighted Decibel (dBA).** An overall frequency-weighted sound level in decibels that approximates the frequency response of the human ear.
- **Maximum Sound Level (L_{max}).** The maximum sound level measured during the measurement period.
- **Minimum Sound Level (L_{min}).** The minimum sound level measured during the measurement period.
- **Equivalent Sound Level (L_{eq}).** The equivalent steady state sound level, which in a stated period of time would contain the same acoustical energy.
- **Percentile-Exceeded Sound Level (L_{xx}).** The sound level exceeded "x" percent of a specific time period. L_{10} is the sound level exceeded 10 percent of the time.
- **Day-Night Level (L_{dn}).** The energy average of the A-weighted sound levels occurring during a 24-hour period, with 10 dB added to the A-weighted sound levels occurring during the period from 10:00 p.m. to 7:00 a.m.
- **Community Noise Equivalent Level (CNEL).** The energy average of the A-weighted sound levels occurring during a 24-hour period with 5 dB added

to the A-weighted sound levels occurring during the period from 7:00 p.m. to 10:00 p.m. and 10 dB added to the A-weighted sound levels occurring during the period from 10:00 p.m. to 7:00 a.m.

L_{dn} and CNEL values rarely differ by more than 1 dB. As a matter of practice, L_{dn} and CNEL values are considered to be equivalent and are treated as such in this assessment. In general, human sound perception is such that a change in sound level of 3 dB is just noticeable, a change of 5 dB is clearly noticeable, and a change of 10 dB is perceived as doubling or halving the sound level.

Pile Driving

Pile driving would likely be required as part of the intake facility construction. Pile driving creates seismic waves that radiate along the surface of the earth and downward into the earth. These surface waves can be felt as ground vibration. Pile driving can result in effects ranging from annoyance of people to damage of structures. Varying geology and distance will result in different vibration levels containing different frequencies and displacements. In all cases, vibration amplitudes will decrease with increasing distance.

As seismic waves travel outward from pile driving, they excite the particles of rock and soil through which they pass and cause them to oscillate. The actual distance that these particles move is usually only a few ten-thousandths to a few thousandths of an inch. The rate or velocity (in inches per second) at which these particles move is the commonly accepted descriptor of the vibration amplitude, referred to as the peak particle velocity (ppv).

Blasting

Blasting would be required as part of the construction process to breach the existing Pardee Dam and fill the enlarged reservoir (Alternative 6). As explained in the project description, a low-level tunnel would be partially excavated from the downstream face, leaving a plug at the upstream face. Water would then be transferred to the reservoir between the two dams. After the water level has equalized, the crest notch would be completed to finished elevation by blasting the remaining concrete. The submerged plug in the tunnel would also be removed by blasting, using divers to load explosives in predrilled holes. The two primary environmental effects of blasting are airblast and groundborne vibration. The following is a brief discussion of each of these effects.

Airblast

Energy released in an explosion creates an air overpressure (commonly called an airblast) in the form of a propagating wave. If the receiver is close enough to the blast, the overpressure can be felt as the pressure front of the airblast passes. The accompanying booming sound lasts for only a few seconds. The explosive charges used in mining and mass grading are typically wholly contained in the ground, resulting in an airblast with frequency content below about 250 cycles per second, or Hertz (Hz).

Because an airblast lasts for only a few seconds, use of L_{eq} (a measure of sound level averaged over a specified period of time) to describe blast noise is inappropriate. Airblast is properly measured and described as a linear peak air overpressure (i.e., an increase above atmospheric pressure) in pounds per square inch (psi). Modern blast monitoring equipment is also capable of measuring peak overpressure data in terms of unweighted dB. Decibels, as used to describe airblast, should not be confused with or compared to dBA, which are commonly used to describe relatively steady-state noise levels. An airblast with a peak overpressure of 130 dB can be described as being mildly unpleasant, whereas exposure to jet aircraft noise at a level of 130 dBA would be painful and deafening.

Ground Vibration Associated with Blasting

Blasting creates seismic waves that radiate along the surface of the earth and downward into the earth. These surface waves can be felt as ground vibration. Airblast and ground vibration can result in effects ranging from annoyance of people to damage of structures. Varying geology and distance will result in different vibration levels containing different frequencies and displacements. In all cases, vibration amplitudes will decrease with increasing distance.

Human Response to Vibration and Airblast

Human response to ground vibration and airblast is difficult to quantify. Vibration and airblast can be felt or heard well below the levels that produce any damage to structures. The duration of the event has an effect on human response, as does blast frequency. Blast events are relatively short, on the order of several seconds for sequentially delayed blasts. Generally, as blast duration and vibration frequency increase, the potential for adverse human response increases. Studies have shown that a few blasts of longer duration will produce a less adverse human response than short blasts that occur more often.

Table 14-1 summarizes the average human response to vibration and airblast that may be anticipated when a person is at rest in quiet surroundings. If the person is engaged in any type of physical activity, the level required for the responses indicated are increased considerably.

Table 14-1. Average Human Response to Airblast and Ground Vibration from Blasting

Response	Ground Vibration Range ppv (inches per second)	Airblast Range (dB)
Barely to distinctly perceptible	0.02–0.10	50–70
Distinctly perceptible to strongly perceptible	0.10–0.50	70–90
Strongly perceptible to mildly unpleasant	0.50–1.00	90–120
Mildly unpleasant to distinctly unpleasant	1.00–2.00	120–140
Distinctly unpleasant to intolerable	2.00–10.00	140–170

Source: Bender pers. comm.

Freeport Intake Facility to Mokelumne Aqueducts

Noise-Sensitive Land Uses

Noise-sensitive land uses are generally defined as locations where people reside or where the presence of unwanted sound could adversely affect the use of the land. Noise-sensitive land uses typically include residences, hospitals, schools, guest lodging, libraries, and certain types of recreational uses. Land uses within the vicinity that are considered noise-sensitive land uses include assorted residences, residential subdivisions, churches, and schools. Because the pipeline alignments are generally located within streets and roads, a large number of such noise-sensitive land uses are located adjacent to the pipelines and other project components.

Existing Noise Environment

City of Sacramento

Major sources of noise near the alternative pipeline alignments include: traffic noise from major freeways, primary arterials, and major city streets; train noise; and aircraft noise from local airports. Results of a citywide community noise survey are typically in the range of 50–75 dBA L_{dn}. In general, areas containing noise-sensitive land uses are quiet, except those near major roadways, airports, railroad tracks, and industrial areas. For purposes of this analysis, sound levels near project facilities are assumed to be within a range of approximately 45–60 dBA L_{dn}.

Sacramento County

Results of a countywide community noise survey results indicate that typical noise levels in noise-sensitive areas of the county are in the range of 50–60 dBA L_{dn}. In general, the areas of Sacramento County that contain noise-sensitive land uses are relatively quiet except near major roadways, airports, railroad tracks, and industrial areas. For purposes of this analysis, sound levels near project facilities are assumed to be within a range of approximately 40–60 dBA L_{dn}.

San Joaquin County

No generalized noise information is available for areas in San Joaquin County, but the areas near the pipeline alignments are generally rural and typically quiet. For purposes of this analysis, sound levels near project facilities are assumed to be within a range of approximately 40–60 dBA L_{dn}.

Existing Noise Levels at Freeport Intake Facility Site

Continuous monitoring was conducted at the Freeport intake facility site between September 6 and September 9, 2002, using a Larson-Davis Model 700 Type 2 sound level meter. The sound meter was placed near the western boundary of the proposed intake facility site (LD 1132).

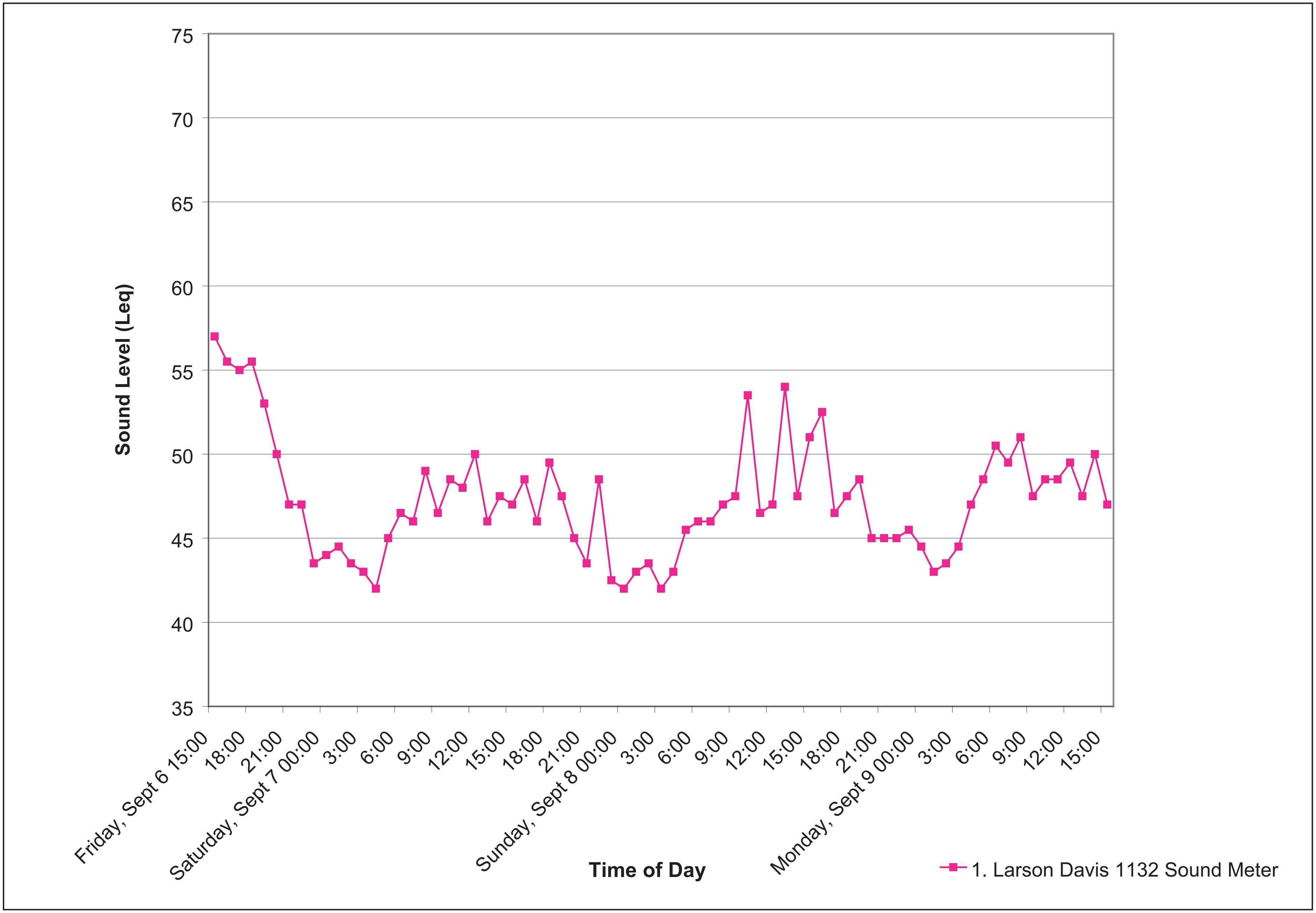
The long-term sound level data were collected over a 4-day period beginning on Friday, September 6, 2002. The purpose of these measurements was to quantify variations in sound level throughout the day, rather than absolute sound levels at a specific receptor of concern. Weather conditions were generally warm and calm. Table 14-2 and Figure 14-1 summarize the results of the long-term monitoring.

Table 14-2. Summary of Long-Term Noise Monitoring (Monitor LD-1132)

Time	1-Hour dB-L_{eq}					Maximum Noise Hour dB-L_{eq} *Minus* Hourly dB-L_{eq}
	Friday (9/6/2002)	Saturday (9/7/2002)	Sunday (9/8/2002)	Monday (9/9/2002)	Average	
12 a.m.	NA[1]	44	42	44.5	44	9
1 a.m.	NA[1]	44.5	43	43	44	9
2 a.m.	NA[1]	43.5	43.5	43.5	44	9
3 a.m.	NA[1]	43	42	44.5	43	9
4 a.m.	NA[1]	42	43	47	44	8
5 a.m.	NA[1]	45	45.5	48.5	46	6
6 a.m.	NA[1]	46.5	46	50.5	48	5
7 a.m.	NA[1]	46	46	49.5	47	5
8 a.m.	NA[1]	49	47	51	49	3
9 a.m.	NA[1]	46.5	47.5	47.5	47	5
10 a.m.	NA[1]	48.5	53.5	48.5	50	2
11 a.m.	NA[1]	48	46.5	48.5	48	5
12 p.m.	NA[1]	50	47	49.5	49	3
1 p.m.	NA[1]	46	54	47.5	49	3
2 p.m.	53.5	47.5	47.5	50	50	3
3 p.m.	57	47	51	47	51	2
4 p.m.	55.5	48.5	52.5	NA[1]	52	0
5 p.m.	55	46	46.5	NA[1]	49	3
6 p.m.	55.5	49.5	47.5	NA[1]	51	1
7 p.m.	53	47.5	48.5	NA[1]	50	3
8 p.m.	50	45	45	NA[1]	47	6
9 p.m.	47	43.5	45	NA[1]	45	7
10 p.m.	47	48.5	45	NA[1]	47	5
11 p.m.	43.5	42.5	45.5	NA[1]	44	8
Average L_{eq}	52	46	47	48	NA[1]	NA[1]

[1] Data not available.

Figure 14-1 indicates that, in the vicinity of the intake facility, there is a typical urban pattern of noise levels, with the lowest noise levels between 2:00 a.m. and 5:00 a.m., and the loudest noise levels in the mid-afternoon. Daytime peaks correspond to morning, lunch, and evening activities, particularly commute traffic on Freeport Boulevard and I-5. Noise levels drop off during the evening



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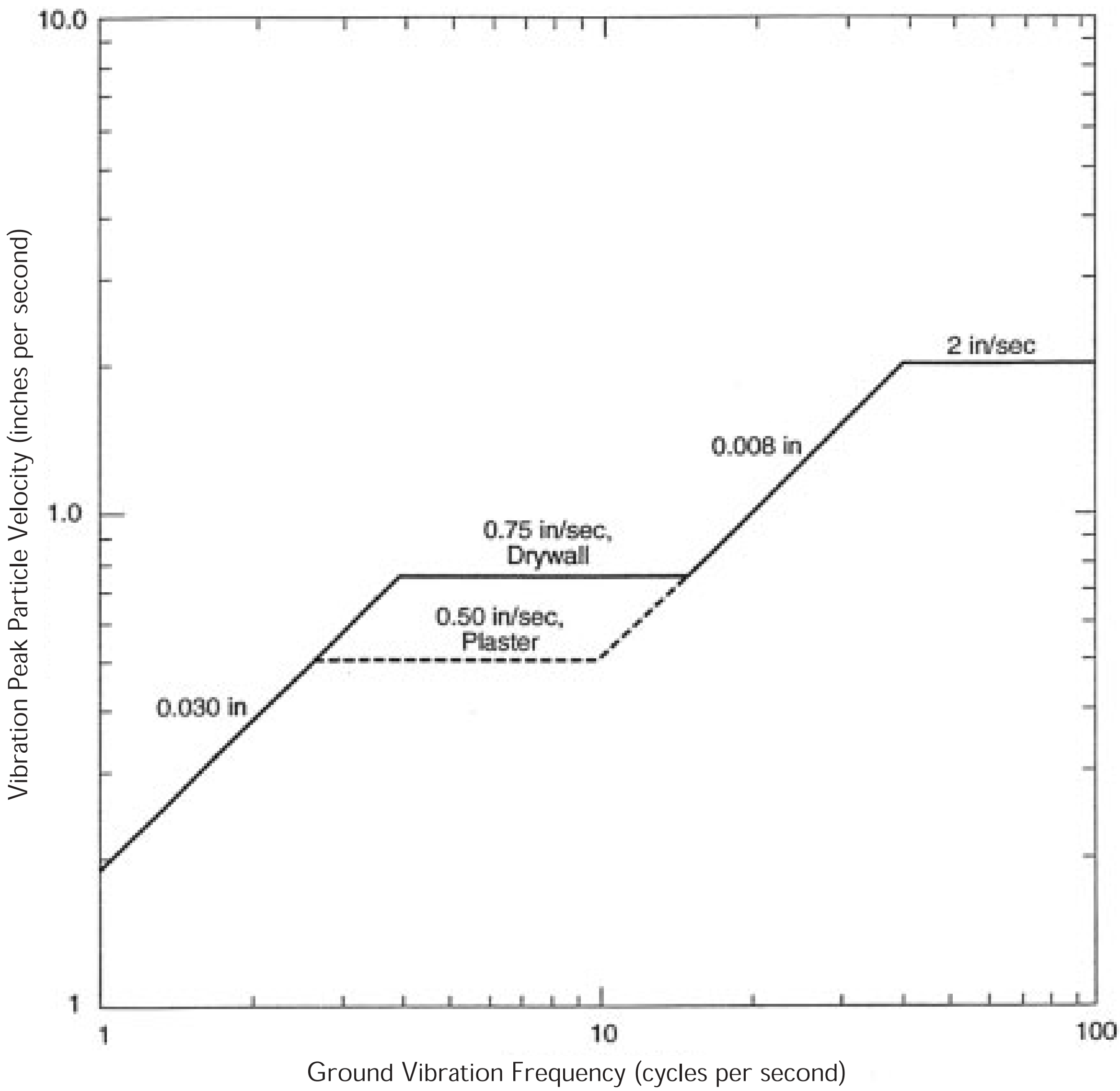
Jones & Stokes

Figure 14-1
Summary of 24 Hour Monitoring at the Freeport Intake Facility Site



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Source: U.S. Bureau of Mines 1980b.

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Figure 14-2
USBM Vibration Criteria

and nighttime hours. Table 14-2 summarizes the average hourly L_{eq} sound levels measured in each hour of the day over the long-term monitoring period. The differences between the sound levels measured during each hour and the maximum noise hour sound levels are also shown. These values are provided for general reference and can be used to estimate worst-noise hour noise levels from measurements not taken during the worst-noise hour and to estimate L_{dn} values from calculated worst-hour noise levels.

Enlarge Pardee Reservoir

Noise-Sensitive Land Uses

Noise-sensitive land uses are generally defined as locations where people reside or where the presence of unwanted sound could adversely affect the use of the land. Noise-sensitive land uses typically include residences, hospitals, schools, guest lodging, libraries, and certain types of recreational uses.

Near Pardee Reservoir, noise-sensitive land uses include:

- the Mokelumne River Lodge, located at Mokelumne River Bridge on SR 49;
- whitewater rafters and kayakers using the Mokelumne River between the SR 49 bridge and the Middle Bar Bridge;
- hikers on the Coast-to-Crest Trail (Narrow Gauge and Fire Road Trials); and
- recreation activities associated with the Pardee Recreation Area.

Recreation activities associated with the Pardee Recreation Area include swimming, fishing, boating, picnicking, camping, and long- and short-term RV use. In addition, the Pardee Recreation Area employee housing facilities located at the recreation area are occupied year round.

Pardee Center, located south of Pardee Dam and the South Spillway, also include offices, operation and maintenance facilities, and residences for EBMUD staff.

Existing Noise Environment

The existing noise environment in the Pardee Reservoir project area is governed primarily by recreation activities on Pardee Reservoir (boating), traffic on SR 49, Middle Bar Road/Gwin Mine Road, Paloma Road, Pardee Dam Road, Stony Creek Road, and other local roadways in the area, and occasional aircraft overflights. The powerhouse located at the existing dam facilities does not contribute to the existing noise environment because of shielding provided by the canyon walls and because the powerhouse facilities are enclosed in a building.

Existing Noise Levels near Pardee Reservoir

Noise monitoring was conducted in the Pardee Reservoir area on November 13, 2002, using a Larson Davis SLM Model 812 sound level meter. Noise monitoring was conducted at two locations:

- Stony Creek Road near the existing Pardee Recreation Area employee housing, and
- Pardee Center housing facilities between McLean Hall Lodge and Pardee House.

Table 14-3 summarizes noise monitoring results.

Table 14-3. Summary of Noise Monitoring at Pardee Reservoir

Position	Date	Start Time	Duration (minutes)	Sound Level (dBA-L_{eq})	L_{max} (dBA)	L_{10} (dBA)	L_{90} (dBA)	Sources
1	11/13/2002	10:56 a.m.	5:00	36.5	54.4	38.0	31.9	Birds overhead, gunshot blast
2	11/13/2002	12:18 p.m.	10:00	40.5	54.8	44.0	33.9	Birds overhead, heavy machinery

Regulatory Setting

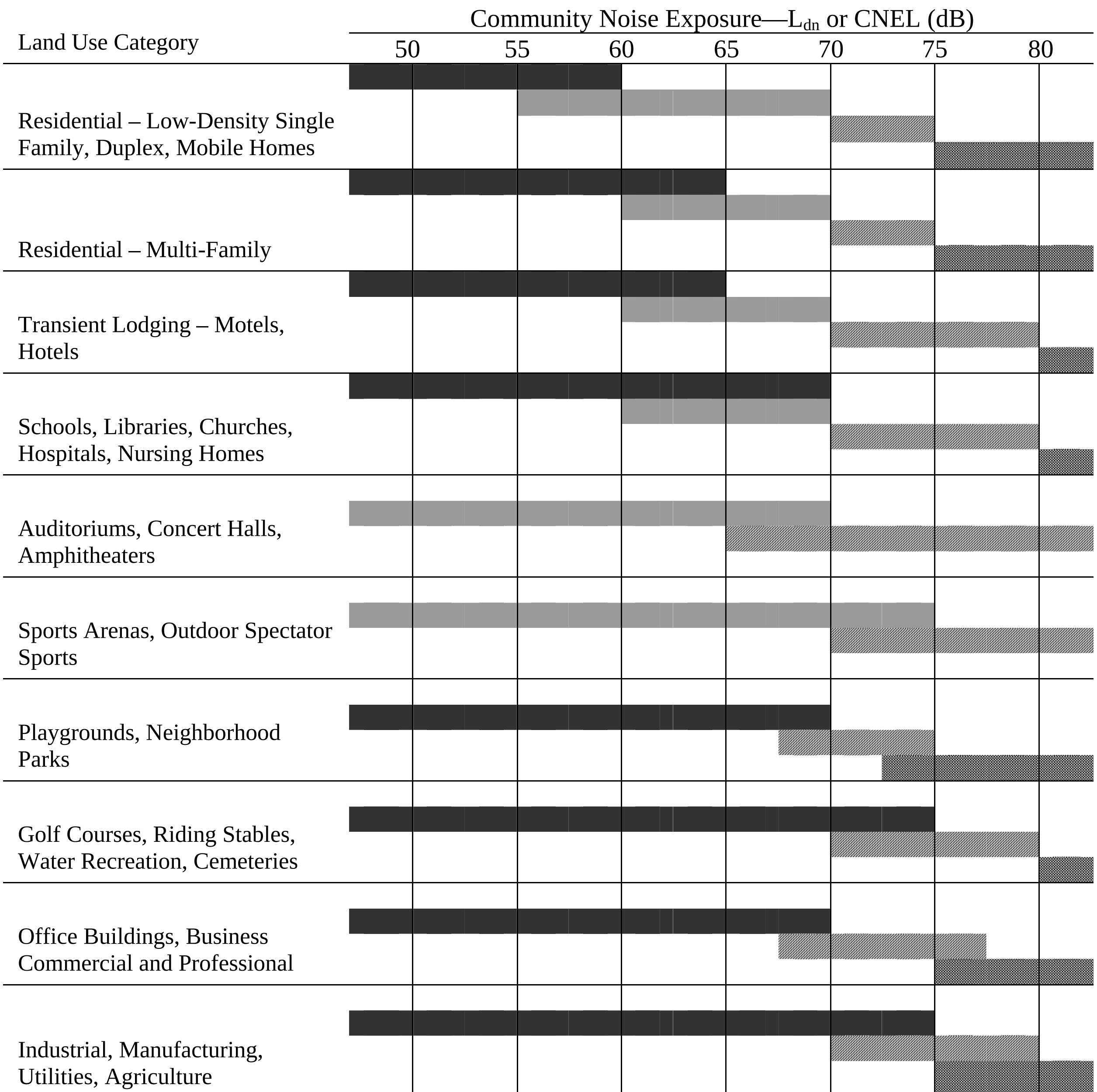
Federal

Reclamation does not have any noise standards. No other federal noise standards would apply to this project.

State

California requires each local government entity to implement a noise element as part of its general plan. *Guidelines for the Preparation and Content of the Noise Element of the General Plan*, published by California Governors Office of Planning and Research, has guidelines for the compatibility of various land uses as a function of community noise exposure. These land use compatibility guidelines are listed in Table 14-4.

Table 14-4. State Land Use Compatibility Standards for Community Noise Environment



Normally Acceptable Specified land use is satisfactory, based upon the assumption that any buildings involved are of normal conventional construction, without any special noise insulation requirements.

Conditionally Acceptable New construction or development should be undertaken only after a detailed analysis of the noise reduction requirements is made and needed noise insulation features are included in the design. Conventional construction, but with closed windows and fresh air supply systems or air conditioning will normally suffice.

Land Use Category		Community Noise Exposure—L_{dn} or CNEL (dB) 50 55 60 65 70 75 80
	Normally Unacceptable	New construction or development should generally be discouraged. If new construction or development does proceed, a detailed analysis of the noise reduction requirements must be made and needed noise insulation features included in the design.
	Clearly Unacceptable	New construction or development generally should not be undertaken.

The Office of Noise Control (ONC) of the California Department of Health published a model noise ordinance in 1977. This model ordinance provides recommended limits on noise generated by various types of noise sources. Because many local ordinances do not specify limits on construction noise, the construction noise limits specified in the model ordinance are provided in Table 14-5 as a point of reference.

Table 14-5. Office of Noise Control Construction Noise Limits

	Single Family Residential		Multi-Family Residential		Semi-Residential/ Commercial	
Time of Day	Duration <10 days	Duration ≥10 days	Duration <10 days	Duration ≥ 10 days	Duration <10 days	Duration ≥10 days
Daily, except Sundays and legal holidays, 7 a.m. to 7 p.m.	75 dBA	60 dBA	80 dBA	65 dBA	85 dBA	70 dBA
Daily, 7 p.m. to 7 a.m. and all day Sunday and legal holidays	60 dBA	50 dBA	65 dBA	5 dBA	70 dBA	60 dBA

Local

The project components are located within the City of Sacramento, and the counties of Sacramento, San Joaquin, Amador, and Calaveras. The jurisdictions have established policies and regulations concerning the generation and control of noise that could adversely affect their citizens and noise-sensitive land uses. General plans are required by state law and serve as the jurisdiction's blueprint for land use and development. The general plans are comprehensive, long-term documents that provide details for the physical development of the jurisdiction, set out policies, and identify ways to put the policies into action. General plans also provide an overall framework for development in the jurisdiction and protection of its natural and cultural resources. The noise elements of general plans contain planning guidelines relating to noise. The noise element identifies goals and policies to support achievement of those goals. The goals and policies contained in general plans are applicable throughout the jurisdiction. The following is a brief discussion of general plan policies and noise ordinance regulations implemented by each jurisdiction to protect its citizens from adverse noises.

City of Sacramento General Plan Noise Element

The City of Sacramento General Plan Noise Element establishes 60 dBA Ldn as the maximum acceptable exterior noise level for schools and single- and multi-family residential areas.

City of Sacramento Noise Ordinance

The City of Sacramento's noise ordinance states that exterior noise limits shall not exceed 50 dBA between 10:00 p.m. and 7:00 a.m. and 55 dBA between 7:00 a.m. and 10:00 p.m. for residential and agricultural areas. The City of Sacramento's noise ordinance exempts construction activities from the ordinance, provided they occur between the hours of 7:00 a.m. and 6:00 p.m., Monday through Saturday, and between 9:00 a.m. and 6:00 p.m. on Sundays. The ordinance further states that internal combustion engines in use on construction sites must be equipped with "suitable exhaust and intake silencers which are in good working order." Agricultural operations that occur between the hours of 6:00 a.m. and 8:00 p.m. are also exempted from the ordinance, provided internal combustion engines are equipped with suitable exhaust and intake silencers which are in good working order.

County of Sacramento General Plan Noise Element

The Sacramento County General Plan Noise Element states that noise created by new non-transportation noise sources may not exceed the noise level standards shown in Table 14-6, as measured immediately within the property line of any affected residentially designated land.

Table 14-6. Noise Level Performance Standards[a] for Residential Areas Affected by Non-Transportation Noise[b]

Statistical Noise Level Descriptor	Exterior Noise Level Standards (dBA) Daytime (7:00 a.m. to 10:00 p.m.)	Exterior Noise Level Standards (dBA) Nighttime (10:00 p.m. to 7:00 a.m.)
L_{50}	50	45
L_{max}	70	65

[a] These standards are for planning purposes and may vary from standards of the County Noise Ordinance, which are for enforcement purposes.

[b] These standards apply to new or existing residential areas affected by new or existing non-transportation sources.

County of Sacramento Noise Ordinance

The Sacramento County Noise Ordinance states that exterior noise limits shall not exceed 50 dBA between 10:00 p.m. and 7:00 a.m. and 55 dBA between 7:00 a.m. and 10:00 p.m. for residential and agricultural areas. However, construction activities between 6:00 a.m. and 8:00 p.m., Monday through Friday, and 7:00 a.m. and 8:00 p.m. on weekends are exempt from this ordinance. Agricultural operations that occur between 6:00 a.m. and 8:00 p.m. are also exempted from the ordinance.

County of San Joaquin General Plan Noise Element

The noise element of the San Joaquin County General Plan states that 65 dB L_{dn} or less is considered acceptable for residential development and that development shall be planned and designed to minimize noise interference from outside noise sources. For schools, group care facilities, and hospitals, 60 dB L_{dn} or less is considered acceptable.

San Joaquin County Code

Chapter 9-1025.9 of the San Joaquin County Development Title is the county's regulation relating to noise. The section on stationary sources states that proposed projects that will create new stationary noise sources or expand existing stationary noise sources shall be required to mitigate the noise level from these stationary sources so as not to exceed the noise level standards specified in Table 14-7.

Table 14-7. County of San Joaquin Development Title Maximum Allowable Noise Exposure from Stationary Sources

	Outdoor Activity Areas[1]	
Noise Level Descriptor	Daytime[2] (7 a.m.–10 p.m.)	Nighttime[2] (10 p.m.–7 a.m.)
Hourly L_{eq}	50 dBA	45 dBA
Maximum level (L_{max})	70 dBA	65 dBA

[1] Where the location of outdoor activity areas is unknown or is not applicable, the noise standard shall be applied at the property line of the receiving land use. When determining the effectiveness of noise mitigation measures, the standards shall be applied on the receiving side of noise barriers or other property line noise mitigation measures.

[2] Each of the noise level standards specified shall be reduced by 5 dB for impulsive noise, single-tone noise, or noise consisting primarily of speech or music.

Construction activities that occur between 6:00 a.m. and 9:00 p.m., Sunday through Saturday, are exempted from the provisions of the county's Development Title, as are noises resulting from the maintenance or modification of private or pubic utility facilities.

County of Amador General Plan Noise Element

The noise element specifies that the maximum allowable noise exposure levels noise-sensitive land uses may be exposed to from non-transportation noise sources are 65 dBA L_{dn} for exterior noise levels (as measured at their property line), and 45 dBA L_{dn} for interior noise levels. Noise levels that exceed these thresholds shall be mitigated to levels below these thresholds. Where noise-sensitive land uses are proposed near existing noise sources, exterior noise levels may not exceed 55 dBA L_{dn} for exterior noise levels (as measured at their property line) or 45 dBA L_{dn} for interior noise levels.

The county's noise element also establishes additional noise standards for noise-generating projects. Table 14-8 summarizes the county's maximum allowable changes in ambient noise levels, while Table 14-9 summarizes temporal limits to noise generation levels, as applied to the county's exterior noise standard of 65 L_{dn} (as measured at their property line) and interior noise standard of 45 L_{dn}. Table 14-10 summarizes the county's maximum allowable intermittent impulse noise levels. The county noise standards indicated in Tables 14-8 through 14-10 apply to the property line of any noise-generating project.

Table 14-8. County of Amador Maximum Allowable Changes in Ambient Noise Levels

Existing Ambient Noise Level	Allowed Increase in Ambient Noise
55 dBA L_{dn}	3 dBA
60 dBA L_{dn}	2 dBA
65 dBA L_{dn}	1 dBA

Table 14-9. County of Amador Maximum Allowable Noise Levels

Duration of Noise Generation	Allowable addition to County Standards[1]
Cumulative period of more than 30 minutes in any hour	+ 0
Cumulative period of more than 15 minutes in any hour	+ 5
Cumulative period of more than 5 minutes in any hour	+ 10
Cumulative period of more than 1 minute in any hour	+ 15
Level that may not be exceed any time per hour[2]	+ 20

Notes:

[1] Exterior standard is 65 dBA L_{dn} and interior standard is 45 dBA L_{dn}.

[2] Noise level may be exceeded for impulse and intermittent noise levels. See Table 14-8.

Table 14-10. County of Amador Maximum Allowable Intermittent Impulse Noise Levels

Impulse Duration	25 μ seconds or Less	1 Second	1 Second	1 Second
Number of Impulses per Day	1	1	10	100
Maximum Noise Level	167 dBA	145 dBA	135 dBA	125 dBA-85

The county's noise element also establishes blasting-noise and vibration limits. Noise from blasting shall not exceed the standards recommended in the U.S. Bureau of Mines' (USBM's) publication RI8485, *Structure Response and Damage Produced by Airblast from Surface Mining*, while vibration from blasting shall not exceed the standards recommended in the USBM's publication RI8508, *Airblast Instrumentation and Measurement Techniques for Surface Mine Blasting*. However, the noise element states that if the USBM revises these publications or updates them with new publications, any new standards or criteria shall automatically become effective in the county's noise element without further action by the county.

Amador County Code

Amador County has no noise ordinance (Grijalva pers. comm.).

County of Calaveras General Plan Policies

Table 14-11 summarizes the county's maximum allowable noise exposure levels for noise-sensitive land uses, as measured at their property line.

Table 14-11. County of Calaveras General Plan Maximum Allowable Noise Levels

Noise-Sensitive Land Use	Maximum Allowable Noise Level
Single Family Residential	60 dBA Ldn
Multifamily Residential	65 dBA Ldn
Schools, Hospitals	70 dBA Ldn

Calaveras County Code

The Calaveras County Code states that various land use types must meet the average and maximum noise standards established in the county's general plan noise element (see Table 14-11).

Environmental Consequences

Methods and Assumptions

The assessment of potential noise impacts was conducted using methodology developed by the Federal Transit Administration (FTA) (Federal Transit Administration 1995) and standard acoustical modeling methods. Specific assumptions used are discussed under each impact.

Significance Criteria

The criteria used for determining the significance of a noise impact are based on Appendix G of the State CEQA Guidelines (Environmental Checklist) and professional standards and practices. Impacts on noise may be considered significant if implementation of an alternative would:

- expose persons to or generate noise levels in excess of standards established in a local general plan or noise ordinance or applicable standards of other agencies,

- expose persons to or generate excessive groundborne vibration or groundborne noise levels,
- result in a substantial permanent increase in ambient noise levels in the project vicinity above levels existing without the project, or
- result in a substantial temporary or periodic increase in ambient noise levels in the project vicinity above levels existing without the project.

These guidelines, along with local noise standards, were used to develop the following specific significance thresholds for noise impacts.

Freeport Intake Facility to Mokelumne Aqueducts

Construction Noise Significance Criteria

The City of Sacramento and the counties of San Joaquin and Sacramento exempt construction activities from compliance with noise standards during specified daytime hours. Although each jurisdiction has adopted slightly different standards, they are generally consistent with normal working hours. Accordingly, construction noise impact thresholds have been based on those specified on the ONC model noise ordinance.

Construction activity is considered to have a significant noise impact if it is expected to result in noise levels that exceed the limits specified in Table 14-5 or exceed the existing noise level by more than 5 dB at sensitive receptor locations.

Ground Vibration Significance Criteria

There are no commonly accepted thresholds for acceptable levels of ground vibration from pile driving. However, the U.S. Department of Transportation suggests a vibration damage threshold of 0.20 inches/second (in/sec) for fragile buildings and 0.12 in/sec for extremely fragile historic buildings (Federal Transit Administration 1995). The Transportation Research Board suggests maximum allowable peak particle velocities from pile driving for various structure types and conditions (Transportation Research Board 1997). Table 14-12 summarizes these values.

For the purposes of this assessment, pile driving will be considered to result in an adverse ground vibration impact if fragile or historic building structures would be exposed to ground vibration in excess of 0.20 inches per second, or if other building structures would be exposed to ground vibration in excess of 0.5 inches per second.

Table 14-12. Transportation Research Board Building Structure Vibration Criteria

Structure and Condition	Limiting ppv (in/sec)
Historic and some old buildings	0.5
Residential structures	0.5
New residential structures	1.0
Industrial buildings	2.0
Bridges	2.0

Operational-Noise Significance Criteria

Operation of facilities is considered to result in a significant noise impact if operations are expected to result in noise that exceeds the existing or presumed ambient sound level by more than 5 dB at sensitive receptor locations.

Enlarge Pardee Reservoir

Construction Noise Significance Criteria

Amador and Calaveras Counties do not have specific noise standards related to construction activity. Therefore, construction noise impact thresholds have been based on those specified on the ONC model noise ordinance.

Construction activity is considered to have a significant noise impact if it is expected to result in noise levels that exceed the limits specified in Table 14-5 or exceed the existing noise level by more than 5 dB at sensitive receptor locations.

Blasting Significance Criteria

Blasting would be required as part of the construction process to breach the existing Pardee Dam. The two primary environmental effects of blasting are airblast and groundborne vibration. The following is a brief discussion of standards used to assess the impacts of blasting.

Airblast Criteria

Conventional noise criteria (for steady-state noise sources) and limits established for repetitive impulsive noise (such as for gun-firing ranges) do not apply to air overpressures from blasting. USBM Report of Investigations 8485 and the regulations issued more recently by the U.S. Office of Surface Mining and Reclamation Enforcement specify a maximum safe overpressure of 0.013 psi (133 dB) for impulsive airblast when recording is accomplished with equipment having a frequency range of response of at least 2–200 Hz.

Ground Vibration Criteria

As discussed above, the Amador County Code uses standards recommended in USBM Report of Investigations 8508 to assess the significance of vibration from blasting. A review of USBM RI8508 was conducted and did not indicate any recommended thresholds of significance from blasting. However, USBM Report of Investigations 8507 contains blasting-level criteria that can be appropriately applied to keep ground vibration well below levels that might cause damage to neighboring structures. At low-vibration frequencies, velocities of ground vibration are restricted to low levels. As vibration frequency increases, higher velocities are allowed up to a maximum of 2.00 inches per second. Figure 14-2 depicts blasting-level criteria as a function of frequency.

Blasting activity is considered to result in a significant noise impact if it is expected to result in:

- airblast that exceeds 133 dB at noise sensitive land uses, or
- ground vibration that exceeds limits specified in Figure 14-2.

Operational-Noise Significance Criteria

Operation of dam facilities is considered to have a significant noise impact if operations are expected to result in noise that exceeds the acceptable noise standards of the relevant jurisdictions or existing or presumed ambient sound level by more than 5 dB at sensitive receptor locations.

Less-than-Significant Impacts

Alternative 1

Alternative 1 would not result in any construction-related or operation-related noise impacts associated with construction of FRWP facilities.

Alternatives 2–5

Alternatives 2 through 5 differ only in the pipeline alignments from the Freeport intake facility to the FSC. Project construction and operation for Alternatives 2 through 5 are very similar. Impacts related to noise for each alternative differ only slightly from each other; therefore, the results for Alternatives 2 through 5 are presented together but are representative of each individual alternative, unless otherwise noted.

Construction-Related Impacts

Impact 14-1: Exposure of Existing Structures to Vibration from Pile Driving Activities

Pile driving would be required at the intake facility site. Table 14-13 presents vibration source levels generated from typical impact pile driver activity. The table was based on FTA methodology (Federal Transit Administration 1995) and was used in this analysis to estimate vibration from construction activities.

Table 14-13. Vibration Source Levels from Typical Impact Pile Driving Activities

Distance to Receptor (feet)	Vibration Level at Receptor ppv (in/sec)
50	0.228
100	0.081
150	0.044
200	0.028
250	0.020
300	0.015
500	0.007
750	0.004
1,000	0.003

Table 14-13 presents estimated vibration source levels associated with typical impact pile driving activities at 50-foot intervals. Further calculations indicate that ground vibration in excess of the 0.20 inch per second threshold could occur within a distance of 55 feet from active pile driving activities, while ground vibration in excess of the 0.5 inch per second threshold could occur within a distance of about 20 feet from active pile driving activities. There are no fragile or historic building structures located within 55 feet, or other buildings located within 20 feet of active pile driving activities that could be exposed to excessive vibration levels. This impact is therefore less than significant. No mitigation is required.

Operation-Related Impacts

There are no less-than-significant operation-related noise impacts associated with Alternatives 2 through 5.

Alternative 6

As described in Chapter 2, “Project Description,” Alternative 6 consists of enlarging Pardee Reservoir and conveying water from the Sacramento River. Alternative 6 includes the following project components: enlarge Pardee Reservoir (which includes additional components), Freeport intake facility, pipeline from intake facility to the Zone 40 Surface WTP, and the Zone 40 Surface WTP. Though slightly different in size, the Freeport intake facility, pipeline from intake facility to the Zone 40 Surface WTP and the Zone 40 Surface WTP project components are the same as those that make up Alternative 5. Therefore, several of the impacts associated with Alternative 5 (described above) are also associated with Alternative 6 and are restated below. Additionally, impacts associated with the enlarge Pardee Reservoir component of this alternative are described below.

Construction-Related Impacts

Impact 14-2: Exposure of Existing Structures to Vibration from Pile Driving Activities

As described above, pile driving will be required at the intake facility site. Table 14-13 presents vibration source levels generated from typical impact pile driver activity. There are no fragile or historic building structures located within 55 feet, or other buildings located within 20 feet of active pile driving activities that could be exposed to excessive vibration levels. This impact is therefore less than significant. No mitigation is required.

Impact 14-3: Exposure of Existing Structures and Noise-Sensitive Uses to Noise and Vibration from Blasting Activities at Enlarged Pardee Reservoir

As discussed in Chapter 2, once construction of the new Pardee Dam is complete, a low-level tunnel would be partially excavated from the downstream face of the existing dam, leaving a plug at the upstream face. Water would then be transferred to the reservoir between the two dams. After the water level has equalized, the crest notch would be completed to finished elevation by blasting the remaining concrete. The submerged plug in the tunnel would also be removed by blasting, using divers to load explosives in predrilled holes.

The need for blasting would depend on site-specific conditions and engineering considerations that are not known at this time. Accordingly, specific information on the location, type, or extent of blasting is not available. Noise and vibration generated by blasting is a complex function of the charge size, charge depth, hole size, degree of confinement, initiation methods, spatial distribution of charges, and other factors. To provide a general indication of the potential for airblast and vibration impacts from blasting, data developed from the blasting assessment for a mining project in northern California is presented in Table 14-14 (Jones & Stokes 1999). Specifically, Table 14-14 presents estimated airblast and ground-vibration values as a function of distance, based on a 293-pound charge under average normal confinement. It is anticipated that blasting charges associated with the enlarge Pardee Reservoir component would be substantially less than 293 pounds.

Table 14-14. Estimated Airblast and Ground-Vibration Levels for a 293-Pound Charge

Distance (feet)	ppv under Average Normal Confinement (in/sec)	Probable Peak Air Overpressure (dB)
250	1.4	130
500	0.46	123
750	0.24	119
1,000	0.15	116
1,250	0.11	114
1,500	0.08	112
1,850	0.057	110
2,000	**0.05**	**109**
2,250	0.042	108
3,450	0.021	103
4,400	0.014	101
5,150	0.011	99
6,200	0.008	97
7,200	0.006	96

The results in Table 14-14 indicate that a 293-pound charge could exceed the ground vibration thresholds indicated in Figure 14-2 (between 0.5 in/sec and 2.0 in/sec) within a distance of between 200 and 500 feet of a blast. In addition, the same charge size could exceed the airblast threshold (130 dB) within about 250 feet of a blast. Pardee Center is the nearest noise-sensitive land use in the vicinity of where blasting would occur, which is in excess of 2,000 feet from the existing Pardee Dam. Table 14-14 indicates that for a 293-pound charge, airblast and ground vibration levels would be below threshold levels at a distance of 2,000 feet. Because the proposed project is anticipated to use blasting charges substantially smaller than a 293-pounds, airblast and ground vibration levels are anticipated to be substantially smaller than those indicated in Table 14-14. Consequently, noise and vibration impacts associated with blasting would be less than significant. No mitigation is required.

Operation-Related Impacts

Impact 14-4: Exposure of Noise-Sensitive Land Uses to Operation of Power-Generating Facilities

Operation of the power-generating facilities and other dam operations associated with the enlarge Pardee Reservoir component of this alternative are not anticipated to result in operational-noise impacts. Noise-generating equipment associated with operation of the dam includes power-generating equipment located at the powerhouse facilities. These facilities would be located within the Mokelumne River canyon, and would be more than 4,200 feet downstream from the nearest noise-sensitive land use (Pardee Center). In addition, the building structure that would enclose the hydroelectric generators and turbines is anticipated to provide sufficient noise attenuation and shielding to minimize noise exposure of nearby noise-sensitive land uses to operational noise.

Sufficient shielding provided by the canyon walls and powerhouse building structure, as well as the distance between the powerhouse facilities and the nearest noise-sensitive land uses (in excess of 4,200 feet), would attenuate noise generated by the powerhouse equipment to less-than-significant levels. Consequently, this impact is considered to be less than significant. No mitigation is required.

Significant Impacts and Mitigation Measures

Alternatives 2–5

Construction-Related Impacts

Impact 14-5: Short-Term Increases in Construction Noise Levels during Daytime Hours

Construction of project features under these alternatives would result in short-term increases in noise levels along the adopted pipeline alignment and at project facility locations. Construction activities at most locations would persist for no more than several days to a few weeks; however, substantially longer construction periods are expected at major facility locations.

Potential noise impacts resulting from construction of facilities were evaluated by estimating the amount of noise generated on a theoretical worst-case period of construction activity. This estimate is based on equipment that would be used during construction activities. A detailed inventory of heavy construction equipment that would be used for the project alternative was provided by the project engineers and used in the estimation of general construction noise. Table 14-15 summarizes anticipated equipment required for construction of each component of the project alternative.

Further, Table 14-15 presents a list of noise generation levels for various types of equipment typically used on various construction projects. The list, compiled by

Table 14-15. Construction Equipment Inventory and Noise Emission Levels: Freeport Intake Facility to Mokelumne Aqueducts

		Project Component						
Construction and Equipment [1]	Typical Noise Level (dBA) 50 ft from Source [2]	Intake Facility	Freeport Intake Facility to Zone 40 Surface WTP/FSC Pipeline	Zone 40 Surface WTP	Terminal Facility	FSC to Mokelumne Aqueducts Pipeline	Canal Pumping Plant	Aqueduct Pumping Plant and Pretreatment Facility
Backhoe	80	X	X	X	X	X	X	X
Compactor	82	X	X	X	X			X
Concrete Mixer	85					X	X	
Concrete Pump	82			X	X	X	X	X
Crane, Derrick	88					X	X	
Crane, Mobile	83	X	X	X	X	X	X	X
Dozer	85	X	X	X	X	X	X	X
Generator	81	X	X	X	X	X	X	X
Grader	85		X	X	X	X	X	X
Loader	85	X	X	X		X	X	X
Paver	89	X	X					
Pile Driver (Impact)	101	X						
Pile Driver (Sonic)	96	X	X		X			
Rail Saw	90		X					
Roller/Sheep's Foot	74	X	X					
Scraper	89			X				X
Truck	88	X	X	X	X	X	X	X
Tunneling/Boring Machine	88 [3]		X					

Sources:

[1] CH2M HILL pers. comm.
[2] Federal Transit Administration 1995.
[3] Jones and Stokes reference material of 300 hp bore machine and 450 hp drilling fluid system.

the FTA (1995), was used in this analysis to estimate construction noise. The magnitude of construction noise impacts was assumed to depend on the type of construction activity, the noise level generated by various pieces of construction equipment, the duration of the activity, and the distance between the activity and noise-sensitive receivers. Shielding effects that might result from local barriers, including topography, are not specifically addressed.

A reasonable worst-case assumption is that the three loudest pieces of equipment would operate simultaneously and continuously over at least a 1-hour period for a combined source noise level. Based on the noise levels summarized in Table 14-15, Tables 14-16 through 14-19 have been developed to calculate estimated sound levels from construction activities as a function of distance based on anticipated activity at each primary construction site.

Freeport Intake Facility

Table 14-16 calculates anticipated noise levels for construction of the intake facility as a function of distance. In the vicinity of simultaneous operation of an impact pile driver[1], truck, and paver, a combined source level of 101 dBA at 50 feet is assumed. Point-source attenuation of 6 dB per doubling of distance, as well as molecular absorption of 0.7 dB per 1,000 feet and anomalous excess attenuation of 1 dB per 1,000 feet, is also assumed (Hoover 1996).

[1] It was anticipated that impact and vibratory pile driving would not occur concurrently. Therefore, only the loudest pile driving (impact) is used in the assessment.

Table 14-16. Estimated Construction Noise in the Vicinity of the Freeport Intake Facility Construction Site

Distance Attenuation	
Distance to Receptor (feet)	Sound Level at Receptor (dBA)
50	101
100	95
225	88
400	82
600	78
800	76
1,000	73
1,500	69
2,000	67
2,500	63
3,000	60
4,000	56
5,280	52
7,500	45

The following assumptions were used:

Basic sound level drop-off rate:	6.0 dB per doubling of distance
Molecular absorption coefficient:	0.7 dB per 1,000 feet
Anomalous excess attenuation:	1.0 dB per 1,000 feet
Reference sound level:	101 dBA
Distance for reference sound level:	50 Feet

Notes: This calculation does not include the effects, if any, of local shielding, which may reduce sound levels further.

Estimates are based on calculations for an impact pile driver, truck, and paver.

Although these anticipated noise levels would be temporary if they were to occur, the noise levels would exceed local noise regulation standards and would be substantially higher than existing noise levels. Nearby residences and other noise-sensitive land uses within approximately 3,000 feet could be temporarily exposed to noise levels that exceed local noise regulations. Noise impacts associated construction at the intake facility site would be significant. There are no mitigation measures available to reduce this impact to less-than-significant levels. Therefore, this impact is significant and unavoidable. However, implementation of Mitigation Measure 14-1 could minimize these potential impacts.

Mitigation Measure 14-1: Provide Public Notice of Proposed Activities and Provide Noise Shielding to the Extent Feasible

Prior to construction, adequate notice should be provided to all potentially affected residences. The construction contractor will designate a noise disturbance coordinator who will be responsible for responding to complaints regarding construction noise. The coordinator will determine the cause of the complaint and will ensure that reasonable measures are implemented to correct the problem. A contact telephone number for the noise disturbance coordinator will be conspicuously posted on construction site fences and will be included in the written notification of the construction schedule sent to nearby residents. Such notices should be provided to all residences within 4,000 feet of construction areas at least 2 weeks before construction activities begin. In addition, noise shielding should be provided to the extent feasible and practicable. Such shielding may include, but is not limited to, features such as movable noise barriers, noise-reducing “blankets,” hay bale shield walls, and similar features. Full consideration should be given to noise-reducing construction methods. A noise specialist shall be consulted to assist in identifying feasible methods of noise reduction.

Freeport Intake Facility to Zone 40 Surface Water Treatment Plant/Folsom South Canal Pipeline

Table 14-17 calculates anticipated noise levels for construction of the pipeline from the intake facility to the Zone 40 Surface WTP/FSC as a function of distance. A reasonable worst-case assumption is that the three loudest pieces of equipment would operate simultaneously and continuously over at least a 1-hour period for a combined source noise level. In the vicinity of simultaneous operation of a rail saw, sonic pile driver, and a paver, a combined source level of 98 dBA at 50 feet is assumed. Point-source attenuation of 6 dB per doubling of distance, as well as molecular absorption of 0.7 dB per 1,000 feet and anomalous excess attenuation of 1 dB per 1,000 feet, is also assumed (Hoover 1996).

Table 14-17. Estimated Construction Noise in the Vicinity of the Freeport Intake Facility to Zone 40 Surface WTP/FSC Pipeline Construction Site

Distance Attenuation	
Distance to Receptor (feet)	Sound Level at Receptor (dBA)
50	98
100	92
225	85
400	79
600	75
800	73
1,000	70
1,500	66
1,600	65
2,500	60
3,000	57
4,000	53
5,280	49
7,500	42

The following assumptions were used:

Basic sound level drop-off rate:	6.0 dB per doubling of distance
Molecular absorption coefficient:	0.7 dB per 1,000 feet
Anomalous excess attenuation:	1.0 dB per 1,000 feet
Reference sound level:	98 dBA
Distance for reference sound level:	50 Feet

Notes: This calculation does not include the effects, if any, of local shielding, which may reduce sound levels further.

Estimates are based on calculations for a rail saw, sonic pile driver, and a paver.

Although these anticipated noise levels would be temporary if they were to occur, the noise levels would exceed local noise regulation standards and would be substantially higher than existing noise levels. Nearby residences and other noise-sensitive land uses within approximately 3,000–5,000 feet could be temporarily exposed to noise levels that exceed local noise regulations. Noise impacts associated with construction would be significant. There are no mitigation measures available to reduce this impact to less-than-significant levels. Therefore, this impact is significant and unavoidable. However, implementation of Mitigation Measure 14-1, described above, could minimize these potential impacts.

Zone 40 Surface Water Treatment Plant and Aqueduct Pumping Plant and Pretreatment Facility

Table 14-18 calculates anticipated noise levels for construction of the Zone 40 Surface WTP and aqueduct pumping plant and pretreatment facility as a function of distance. A reasonable worst-case assumption is that the three loudest pieces of equipment would operate simultaneously and continuously over at least a 1-hour period for a combined source noise level. In the vicinity of simultaneous operation of one scraper and two trucks, a combined source level of 93 dBA at 50 feet is assumed. Point-source attenuation of 6 dB per doubling of distance, as well as molecular absorption of 0.7 dB per 1,000 feet and anomalous excess attenuation of 1 dB per 1,000 feet, is also assumed (Hoover 1996).

Table 14-18. Estimated Construction Noise in the Vicinity of the Zone 40 Surface WTP and Aqueduct Pumping Plant and Pretreatment Facility Construction Sites

Distance Attenuation	
Distance to Receptor (feet)	Sound Level at Receptor (dBA)
50	93
100	87
225	80
400	74
600	70
800	68
1,000	65
1,500	61
2,000	58
2,500	55
3,000	52
4,000	48
5,280	44
7,500	37

The following assumptions were used:

Basic sound level drop-off rate: 6.0 dB per doubling of distance
Molecular absorption coefficient: 0.7 dB per 1,000 feet
Anomalous excess attenuation: 1.0 dB per 1,000 feet
Reference sound level: 93 dBA
Distance for reference sound level: 50 Feet

Notes: This calculation does not include the effects, if any, of local shielding, which may reduce sound levels further.

Estimates are based on calculations for a one scraper and two trucks.

Although these anticipated noise levels would be temporary if they were to occur, the noise levels would exceed local noise regulation standards and would be substantially higher than existing noise levels. Nearby residences and other noise-sensitive land uses within approximately 3,000 feet could be temporarily exposed to noise levels that exceed local noise regulations. Noise impacts associated with construction at the Zone 40 Surface WTP and aqueduct pumping plant and pretreatment facility sites would be significant. There are no mitigation measures available to reduce this impact to less-than-significant levels. Therefore, this impact is significant and unavoidable. However, implementation of Mitigation Measure 14-1, described above, could minimize these potential impacts.

Canal Pumping Plant and Folsom South Canal to Mokelumne Aqueducts Pipeline

Table 14-19 calculates anticipated noise levels for construction of the canal pumping plant and the pipeline from the FSC to Mokelumne Aqueducts (FSCC pipeline) as a function of distance. A reasonable worst-case assumption is that the three loudest pieces of equipment would operate simultaneously and continuously over at least a 1-hour period for a combined source noise level. In the vicinity of simultaneous operation of one derrick crane and two trucks, a combined source level of 93 dBA at 50 feet is assumed. Point-source attenuation of 6 dB per doubling of distance, as well as molecular absorption of 0.7 dB per 1,000 feet and anomalous excess attenuation of 1 dB per 1,000 feet, is also assumed (Hoover 1996).

Table 14-19. Estimated Construction Noise in the Vicinity of the FSC to Mokelumne Aqueducts Pipeline and Canal Pumping Plant Active Construction Sites

Distance Attenuation	
Distance to Receptor (feet)	Sound Level at Receptor (dBA)
50	93
100	87
225	80
400	74
600	70
800	68
1,000	65
1,500	61
2,000	58
2,500	55
3,000	52
4,000	48
5,280	44
7,500	37

The following assumptions were used:

Basic sound level drop-off rate:	6.0 dB per doubling of distance
Molecular absorption coefficient:	0.7 dB per 1,000 feet
Anomalous excess attenuation:	1.0 dB per 1,000 feet
Reference sound level:	93 dBA
Distance for reference sound level:	50 Feet

Notes: This calculation does not include the effects, if any, of local shielding, which may reduce sound levels further.

Estimates are based on calculations for one derrick crane and two trucks.

Although these anticipated noise levels would be temporary if they were to occur, the noise levels would exceed local noise regulation standards and would be substantially higher than existing noise levels. Nearby residences and other noise-sensitive land uses within approximately 4,000 feet could be temporarily exposed to noise levels that exceed local noise regulations. Noise impacts associated with construction at the canal pumping plant site would be significant. There are no mitigation measures available to reduce this impact to less-than-significant levels. Therefore, this impact is significant and unavoidable. However, implementation of Mitigation Measure 14-1, described above, could minimize these potential impacts.

Impact 14-6: Exposure of Noise-Sensitive Land Uses to General Construction Noise at Night

Most construction activity would be limited to daytime hours consistent with local noise regulations. However, certain construction activities may require construction to occur over 24-hour periods for limited times, and nighttime construction may be desirable in some locations to minimize potential traffic or other issues. Potential noise impacts resulting from nighttime construction of facilities were evaluated by estimating the amount of noise generated on a theoretical worst-case period of construction activity, as previously described under "Impact 14-5: Short-Term Increases in Construction Noise Levels during Daytime Hours." This estimate is based on equipment that would be used during construction activities for the Freeport intake facility, pipelines, Zone 40 Surface WTP and aqueduct pumping plant and pretreatment facility, canal pumping plant, and all other related facilities. Estimated construction noise is shown in Tables 14-16 through 14-19.

Although the anticipated noise levels would be temporary if they were to occur, the noise levels would exceed local noise regulation standards and would be substantially higher than existing noise levels. Nearby residences and other noise-sensitive land uses could be temporarily exposed to noise levels that exceed local noise regulations. Noise impacts associated with nighttime construction would be significant. There are no mitigation measures available to reduce this impact to less-than-significant levels. Therefore, this impact is unavoidable. However, implementation of Mitigation Measures 14-1 and 14-2 could minimize these potential impacts.

Mitigation Measure 14-2: Minimize Nighttime Construction Activity

Construction activities should be limited to daytime hours consistent with local noise regulations to the maximum extent feasible. If nighttime construction is determined to be required, adequate notice should be provided to all potentially affected residences. The construction contractor will designate a noise disturbance coordinator who will be responsible for responding to complaints regarding construction noise. The coordinator will determine the cause of the complaint and will ensure that reasonable measures are implemented to correct the problem. A contact telephone number for the noise disturbance coordinator will be conspicuously posted on construction site fences and will be included in the written notification of the construction schedule sent to nearby residents. Such notices should be provided at least two weeks prior to commencement of nighttime construction activities to all residences within 4,000 feet of nighttime construction areas.

Operation-Related Impacts

Impact 14-7: Increase in Noise Levels from Facility Operation

These alternatives would require long-term operation of major facilities including the intake facility, the Zone 40 Surface WTP, the canal pumping plant, and aqueduct pumping plant and pretreatment facility. As described in the Environmental Commitments section of Chapter 2, project facilities would be designed to meet the local jurisdictions noise standards. However, because ambient noise levels in some areas could be as low as 35-40 dBA L_{dn}, each of these facilities would be capable of generating noise levels that could be 5 dB greater than existing noise levels. Accordingly, this impact is significant. While implementation of the noise attenuation environmental commitment would minimize this impact, it may not reach a less-than-significant level. Therefore, this impact is considered significant and unavoidable.

Alternative 6

Construction-Related Impacts

Impact 14-8: Short-Term Increases in Construction Noise Levels during Daytime Hours

As described above, construction of project components under this alternative would result in short-term increases in noise levels along the pipeline alignment, at project facility locations, and at Pardee Dam. Construction activities at most locations would persist for several days to no more than a few weeks; however, substantially longer construction periods are expected at major facility locations and Pardee Dam.

Potential noise impacts resulting from construction of facilities were evaluated by estimating the amount of noise generated on a theoretical worst-case period of construction activity, as previously described under "Impact 14-5: Short-Term Increases in Construction Noise Levels during Daytime Hours." This estimate is based on equipment that would be used during construction activities for the Freeport intake facility, pipelines, Zone 40 Surface WTP, enlarging Pardee Dam, and all other related facilities. Table 14-15 summarizes anticipated equipment required for construction of each component of the project alternative, and estimated construction noise is shown in Tables 14-16 through 14-19.

Although the anticipated noise levels would be temporary if they were to occur, the noise levels would exceed local noise regulation standards and would be substantially higher than existing noise levels. Nearby residences and other noise-sensitive land uses could be temporarily exposed to noise levels that exceed local noise regulations. Noise impacts associated with construction would be significant. There are no mitigation measures available to reduce this impact to less-than-significant levels. Therefore, this impact is unavoidable. However, implementation of Mitigation Measures 14-1 could minimize these potential impacts.

Impact 14-9: Exposure of Noise-Sensitive Land Uses to General Construction Noise at Night

Most construction activity would be limited to daytime hours consistent with local noise regulations. However, certain construction activities may require construction to occur over 24-hour periods for limited times, and nighttime construction may be desirable in some locations to minimize potential traffic or other issues. Potential nighttime noise impacts resulting from construction of this alternative were evaluated by estimating the amount of noise generated on the theoretical worst-case day of construction activity, as described above. This estimate is based on equipment that would be used during construction activities. A detailed inventory of heavy construction equipment that would be used for the project alternative was not available; therefore, this noise analysis is based on anticipated construction equipment that would be used during construction activities. Table 14-15 summarizes anticipated equipment required for construction of each component of the project alternative.

Based on the noise levels summarized in Table 14-15, Table 14-20 calculates estimated sound levels from construction activities as a function of distance. Simultaneous operation of an impact pile driver[2], rock drill, and a paver for a combined source level of 103 dBA at 50 feet is assumed. Point-source attenuation of 6 dB per doubling of distance, as well as molecular absorption of 0.7 dB per 1,000 feet and anomalous excess attenuation of 1 dB per 1,000 feet, are assumed (Hoover 1996). The canyon topography surrounding the new dam facilities and the distance to the nearest noise-sensitive land uses (i.e., Pardee Center, more than 4,200 feet away) would provide sufficient attenuation to minimize construction noise at the new Pardee Dam construction site to less-than-significant levels. However, in other construction areas associated with this alternative (i.e., construction of the Pardee Saddle Dams, Jackson Creek Saddles Dams, removal of Middle Bar Bridge, and construction of the SR 49 replacement bridge), the surrounding topography would not provide sufficient attenuation of noise at the remaining construction sites. In addition, the other construction sites are closer to nearby noise-sensitive land uses (e.g., the Mokelumne River Lodge is approximately 250 feet from the SR 49 bridge).

[2] It was anticipated that impact and vibratory pile driving would not occur concurrently. Therefore, only the loudest pile driving (impact) is used in the assessment.

Table 14-20. Estimated Construction Noise in the Vicinity of an Active Enlarge Pardee Reservoir Construction Site

Distance Attenuation	
Distance to Receptor (feet)	Sound Level at Receptor (dBA)
50	103
100	97
225	90
400	84
600	80
800	78
1,000	75
1,500	71
2,000	68
2,500	65
3,000	62
4,000	58
5,280	54
7,500	47

The following assumptions were used:

Basic sound level drop-off rate:	6.0 dB per doubling of distance
Molecular absorption coefficient:	0.7 dB per 1,000 feet
Anomalous excess attenuation:	1.0 dB per 1,000 feet
Reference sound level:	103 dBA
Distance for reference sound level:	50 Feet

Notes: This calculation does not include the effects, if any, of local shielding, which may reduce sound levels further.

Estimates are based on calculations for an impact pile driver, rock drill, and paver.

The results in Table 14-20 indicate that construction activities within approximately 3,000 feet of noise-sensitive land uses could expose these land uses to noise levels in excess of the nighttime threshold of 60 dBA and/or exceed existing conditions by more than 5 dB. Noise-sensitive land uses located within this distance (primarily Mokelumne River Lodge) would be exposed to noise levels in excess of the applicable significance thresholds listed above; this would result in a significant noise impact. There are no mitigation measures available to reduce this impact to less-than-significant levels. Therefore, this impact is significant and unavoidable. However, implementation of Mitigation Measures 14-1 and 14-2, described above, could minimize these potential impacts.

Operation-Related Impacts

Impact 14-10: Increase in Noise Levels from Facility Operation

This alternative would require long-term operation of major facilities including the intake facility and the Zone 40 Surface WTP. As described in the Environmental Commitments section of Chapter 2, project facilities would be designed to meet the local jurisdictions noise standards. However, because ambient noise levels in some areas could be as low as 35-40 dBA L_{dn}, each of these facilities would be capable of generating noise levels that could be 5 dB greater than existing noise levels. Accordingly, this impact is significant. While implementation of the noise attenuation environmental commitment would minimize this impact, it may not reach a less-than-significant level. Therefore, this impact is considered significant and unavoidable.

Chapter 15

Public Health and Safety

Chapter 15
Public Health and Safety

Affected Environment

Existing Environmental Contamination

The project area encompasses urban and rural lands that support residences, small businesses (such as gas stations and stores), and industries (such as wineries, packing companies, and dairy operations), as well as agricultural lands in Sacramento, Calaveras, Amador, and San Joaquin Counties (see Figures 2-1, 2-2, and 2-3). Undocumented soil contamination could exist at or near commercial and industrial sites, along railroad tracks where pesticides or other chemicals could have been used or released, and potentially in cultivated areas where agricultural chemicals are used.

Freeport Intake Facility to Mokelumne Aqueducts

To identify known sites of potential concern, a search of federal and state databases was performed (Environmental Data Resources, Inc. 2002), which covered most of the potentially affected areas. The search area did not extend north of Florin Road between Bradshaw Road and the FSC. A search for sites of potential concern will be required for the specific location of the Zone 40 Surface WTP, if the selected location is north of Florin Road, and for the area north of Florin Road between Bradshaw Road and the FSC, if either Alternative 2 or 4 is selected and the pipeline is located on the north side of Florin Road.

The search identified 286 sites with potential environmental concerns within the search guidelines set forth by the American Society for Testing and Materials. Sites that had been remediated under agency oversight were considered to pose minimal risk to workers and the public during pipeline construction, as were sites greater than ¼ mile away from the pipeline alignment areas, including the intake facility, canal pumping plant, and aqueduct pumping plant and pretreatment facility. In addition, if a release did not affect groundwater and the site was not adjacent to pipeline alignments, the site was not considered to pose a risk to public health and safety.

Of the 286 sites initially identified in the database search, 20 were considered to present a potential risk to public health and safety and are included in the following discussion. These sites are listed in Table 15-1. Some of these sites have the potential to affect more than one segment, as well as more than one pipeline alignment alternative. None of the sites listed in Table 15-1 is located along any of the segments near the intake facility, the terminal facility, the canal pumping plant, the surge tank, or the aqueduct pumping plant and pretreatment facility (Camanche site and optional Brandt site).

The EDR database search did not identify any sites containing significant contamination along the FSCC pipeline alignment from the FSC to Mokelumne Aqueducts. Given the generally agricultural uses of these segments, undocumented soil contamination could exist where agricultural chemicals are being or have been used.

Historical gold and copper mining along the upper Mokelumne River drainage could have resulted in mercury contamination of alluvial sediment at the FSCC pipeline Mokelumne river crossing. Acid mine drainage, spilled concentrator reagents, and some detrital heavy metal sulfide minerals were released into the Mokelumne River from Penn Mine and carried downstream before construction of Camanche Reservoir (Leland Gardner and Associates 1996). Some remnants of solid components of those releases could still be present in the downstream river alluvium, although it is unlikely that more than trace amounts remain. Remnants of fuel, lubricants, hydraulic fluid, and similar substances, possibly spilled during construction of Camanche Dam and the Mokelumne River fish hatchery, also could be present near the FSCC pipeline Mokelumne River crossing. An existing powerhouse with a substation at the dam could also be a source of past soil contamination along the FSCC pipeline.

Table 15-1. Hazardous Material and Hazardous Waste Locations from the Freeport Intake Facility to the Mokelumne Aqueducts

Alternative	Segment(s) Affected	Affected Matrix	Business Names and Address	Contaminants of Concern
2, 3	B, C	Groundwater	Shell #6698-31, 8900 Pocket Rd	Gasoline
2, 3	C	Not reported	SMUD PCB Substation Site #15, Meadowview Road at West	PCBs
2, 3	C	Soil	Office of Emergency Services 2800 Meadowview Rd	Diesel
2, 3	C	Soil	CHP Academy Site (former) 2810–2814 Meadowview Rd	Lead
2, 3	C	Soil	United Gas and Food, 1481 Meadowview Rd	Gasoline
2, 3, 4, 5, 6	C, R	Groundwater	Former Bel Air Property, 2450 Meadowview Rd	Chlorinated Hydrocarbons
2, 3, 4, 5, 6	C, R	Not reported	Meadowview Community Center, 2450 Meadowview Rd	VOCs, TPH
2, 3	E	Groundwater	ARCO SS, 6698 Mack Rd, Case 2	Gasoline, MTBE
2, 3	E	Groundwater	TOSCO Service Station 5579, 6500 Mack Rd	Gasoline, MTBE
2, 3	E	Groundwater	Shell, 6490 Mack Rd	Gasoline
2, 3, 4, 5, 6	F	Not reported	Calvey Packing, 7728 Wilbur Way	Not reported
2, 3, 4, 5, 6	H	Soil	Lucky Stores, Inc., 8371 Carbide Ct.	Gasoline
2, 3, 4, 5, 6	H	Not reported	Building 6, 7550 Reese	Diesel
2, 3, 4, 5, 6	H	Soil	ARCO 5585 Case 2, 8100 Gerber Rd	Gasoline
2, 3, 4, 5, 6	I	Not reported	Citizens Telecommunication Co. of California, Inc., 9600 Gerber Rd	Not reported
2, 3, 4, 5, 6	I, J	Not reported	Mohan's Iron Works, 9681 Gerber Rd	Not reported
3, 5	M	Not reported	Gerber Dump, Gerber/Excelsior Rd	Not reported
3, 5	M	Groundwater	Gerber Road Disposal Site, 10401 Gerber Rd	Sanitary landfill
4, 5, 6	R, Option 1	Groundwater	GTE Data Services, 7901 Freeport Blvd	Diesel

LUST = Leaking Underground Storage Tank.
PCBs = Polychlorinated biphenyls.
TBE = Methyl tert-butyl ether.
VOCs = Volatile organic compounds.
TPH = Total petroleum hydrocarbons.

Source: Environmental Data Resources, Inc. 2002.

Enlarge Pardee Reservoir

No hazardous materials data search has been conducted for the enlarge-Pardee-Reservoir component, including the new replacement dam site, the saddle dams, ancillary facilities, or inundation area. There are numerous old mine sites in or above the inundation area. These sites could potentially be sources of contaminants.

Flood Control

Freeport Intake Facility to Mokelumne Aqueducts

The proposed site for the Freeport intake facility on the Sacramento River is in the river channel next to levees that are part of the Sacramento River Flood Control Project. The levees are operated and maintained by the State Reclamation Board.

The pipeline alignments cross the floodplains of natural streams and rivers in Sacramento and San Joaquin Counties. These streams and rivers help provide flood protection during seasonal storms by collecting and directing runoff downstream.

The Zone 40 Surface WTP, terminal facility, canal pumping plant, or aqueduct pumping plant and pretreatment facility (Camanche site and optional Brandt site) are not within the floodplains of natural streams and rivers.

Enlarge Pardee Reservoir

As described in more detail in Chapter 2, “Project Description,” Pardee Reservoir provides flood control for the Mokelumne River watershed downstream of Pardee Dam.

Environmental Consequences

Methods and Assumptions

The evaluation of potential impacts on public health and safety addresses the potential for health and safety hazards during project construction and operation of project facilities after construction. The analysis includes potential effects on workers related to construction activities, as well as general facility safety and hazards to both workers and the public posed by the new facilities.

Implementation of permanent security and design features described in Chapter 2 is assumed in the analysis.

Significance Criteria

The criteria used for determining the significance of an impact on public health and safety are based on the State CEQA Guidelines environmental checklist and professional standards and practices. Impacts on public health and safety may be considered significant if implementation of an alternative would:

- create a significant hazard to the public or the environment through the routine transport, use, or disposal of hazardous materials;
- create a significant hazard to the public or the environment through reasonably foreseeable upset and accident conditions involving the release of hazardous materials to the environment;
- be located on a site that is on a list of hazardous materials sites compiled pursuant to California Government Code 65962.5, and as a result would create a significant hazard to the public or the environment;
- impair implementation of or physically interfere with an adopted emergency response plans or emergency evacuation plan;
- expose people or structures to a significant risk of loss, injury, or death involving wildland fires;
- place within a 100-year flood hazard area structures which would impede or redirect flood flows; or
- 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.

Less-than-Significant Impacts

Alternative 1

Under this No-Action Alternative, hazardous materials and contaminated groundwater would continue to exist at recorded locations identified by state and federal databases, and new sites could be identified. However, the potential for project-generated worker or resident exposure to these substances as a result of the FRWP would not occur because the project facilities would not be constructed.

Alternatives 2–5

Alternatives 2 through 5 differ only in the pipeline alignments from the Freeport intake facility to the FSC. Project construction and operation for Alternatives 2 through 5 are very similar. Impacts related to public health and safety for each alternative differ only slightly from each other; therefore, the results for Alternatives 2 through 5 are presented together but are representative of each individual alternative, unless otherwise noted.

Construction-Related Impacts

Impact 15-1: Exposure of People to Existing Contamination

As noted in the Affected Environment discussion above, soil contamination could exist at or along the project component locations. Construction workers and members of the public could be exposed to existing soil contamination during ground-disturbing activities such as excavation and grading. Because groundwater also could be contaminated in these areas, workers and residents could be exposed to contaminated groundwater during trench and tunnel dewatering.

As noted in the Environmental Commitments section of Chapter 2, FRWA would conduct Phase I hazardous materials studies before the beginning of construction to identify the potential for soil and groundwater contamination in construction areas for the project components. Areas where contamination is suspected or confirmed would be examined in Phase II studies. The Phase II assessment would include soil and groundwater sampling and analysis for likely contamination. As part of Phase II studies, appropriate state and local agencies would be notified and applicable requirements implemented to minimize or avoid health risks. In addition, construction workers would be required to comply with worker safety requirements, including those set forth by Cal OSHA.

As noted above, a database search and preliminary hazardous materials assessment have been performed for most of the pipeline alignment areas. The assessment did not reveal sites of potential concern at locations along any of the pipeline segments near the intake facility, the terminal facility, the canal pumping plant, or the aqueduct pumping plant and pretreatment facility. The assessment revealed possible hazardous or potentially hazardous soil and groundwater contamination along some segments of the pipeline alignments, and it is possible that previously undiscovered contamination could be encountered during construction. In the case of previously undiscovered contamination, construction procedures would be temporarily stopped at the site of concern until an appropriate investigation were completed and appropriate measures to protect human health and the environment developed. As discussed earlier, a search for sites of potential concern will be required for the specific site of the Zone 40 Surface WTP, if the selected location is north of Florin Road, and for the area north of Florin Road between Bradshaw Road and the FSC, if either Alternative 2 or 4 is selected and the pipeline is located on the north side of Florin Road.

FRWA has committed to conducting Phase I environmental site assessments before the beginning of construction. If necessary, Phase II investigations will also be conducted. Based on the findings of the Phase II investigations, appropriate measures to protect human health and the environment will be developed before construction proceeds.

Groundwater levels typically are well below the anticipated depth of excavation throughout the project area. Therefore, the potential for human exposure to known contaminated groundwater would be extremely low in most areas. However, in areas where the project components cross streams and rivers or are close to surface water bodies, groundwater could be encountered during construction. If the soil is contaminated, the groundwater also could be contaminated, and construction workers and members of the public could be exposed to the contaminated groundwater during trench and tunnel dewatering procedures. To reduce this risk, Phase II environmental site assessments would be conducted in areas where contaminated groundwater is anticipated based upon Phase I assessments. If groundwater that is contaminated by potentially hazardous materials is expected to be extracted during dewatering, appropriate local agencies and the Central Valley RWQCB would be notified. A contingency plan to dispose of contaminated groundwater would be developed before construction activities begin. In addition, the project would comply with all local requirements for dewatering, including those for issuance of a dewatering permit.

Because the project would be designed to include implementation of the measures described above, this impact is less than significant. No mitigation is required.

Impact 15-2: Contamination of Soil and Water during Construction

Potentially toxic substances such as fuels, oils, and lubricants would be used during project construction. Accidental releases of these substances could contaminate soils and degrade the quality of surface water and groundwater, resulting in a public safety hazard. The potential for water quality degradation would be of highest concern where the project components cross streams and rivers and wherever dewatering procedures would be implemented. This effect would be minimized through development and implementation of the project hazardous materials management plan as described in the Environmental Commitments section of Chapter 2. This plan would include protocols for handling and disposing of hazardous materials and practices to reduce the potential risks to public health from hazardous materials during construction.

Because the project would be designed to include implementation of the measures described above, this impact is less than significant. No mitigation is required.

Impact 15-3: Increased Risk of Fires during Construction

Several project components would be constructed within or near annual grasslands with high potential for fire during dry seasons. Operation of equipment used to construct project components, such as bulldozers, tractors, transportation vehicles, welders, and grinders, could increase the potential for fire. This hazard would be minimized or avoided through implementation of the project fire control plan described in Chapter 2, under Environmental Commitments. This plan would require coordination with the appropriate agencies responsible for fire protection on lands crossed by the proposed project components, as well as compliance with all applicable local, state, and federal fire regulations. The plan would be approved by all affected fire agencies before construction in areas with high fire hazards.

Because the project would be designed to include implementation of the measures described above, this impact is less than significant. No mitigation is required.

Impact 15-4: Increased Flooding along Sacramento River

The intake facility would be constructed on the river side of an existing levee. Construction crews and equipment would require access to and over the levees into the river channel. Construction of facilities in the river channel would be limited to periods acceptable to the regulatory agencies and would not cause increased flooding or decrease the effectiveness of existing flood control operations. The project would require issuance of levee encroachment permits from the State Reclamation Board for construction activities on the levees. To comply with State Reclamation Board requirements, project construction and operation would be planned to ensure that the integrity and safety of the levees are not compromised and that access to the levees for maintenance or repair is not restricted.

An intake facility located in the river channel would not substantially affect channel flood capacity because the intake facility displacement would be minor compared to the overall floodway capacity. A two-dimensional hydraulic model was used to evaluate impacts. The results of the model are included in Appendix D and summarized in this analysis. In general, two-dimensional hydraulic models are best suited to evaluating specific changes in water surface elevation around the encroachment (in this case the intake facility) and changes in velocity and scour potential. These are the key factors used in identifying potential effects on the flood control system.

High-flow scenarios are typically used to evaluate impacts on a flood control system because they represent the greatest threat, at compared to low-flow event. The two-dimensional hydraulic model was used to evaluate existing and with project conditions under two flow scenarios: the original design flow and a worst case flood event. The worst case event, 150,100 cfs, is considered to be the maximum possible flow that could reach the location of the intake facility without overtopping the upstream levees. The worst case event is much larger than the design flow of 110,000 cfs, which is the flow that the flood control system was originally designed for and that the Reclamation Board typically uses to evaluate project impacts.

Considering changes in water surface elevation, the design flow shows a maximum decrease in water surface elevation of 0.3 ft on the face of the intake facility and a maximum increase in water surface elevation of less than 0.2 ft on the downstream side of the structure. The worst case flow shows a maximum decrease in water surface elevation of 0.4 ft on the face of the structure and a maximum increase in water surface elevation of less than 0.2 ft on the downstream side of the structure. All of these changes are very localized and do not propagate upstream or downstream of the intake facility. Furthermore, an upstream decrease and downstream increase are typical hydraulic results given the size and orientation of this encroachment.

Considering changes in velocity, changes immediately adjacent to and downstream of the intake facility increase over a range of 0.25 foot per second (fps) to 1.5 fps for the design flow and a range of 0.25 fps to 1.7 fps for the worst case flow. In addition, the localized flow pattern changes due to the formation of eddies on the upstream and downstream ends of the intake facility. These changes could result in increased scour along the face of the intake facility and the flood control levee immediately downstream of the intake facility. These changes are limited to the localized area around the intake facility.

As described in the project description (Chapter 2), streambank protection features have been incorporated into the project design to protect the intake facility and the flood control levee from erosion that may occur as a result of increased velocities and scour potential. Because changes in water surface elevation are extremely small, even under the worst case scenario, and because there are no changes upstream or downstream of the site and the potential for erosion has been reduced by streambank protection measures, the impact on flood protection along the Sacramento River would be less than significant. No mitigation is required.

Impact 15-5: Increased Flooding during Pipeline Construction

Pipeline construction through stream and river floodplains would be designed and scheduled to ensure that the potential for increased flooding during construction is avoided or minimized. Construction procedures call for tunneling the pipeline beneath the largest river, the Mokelumne River, and for open trench construction within the floodplains of other streams and rivers. Construction would be short-term and would occur during the dry season when streamflows are low and risk of major flooding would be minimal. Streambeds and riverbeds would be restored to their original dimensions immediately following pipeline installation. This impact is less than significant. No mitigation is required.

Operation-Related Impacts

Impact 15-6: Use and Storage of Hazardous Materials during Operations

Operation of the Zone 40 Surface WTP would involve the use of water treatment chemicals, including sodium hydroxide (caustic soda), calcium hydroxide (lime), sodium bicarbonate (soda ash), zinc orthophosphate, alum, polymer(s), and chlorine (either in gaseous form or as sodium hypochlorite). The corporation yard associated with the Zone 40 Surface WTP would have a fueling station and automotive service facility that would likely involve the use and storage of gasoline, diesel, oils, and lubricants. Other chemicals used at the Zone 40 Surface WTP would likely include small quantities of laboratory chemicals, paints, solvents, and janitorial supplies. In addition, biological growth inhibitors, such as chloramines, might be added at the turnout to the Zone 40 Surface WTP, as well as at the intake structure. Operation of the aqueduct pumping plant and pretreatment facility would involve ozone generators, liquid oxygen, sodium hypochlorite, alum, polymers, hydrogen peroxide, and lime.

Federal, state, and local laws require planning to ensure that hazardous materials are properly used, stored, and disposed of to prevent or minimize injury to workers, the public, and the environment. If quantities of hazardous materials above certain threshold amounts are used or stored on site, hazardous materials business plans would have to be prepared. These plans include a hazardous materials inventory, emergency response plan, and employee training requirements. If chlorine gas above the state threshold amount were stored, a risk management plan would need to be prepared. As required by law, the facility would have an emergency response plan to address potential accidents related to the use and storage of all hazardous materials at the facilities. Compliance with applicable regulations would reduce potential impacts related to the use and storage of hazardous materials at the Zone 40 Surface WTP and aqueduct pumping plant and pretreatment facility to insignificant levels. No mitigation is required.

Impact 15-7: Transportation of Hazardous Materials during Operations

Chemicals used in large quantities at the Zone 40 Surface WTP and aqueduct pretreatment facility would be delivered in bulk shipments, such as by tank trucks and trailers. Delivery of chemicals at full build-out would result in about five trips per week to each facility. Accidents associated with transport of these chemicals could pose hazards to the public. Accidents associated with unloading of chemicals at the facilities could pose hazards to workers and nearby residents if not carefully controlled. Federal and state laws govern the transportation of hazardous materials. As required by law, treatment plant staff workers who handle hazardous materials would be appropriately trained, and the facility would have an emergency response plan to address potential accidents. Compliance with applicable regulations would reduce potential impacts related to the transportation of hazardous materials to insignificant levels. No mitigation is required.

Alternative 6

As described in Chapter 2, "Project Description," Alternative 6 consists of enlarging Pardee Reservoir and conveying water from the Sacramento River. Alternative 6 includes the following project components: enlarge Pardee Reservoir (which includes additional components), Freeport intake facility, pipeline from intake facility to the Zone 40 Surface WTP, and the Zone 40 Surface WTP. Though slightly different in size under Alternative 6, the Freeport intake facility, pipeline from intake facility to the Zone 40 Surface WTP, and the Zone 40 Surface WTP project components are the same as those that make up Alternative 5. Therefore, several of the impacts associated with Alternative 5 (described above) are also associated with Alternative 6 and are restated below. Additionally, impacts associated with the enlarge Pardee Reservoir component of this alternative are described below.

Construction-Related Impacts

Impact 15-8: Exposure of People to Existing Contamination

Impacts associated with the project components from the Freeport intake facility to the Zone 40 Surface WTP would be the same as for Alternatives 2–5, described above.

Construction of the enlarge Pardee Reservoir component is unlikely to expose people to existing contamination because the area is being used as grazing and open space lands and has not been subject to urban, industrial, or intensive agricultural uses. However, as noted in the Environmental Commitments section of Chapter 2, Phase I studies of the dam site, borrow areas, and ancillary facility sites would be conducted before the start of any work in those areas. If contamination is found, further study and/or cleanup (Phase II studies) would be conducted before any construction activities could occur on or near the contaminated sites.

Because the project would be designed to include implementation of the measures described above, this impact is less than significant. No mitigation is required.

Impact 15-9: Contamination of Soil and Water during Construction

Impacts associated with the project components from the Freeport intake facility to the Zone 40 Surface WTP would be the same as for Alternatives 2–5, described above.

Large quantities of potentially toxic substances such as fuels, oils, and lubricants would be used during construction of the new dam. Accidental releases of these substances could contaminate soils and degrade the quality of surface water and groundwater, resulting in a public safety hazard. The potential for water quality degradation would be of highest concern with respect to spills or other accidental discharges into the Mokelumne River. This effect would be minimized through implementation of the project hazardous materials management plan as described in Chapter 2, under “Environmental Commitments”. This plan would include protocols for handling and disposing of hazardous materials and practices to reduce the potential risks to public health from hazardous materials during construction.

Because the project would be designed to include implementation of the measures described above, this impact is less than significant. No mitigation is required.

Impact 15-10: Increased Risk of Fires during Construction

Impacts associated with the project components from the Freeport intake facility to the Zone 40 Surface WTP would be the same as for Alternatives 2–5, described above.

The replacement dam and ancillary facilities would be constructed within or near annual grasslands and chaparral with high potential for fire during dry seasons. Operation of equipment used to construct the new dam and ancillary facilities, such as bulldozers, tractors, excavators, transportation vehicles, welders, and grinders, would increase the potential for fire near construction areas. Additionally, the 300 workers at the site over a 4-year construction period could increase the risk of accidental fires from cigarettes, off-road vehicle travel, and other incidental activities. These hazards would be minimized or avoided through implementation of the project fire control plan described in the Environmental Commitments section of Chapter 2. This plan would require coordination with the appropriate agencies responsible for fire protection in dam and ancillary facility construction areas, as well as compliance with all applicable local, state, and federal fire regulations. The plan would be approved by all affected fire agencies before construction in areas with high fire hazards.

Because the project would be designed to include implementation of the measures described above, this impact is less than significant. No mitigation is required.

Impact 15-11: Increased Flooding along Sacramento River

Flood protection impacts associated with the construction and location of the intake facility would be similar to those described in Alternatives 2–5. As described in the project description (Chapter 2), streambank protection features have been incorporated into the project design to protect the intake facility and the flood control levee from erosion that may occur as a result of increased velocities and scour potential. Because changes in water surface elevation are extremely small, even under the worst case scenario, and because there are no changes upstream or downstream of the site and the potential for erosion has been reduced by streambank protection measures, the impact on flood protection along the Sacramento River would be less than significant. No mitigation is required.

Impact 15-12: Increased Flooding during Pipeline Construction

Flood protection impacts associated with the construction and installation of the pipeline would be similar to those described in Alternatives 2–5. Pipeline construction through stream and river floodplains would be short-term and would occur during the dry season when streamflows are low and risk of major flooding would be minimal. Streambeds and riverbeds would be restored to their original dimensions immediately following pipeline installation. This impact is less than significant. No mitigation is required.

Impact 15-13: Construction Activity Hazards to Workers

Construction activities could subject workers to numerous hazards, such as collapse of trenches, blasting hazards in borrow areas, and hazards associated with use of heavy equipment. These hazards would be mitigated by strict adherence to Cal OSHA requirements and careful training and monitoring of project employees. Therefore, this impact is less than significant.

Impact 15-14: Downstream Flood Hazards from Rupture of the Proposed Dam

As described in Chapter 9, "Geology, Soils, Seismicity, and Groundwater" the proposed dam would be designed to withstand the maximum credible earthquake without failing. Therefore, downstream flood hazards would be less than significant.

Impact 15-15: Increased Flooding during Dam Construction

During construction of the new dam, flood protection provided by the existing Pardee Reservoir would not be affected because operation of the existing reservoir would not change. In the event of a large flood, the dam construction site would not affect the discharge of water from Pardee Reservoir or passage of water between Pardee and Camanche Reservoirs. To minimize the risk of flooding the replacement dam construction site, increased flood storage would be provided in Pardee Reservoir. The impact on flood protection provided by Pardee Reservoir is less than significant. No mitigation is required.

Operation-Related Impacts

Impact 15-16: Use and Storage of Hazardous Materials during Operations

Operation of the Zone 40 Surface WTP would involve the use of water treatment chemicals including sodium hydroxide (caustic soda), calcium hydroxide (lime), sodium bicarbonate (soda ash), zinc orthophosphate, alum, polymer(s), and chlorine (either in gaseous form or as sodium hypochlorite). The corporation yard associated with the Zone 40 Surface WTP would have a fueling station and automotive service facility that would likely involve the use and storage of gasoline, diesel, oils, and lubricants. Other chemicals used at the Zone 40 Surface WTP would likely include small quantities of laboratory chemicals, paints, solvents, and janitorial supplies. In addition, biological growth inhibitors, such as chloramines, might be added at the turnout to the Zone 40 Surface WTP, as well as at the intake structure.

Federal, state, and local laws require planning to ensure that hazardous materials are properly used, stored, and disposed of to prevent or minimize injury to workers, the public, and the environment. If quantities of hazardous materials above certain threshold amounts are used or stored on site, hazardous materials business plans would have to be prepared. These plans include a hazardous materials inventory, emergency response plan, and employee training requirements. If chlorine gas above the state threshold amount were stored, a risk management plan would need to be prepared. As required by law, the facility would have an emergency response plan to address potential accidents related to the use and storage of all hazardous materials at the facilities. Compliance with applicable regulations would reduce potential impacts related to the use and storage of hazardous materials at the Zone 40 Surface WTP to insignificant levels. No mitigation is required.

Impact 15-17: Transportation of Hazardous Materials during Operations

Chemicals used in large quantities at the Zone 40 Surface WTP would be delivered in bulk shipments, such as by tank trucks and trailers. Delivery of chemicals at full build-out would result in about five trips per week to each facility. Accidents associated with transport of these chemicals could pose hazards to the public. Accidents associated with unloading chemicals at the facilities could pose hazards to workers and nearby residents if not carefully controlled. Federal and state laws govern the transportation of hazardous materials. As required by law, treatment plant staff workers who handle hazardous materials would be appropriately trained, and the facility would have an emergency response plan to address potential accidents. Compliance with applicable regulations would reduce potential impacts related to the transportation of hazardous materials to insignificant levels. No mitigation is required.

Significant Impacts and Mitigation Measures

None of the project alternatives would result in significant construction-related or operation-related impacts on public health and safety, and no mitigation measures are required.

Chapter 16

Visual Resources

Chapter 16
Visual Resources

Affected Environment

Concepts and Terminology for Visual Analysis

Identification of a project area's existing visual resources and conditions involves three steps:

- objective identification of the visual features (visual resources) of the landscape,
- assessment of the character and quality of those resources relative to overall regional visual character, and
- determination of the importance to people, in other words, the sensitivity, of views of visual resources in the landscape.

Aesthetic Value

The aesthetic value of an area is a measure of its visual character and quality, combined with the viewer response to the area.

Scenic Quality

The scenic quality component can best be described as the overall impression that an individual viewer retains after driving through, walking through, or flying over an area.

Viewer Response

Viewer response is a combination of viewer exposure and viewer sensitivity.

Viewer Exposure

Viewer exposure is a function of the number of viewers, the number of views seen, the distance of the viewers from the views, and the viewing duration.

Viewer Sensitivity

Viewer sensitivity relates to the extent of the public's concern for a particular viewshed. These terms and criteria are described in detail below.

Visual Character

Both natural and artificial landscape features comprise the character of an area or view. Character is influenced by geologic, hydrologic, botanical, wildlife, recreational, and urban features. Urban features include those associated with landscape settlements and development, among them roads, utilities, structures, earthworks, and the results of other human activities. The basic components used to describe visual character for most visual assessments are the elements of form, line, color, and texture of the landscape features. The appearance of the landscape is described in terms of the dominance of each of these components.

Visual Quality

Visual quality is evaluated using the well-established approach to visual analysis adopted by the FHWA, employing the concepts of vividness, intactness, and unity (Federal Highway Administration 1983). These terms are defined below.

Vividness

Vividness is the visual power or memorability of landscape components as they combine in striking and distinctive visual patterns.

Intactness

Intactness is the visual integrity of the natural and human-built landscape and its freedom from encroaching elements; this factor can be present in well-kept urban and rural landscapes, as well as in natural settings.

Unity

Unity is the visual coherence and compositional harmony of the landscape considered as a whole; it frequently attests to the careful design of individual components in the landscape. (Federal Highway Administration 1983.)

Visual quality is evaluated based on the relative degree of vividness, intactness, and unity, as modified by its visual sensitivity. High quality views are highly vivid, relatively intact, and exhibit a high degree of visual unity. Low quality views lack vividness, are not visually intact, and possess a low degree of visual unity.

Viewer Exposure and Sensitivity

The measure of the quality of a view must be tempered with the overall sensitivity of the viewer. Viewer sensitivity or concern is based on the visibility of resources in the landscape, the proximity of viewers to the visual resource, the elevation of viewers relative to the visual resource, the frequency and duration of views, the number of viewers, and the type and expectations of individuals and viewer groups.

The importance of a view is related in part to the position of the viewer to the resource; therefore, visibility and visual dominance of landscape elements are dependent on their placement within the viewshed. A viewshed is defined as all of the surface area visible from a particular location (e.g., an overlook) or sequence of locations (e.g., a roadway or trail) (Federal Highway Administration 1983). To identify the importance of the views of a resource, a viewshed must be broken into distance zones of foreground, middleground, and background. Generally, the closer a resource is to the viewer, the more dominant it is and the greater its importance to the viewer.

Visual sensitivity is dependent on the number and type of viewers, and the frequency and duration of views. Visual sensitivity is also modified by viewer activity, awareness, and visual expectations in relation to the number of viewers and viewing duration. For example, visual sensitivity is generally higher for views seen by people who are driving for pleasure; people engaging in recreational activities, such as hiking, biking or camping; and homeowners. Sensitivity tends to be lower for views seen by people driving to and from work or as part of their work (Federal Highway Administration 1983). Commuters and nonrecreational travelers have generally fleeting views and tend to focus on commute traffic, not on surrounding scenery, and therefore are generally considered to have low visual sensitivity. Residential viewers typically have extended viewing periods and are concerned about changes in the views from their homes; therefore, they generally are considered to have high visual sensitivity. Viewers using recreation trails and areas, scenic highways, and scenic overlooks are usually assessed as having high visual sensitivity.

Judgments of visual quality and viewer response are most appropriately based in a regional frame of reference. The same landform or visual resource appearing in different geographic areas could have a different degree of visual quality and sensitivity in each setting. For example, a small hill may be a significant visual element on a flat landscape but have very little significance in mountainous terrain.

Freeport Intake Facility to Mokelumne Aqueducts

Regional Visual Character

The project corridor, located in central to southeastern Sacramento County and northeastern San Joaquin County, extends from the flat, open lands of the Sacramento Valley to the transitional zone between the Sacramento Valley and the foothills of the western slope of the Sierra Nevada. The corridor extends through three basic character zones:

- from the Sacramento River, east through a developed landscape comprised of residential, commercial, and light industrial uses;
- to grazing lands with vernal pools and irrigated farmlands; and
- south through agricultural lands and open space areas.

The landscape pattern is influenced by development extending from existing cities and major roadways in the region. I-5 and SRs 12, 88, and 99 traverse the project corridor. Major water bodies within the project area are the Sacramento River, Laguna Creek, Dry Creek, Mokelumne River, and Camanche Reservoir.

Freeport Intake Facility

The intake facility site is located along the left (east) levee of the Sacramento River near the Pocket/Freeport area.

The visual character of the landscape at the site consists generally of riverine elements, including the river surface and steep levee banks. There is little to no vegetation along the riverside of the levee. Vegetation is limited on the left side of the river near the project area, largely as a result of evident flood management and erosion control measures, such as riprap, rubble, and vegetation removal. Therefore, this site appears more open and exposed. (Figure 16-1.)

Directly adjacent to the site, on the landward side of the levee, is Sacramento City's old Meadowview Sewage Treatment Plant (which is now abandoned and serves as a storage yard for the SRCSD). Two dominant structures are located just inland from the site: a large water storage tank on the east bank of the river approximately north 500 feet of the intake facility site, and the I-5 bridge

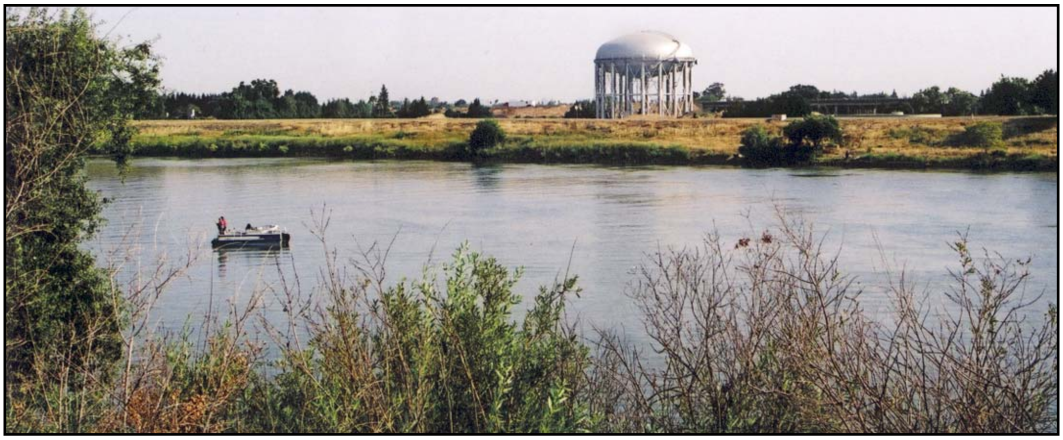


Photo 1. Looking northeast from South River Road (a designated scenic highway in Yolo County), across the Sacramento River toward the proposed intake site. Note the two dominant structures located just inland from the site: a large water storage tank approximately 500 feet north of the intake site and the I-5 bridge structure that passes over SR 160 just north of the site (to the right of the water storage tank). Pocket Area residences are visible to the left of the photo.

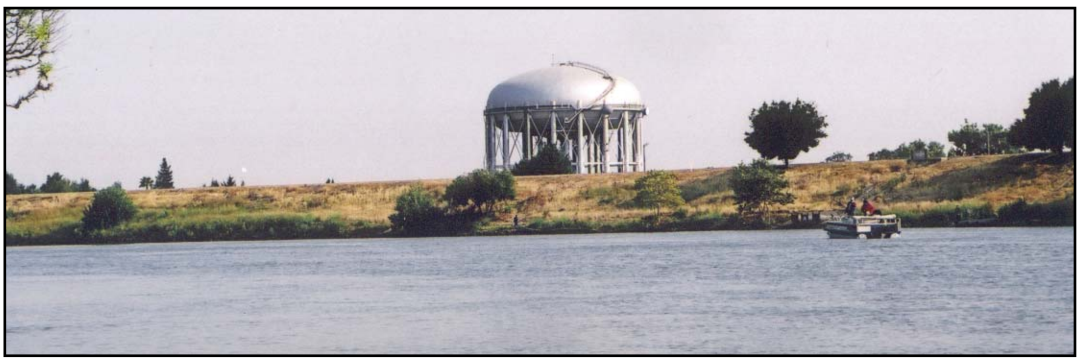


Photo 2. Looking northeast from across the Sacramento River toward the proposed intake site. Note that there is little to no vegetation along the riverside of the levee, largely due to evident flood management and erosion control measures, such as riprap, rubble, and vegetation removal. Also note the dominance and visibility of the large water storage tank.

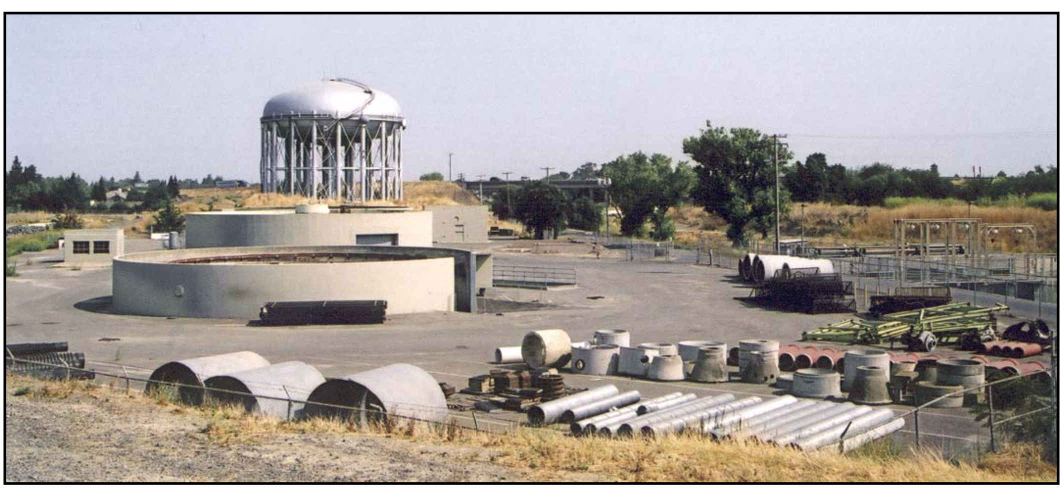


Photo 3. Looking from the levee bike trail at the landward side of the levee. Note the existing level of development immediately adjacent the proposed intake site.

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Figure 16-1
Views of the Freeport Intake Facility Site

structure that passes over SR 160 just north of the site. Currently, both of these prominent structures are visible from the levee trail, Pocket Area residences, and the Sacramento River. From the second and third stories of Pocket Area residences and along the levee trail upstream of the site, the water storage tank is a dominant feature, with some views obstructed by existing vegetation. Both structures and the abandoned treatment plant site are visible from the levee recreation bike trail and some Pocket Area residences. Both structures are visible from the Sacramento River at the proposed intake facility site. Just south of the site, on the riverside of the levee several stormwater outfall pipes extend from the top of the levee to the river edge. (Figure 16-1.)

SR 160, an officially designated state scenic highway, runs behind the intake facility site along the landward toe of the levee. South River Road runs atop the levee on the opposite bank of the river and offers views from the roadway. This site occupies the foreground of three viewsheds (i.e., the levee trail, some Pocket Area residences, and the Sacramento River) and would expose recreationists and residents to views of the intake facility. For these viewer groups, exposure and sensitivity would be relatively high. Commuters travelling along the I-5 corridor over SR 160 would have frequent views of the site; however, viewer exposure from I-5 would be limited to southbound travelers and be of short duration because of the traffic's high speed. The intake facility site would not be visible from the Freeport marina or other residences and business in Freeport because of bends in the river and the bordering levee. Views of the intake facility site from SR 160 would be blocked by the levee, and views from South River Road would be intermittent because they are blocked by intervening vegetation.

In summary, visual resources in the vicinity of this site range from low to moderate intactness and vividness. Upstream views from the site are generally of lower quality than downstream views because of the proximity of the water storage tank and I-5 overpass. Views downstream are higher quality because of the picturesque qualities of the river corridor. Views associated with this site are less than moderately unified because the existing landscape and development is not congruent and harmonious in terms of scale, color, and form, owing to the contrast of residential and industrial development within the river corridor.

Freeport Intake Facility to Zone 40 Surface Water Treatment Plant/Folsom South Canal Pipeline

The project corridor extends through south Sacramento City and central Sacramento County, from the Sacramento River intake facility site east to the FSC. In general, a mix of developed, agricultural, and natural landscapes characterize this area. Development occurs along most of I-5 and SR 99, both of which run north to south and bisect the corridor area. There are some agricultural lands still present in the western portion of the corridor; however, almost the entire western portion of the corridor is a developed landscape comprised of residential, commercial, and light industrial uses. Much of the development in this corridor area has occurred in recent years, as is evidenced by the contemporary architectural styles and new landscaping. Rural “ranchettes” lie to the east. Open space, consisting of grazing lands with vernal pools and irrigated farmlands, is present in the eastern portion of the corridor area. However, this area is rapidly changing from a rural, pastoral landscape of rangeland and open space to an urbanized landscape, with development of planned communities and small commercial establishments, as identified in the North Vineyard Station Specific Plan and the Vineyard Springs Comprehensive Plan. Roadways are prevalent in the corridor area. Other developed features include railroads running from north to south through the corridor area, utility lines, and electrical towers. The Sacramento River borders the western edge of this corridor. Morrison Creek, Laguna Creek, Elder Creek, Union House Creek, and Florin Creek are the primary water features in this corridor area. Most of these water bodies have been channelized in the western portion of the corridor area, resulting in disturbed and limited vegetation. These drainageways flow naturally and host vegetation in the eastern portion of the corridor.

Zone 40 Surface Water Treatment Plant

The potential sites for the Zone 40 Surface WTP are located within the Vineyard Community area, in an area bounded by Gerber, Excelsior, Bradshaw, and Elder Creek Roads. The visual resources of the Vineyard area consist of grazing lands with vernal pools, irrigated farmlands, a commercial nursery, rural residences, and natural vegetation along the creeks in the area. However, this area is rapidly changing from a rural, pastoral landscape of rangeland and open space to an urbanized landscape, as identified in the North Vineyard Station Specific Plan and the Vineyard Springs Comprehensive Plan.

Most of the potential sites for the WTP are agricultural-residential lands, and open space areas with vernal pools. Currently, there is limited built landscape, consisting mainly of “ranchettes,” electrical towers, overhead utility lines supported generally by single wood poles, and two-lane roads (e.g., Florin Road, Gerber Road). Lands to the west and south of the alternative sites are planned for development of planned communities and small commercial establishments.

From Florin Road, Gerber Road, Bradshaw Road, and surrounding agricultural-residential and open space lands, these alternative sites would occupy the foreground and middleground of these viewsheds. Area residents and commuters travelling along these roadways would most likely have the most frequent views of the facility. Exposure and sensitivity would be considered relatively high for residents and low to moderate for commuters.

In summary, views associated with these sites have low to moderate vividness because they are representative of the agricultural-residential surroundings in the area and are relatively common and typical of the roadside scenery in this area; they are moderately intact because the area is a mix of open space rangelands and “ranchettes” with nearby encroaching elements; and are moderately unified because the existing landscape is congruent and harmonious in terms of scale, color, and form with nearby encroaching elements.

Folsom South Canal to Mokelumne Aqueducts Pipeline

The project corridor extends through southeastern Sacramento County and northeastern San Joaquin County, from the FSC southeast to the Mokelumne Aqueducts. In general, agricultural and natural landscapes characterize this area. Proceeding southeast through the corridor, agricultural-residential lands are found near the FSC. Agricultural lands, with vernal pools and drainages present throughout, dominate the central extent of the corridor area. The southern portion of the corridor, which lies within the transitional zone between the Sacramento Valley and the foothills of the western slope of the Sierra Nevada, contains mainly open space and grazing areas with a mixture of grasslands and scattered oak woodlands. Development throughout the corridor area is limited and consists mainly of agricultural-residential development. SRs 88 and 12 and Liberty Road bisect the corridor area, through open space lands. SR 88 and Liberty Road are designated as scenic routes in the San Joaquin County General Plan. Other developed features include utility lines and rural roads. Dry Creek and the lower Mokelumne River, lined with riparian vegetation, are the primary water features that traverse this corridor area.

Canal Pumping Plant

The canal pumping plant site is located at the terminus of the FSC. The visual resources in this area consist of agricultural and rural residential lands and open space areas, and the lands adjacent to the FSC are generally undeveloped with limited access. Currently, there are no overhead high voltage transmission lines or telecommunication lines located at this site. This portion of the FSC is closed to the public and there are between 10 and 15 residences located within 1,400 and 1,500 feet of the site near a private road west of Clay Station Road. Access to the site is limited to nearby residents, and viewer exposure is low to moderate. However, from the surrounding residences and agricultural and open space lands, the site would occupy the foreground and middleground of these viewsheds. The area residents would most likely have the most frequent views of the facility. For all of these viewer groups, sensitivity could be relatively high.

Aqueduct Pumping Plant and Pretreatment Facility

The Aqueduct Pumping Plant and Pretreatment Facility (Camanche site) is located in a flat area on EBMUD property, just west of the Camanche Reservoir dike. The visual resources in this area consist of grazing lands and open space areas, with grasslands and groves of trees. The Camanche Reservoir dike is a prominent feature in this flat, open space area. The nearest residence is more than 1,000 feet away from this site. SR 12 is located approximately 3,500 feet south of the site. Access to the site is limited because it is located on EBMUD property. In general, viewer exposure of the site is low to moderate. However, the site would occupy the foreground and middleground of views from nearby residences and agricultural and open space lands. The area residents would most likely have the most frequent views of the facility, while the site would be relatively distant from SR 12, where views are of a short duration because of the traffic's fast speed. For nearby residents, sensitivity could be relatively high.

An optional Aqueduct Pumping Plant and Pretreatment Facility site (optional Brandt site) is located in a field next to the Mokelumne Aqueducts. The site is located northeast of Brandt Road, and approximately 4,500 feet southeast of the Cord Road/Acampo Road intersection. The visual character of the surrounding landscape is rural, with grazing, gravel mining, and open space lands consisting of grasslands and oak groves along the low-lying, rolling hills. Significant oak groves are visible northwest of the site, adjacent to the Cord Road/Acampo Road intersection. Urban encroachment is minimal and the built environment near the site is limited and consists of the existing Mokelumne Aqueducts, an existing 230-kV electrical transmission line located approximately 500 feet west of the site, a poultry ranch/facility, and rural and private roads. There are rural residences located along Acampo Road and Brandt Road, approximately 5,000 feet to 1.5 miles away. Aggregate mining operations occur in the area with an aggregate plant, operated by KRC Aggregate, located approximately one mile west of the site. The rural community of Clements is approximately 5 miles west of the site. Overall views near the treatment and pumping facilities site are of moderate to high quality, mostly because of the rural environment, natural landscape, and minimal amount of urban encroachment in the area.

From Cord Road, Acampo Road, Brandt Road, the aggregate plant, and surrounding rural residences and open space lands, this site would occupy the middleground of these viewsheds. The area residents traveling to and from rural residences and aggregate plant workers traveling along these roadways would most likely have the most frequent views of the facilities. Because there are residents located in the area with potential views of the facilities, viewer sensitivity could be moderate to high.

Enlarge Pardee Reservoir

Regional Visual Character

The project area located on the border of Amador and Calaveras Counties, is located in the foothills of the western slope of the Sierra Nevada. The region is characterized by rolling hills and small valleys, with occasional rock outcrops. The dominant natural vegetation is annual grassland and native oak woodlands occurring in varying densities. The tree canopy cover and species diversity increases in small draws and valley bottoms where the moisture is more readily available. The contrasts in form, color, and texture of this vegetation add visual variety and interest to the foothill landscape. The area is a rural, pastoral landscape of rangeland and open space, with residences scattered throughout the foothills. SRs 12 and 88, located north and south of the project site, traverse these foothills from west to east, while SR 49 crosses the upper Mokelumne

River from north to south. Several rural roads traverse the project area. The main water features include Pardee Reservoir and the Mokelumne River.

Pardee Reservoir

Pardee Reservoir lies within the foothills of the Sierra Nevada. When full, the reservoir has a surface elevation of 568 feet above msl and a surface area of approximately 2,250 acres. The reservoir encompasses 37 miles of shoreline with its three main arms extending east, north, and south. The majority of the area surrounding the reservoir is a rural, pastoral landscape of open space. Several herb-, shrub-, and tree-dominated plant communities exist within the lands surrounding the reservoir. Overall, the dominant vegetation surrounding the existing reservoir shoreline is grasslands, chaparral, riparian habitat, oak woodlands, and foothill pine. The built environment surrounding the reservoir is limited, consisting of roads and reservoir facilities (including the main dam, auxiliary dams, and recreation facilities). The reservoir facilities are located along the western shoreline of the reservoir's North and South Arms. Also located to the west, Pardee Dam Road extends along the entire length of the reservoir. Scattered throughout the Eastern Arm and eastern shoreline of the reservoir are several unimproved, dirt roads and trails.

Pardee Reservoir is a significant visual feature in the regional landscape. The lake and shoreline contrast sharply with the nearby rolling wooded foothills. Visual quality is highest in the winter and spring when reservoir levels are high; however, the viewer exposure is highest from February to October, when the Pardee Recreation area is open. As summer progresses, reservoir drawdown typically exposes a ring of bare soil along the shoreline, negatively affecting the visual quality (Figure 16-2). The reservoir and nearby facilities occupy the foreground of the various viewsheds around the lake and the adjacent area. Major viewer groups of the reservoir and reservoir facilities are the residents of nearby areas, recreationists using the reservoir, and facility staff members. For these viewer groups, exposure and sensitivity is relatively high. Overall, views associated with the reservoir are vivid because they are not typical of the roadside scenery in the area; they are intact because the area is a rural, open space environment free from encroaching elements; and are unified because the existing landscape is congruent and harmonious in terms of scale, color, and form.

Middle Mokelumne River Inundation Area

Downstream of the Pardee Dam and South Spillway, the Middle Mokelumne River runs southwest to Camanche Reservoir. The vegetation along the riverside is riparian habitat. The uplands surrounding this stretch of the river are generally a rural, pastoral landscape of open space foothills and gulches. Several herb-, shrub-, and tree-dominated plant communities exist within this area. The dominant vegetation along the uplands areas is grasslands, chaparral, oak woodlands, and foothill pine. (Figure 16-2.)

The built environment surrounding the reservoir is limited, consisting of the powerhouse access road, utility lines and reservoir facilities. The backside of the Pardee Dam is the dominant structure within this area. At the toe of the dam is the powerhouse: a concrete structure, equipped with two hydroelectric turbine generator units. The third unit, added in 1983, is in an annex on the downstream side of the original structure. A substation located on the roof of the powerhouse connects with an overhead 60-kV transmission line. This transmission line extends from the existing powerhouse substation south, a distribution line extends from the existing powerhouse substation to Pardee Center, and other overhead utility lines stretch from north to south through this area. On the north side of the river, the powerhouse access road extends from Pardee Dam Road down into the canyon to the powerplant. The backside of the South Spillway, located south of Pardee Dam, is also a prominent feature within this area. This concrete spillway discharges flood flows to the river through Mexican Gulch.

From the observation point, Pardee Dam Road, and facility areas, this area occupies the foreground of these viewsheds. In general, views of this area are limited to recreationists, observation point viewers, Pardee Dam Road motorists, and facility staff members. For these viewer groups, exposure and sensitivity is relatively high. Overall, views associated with this area are vivid because they are not typical of the roadside scenery in the area; they are intact because the area is a rural, open space environment free from encroaching elements; and they are unified because the existing landscape is congruent and harmonious in terms of scale, color, and form.

Upper Mokelumne River

The upper Mokelumne River flows into the east arm of the Pardee Reservoir. The uplands surrounding the Mokelumne River Canyon are characterized by rolling hills and small valleys, with occasional rock outcrops. The dominant natural vegetation in these upland areas is annual grassland and native oak woodlands. The area is a rural, pastoral landscape of rangeland and open space, with residences scattered throughout the hills. The plant diversity increases in the several small gulches that feed the river, where the moisture is more readily available. Along the river the riparian vegetation is dense and mostly undisturbed. (Figure 16-3.)

The built environment along this stretch of the river is limited. A 60 kV transmission line crosses the upper part of the reservoir about 4,000 feet downstream of the Middle Bar Bridge. The Middle Bar Bridge is a one-lane steel girder bridge that spans the upper reaches of the existing Pardee Reservoir. The bridge connects Gwin Mine Road from the south to the Middle Bar Road in the north. Vehicular traffic may use the bridge to cross the river, but it is used almost exclusively by anglers to access the upper reservoir when the reservoir is near capacity. A few residences are situated along these two roadways; however,

Photo 4. Looking at the east arm of Pardee Reservoir. Note that several herb-, shrub-, and tree-dominated plant communities exist within the lands surrounding the reservoir. Also note the exposed ring of bare soil along the shoreline.

Photo 5. Looking south from Pardee Dam Road at the Middle Mokelumne River (downstream of the Pardee Dam). Note the dominance of vegetation along the river and the limited built environment within this open space area. Enlargement of the reservoir will inundate this area.

Figure 16-2
Views of Pardee Reservoir

Photo 6. Looking east from the Middle Bar Bridge at the upper Mokelumne River. Note the flowing water of the river, the dense riparian vegetation found along the river's edge, and the dominance of vegetation within this open space area. This area is relatively free of visible built elements.

Photo 7. Looking south across the upper Mokelumne River at the SR 49 Bridge. Note the flowing water of the river and the dense riparian vegetation along the river's edge. The SR 49 bridge (an eligible State Scenic Highway) is a dominant structure within this open space area.

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Figure 16-3
Views of the Upper Mokelumne River

views of the river and reservoir are restricted by the natural vegetation and topography in the area.

Development of the Middle Bar Take-Out Facility was recently completed on the north shore of the Mokelumne River adjacent to the Middle Bar Bridge and Middle Bar Road. Construction began in fall of 2002 and was completed in May 2003. The facility is a 2-acre boating take-out, extending inland from the current shore of the river to an approximate elevation of 600 feet above msl. The development of the new facility supports whitewater boating on the Middle Bar portion of the river and fishing from the bridge. The facility includes a parking area, restroom, pedestrian paths for boaters and anglers, and appropriate signage and fencing.

Farther upstream, SR 49 crosses the Mokelumne River at Big Bar via a two-lane bridge (Figure 16-3). SR 49 is designated as an eligible state scenic highway (not officially designated) by Caltrans (California Department of Transportation 1999), and is a designated scenic highway in the Calaveras County General Plan. A 60-kV transmission line crosses the Mokelumne River just upstream of the SR 49 bridge.

On the south side of the Mokelumne River adjacent to the SR 49 Bridge, is the Mokelumne River Lodge. The lodge sits on a hill adjacent to the river, providing its guests with views of the whitewater of the river and its natural riparian vegetation. The two-story lodge has seven guestrooms and a balcony across the front of the second story.

The stretch of the upper Mokelumne River between the Electra Powerhouse Afterbay Dam and the SR 49 Bridge (known as the Electra Run) is used for picnicking, swimming, fishing, and gold mining activities. Most activity is concentrated around PG&E's Electra Day Use Area, located approximately 0.20 mile below the Electra Powerhouse Afterbay Dam. Two other well-defined beaches with restroom facilities are located along this stretch of the river. The Electra Run extends approximately 3 miles, and is a very popular whitewater boating run. Access to the put-in for the run is from SR 49 and Electra Road, near the Electra Picnic Area. Two take-out areas are used by boaters, one on Electra Road approximately 0.5 mile upstream from the SR 49 bridge and the other at the SR 49 bridge. (Entrix 1998.)

In general, views of this upper Mokelumne River are limited to recreationists, SR 49 motorists, and lodge visitors. For the recreationists and lodge visitors, exposure and sensitivity to the river is relatively high. Commuters traveling along the SR 49 bridge have views of the Mokelumne River Canyon; however, these viewers have lower aesthetic sensitivity and exposure is of short duration because of the traffic's fast speed. Overall, views associated with this stretch of the Mokelumne River are vivid because they are not typical of the roadside scenery in the area; they are intact because the area is a rural, open space environment free from encroaching elements; and they are unified because the existing landscape is congruent and harmonious in terms of scale, color, and form.

Regulatory Setting

The regulatory setting for a project is typically described on a macro- to micro-basis, wherein federal policies are outlined first followed by state and municipal ordinances, descending in jurisdiction. Because of the vast and linear nature of the proposed project, the regulatory setting is described to parallel the physical setting (from west to east). The relevant plans and programs are summarized in this section and specific policies or regulations of the plans/programs are referenced in the impact analysis as appropriate.

Sacramento River Greenway Draft Plan

The Sacramento River Greenway Plan is a regional resource management plan for a portion of the Sacramento River. The Greenway Plan was initiated by the State Lands Commission, through a Memorandum of Understanding with the City of Sacramento and the counties of Sacramento and Yolo. The goals of the Plan are: to preserve, protect, enhance, and restore the riparian corridor and it associated ecosystems; and to design a system of controlled public access for active and passive recreational uses related to the river. The Plan contains land use policies and implementation measures that support these goals and are relevant to the management of visual resources.

Sacramento River Parkway Plan

The Sacramento River Parkway Plan (Plan) is the "area plan" for the City of Sacramento portion of the Sacramento River Greenway Plan. The main features of the Plan are the preservation of riparian habitat, while providing public access to recreational opportunities along the Parkway. The Plan contains land use policies and implementation measures that support these goals and are applicable to visual resources.

City of Sacramento General Plan

The City of Sacramento General Plan includes several objectives, goals, and policies that may be applicable for the visual resources analysis of the project alternatives including those related to open space and natural resource conservation.

Pocket Area Community Plan

The Pocket Area Community Plan includes the South Pocket Specific Plan. The South Pocket is generally bounded by Florin Road to the north, the City of

Sacramento boundary to the south, the Sacramento River to the west, and I-5 to the east. The South Pocket Specific Plan contains the following goal that may be applicable for the visual resources analysis of the project alternatives:

Goal 2: Encourage the development of attractive, healthy and aesthetically pleasing living environments by:

- encouraging suitable landscape and design of residential and commercial projects,
- providing adequate light and air easements adjoining the Sacramento River levee and I-5,
- requiring that all service utilities be made as attractive or unobtrusive as possible,
- encouraging retention and protection of trees.

County of Sacramento General Plan

The Sacramento County General Plan includes several objectives, goals, and policies that may be applicable for the visual resources analysis of the project alternatives including those addressing land use, conservation, and scenic highways.

Vineyard Community Plan

The Vineyard Community Plan area is generally bounded by Jackson Highway (SR 16) and Kiefer Boulevard on the north, Calvine Road on the south, Elk Grove–Florin Road on the west, and Grant Line Road and Sunrise Boulevard on the east. The Plan includes several policies and programs that may be applicable for the visual resources analysis of the project alternatives, including those addressing natural environmental resources and agricultural and commercial/industrial uses.

San Joaquin County General Plan

The San Joaquin County General Plan includes several objectives, goals, and policies that may be applicable for the visual resources analysis of the project alternatives, including those addressing community development (e.g., growth accommodation, industrial development, utility corridors), open space, water resources and quality, vegetation, fish and wildlife habitat.

Amador County General Plan

The Amador County General Plan contains an Amador County Development Policy Statement appendix. The Amador County Development Policy Statement includes several policies that may be applicable for the visual resources analysis of the project alternatives including those addressing land use, recreation and parkways, scenic roads and highways, and scenic areas of special importance.

Calaveras County General Plan

The Calaveras County General Plan includes several objectives, goals, and policies that may be applicable for the visual resources analysis of the project alternatives, including those addressing scenic highways and cultural, historic, and scenic resources.

Caltrans State Scenic Highways Program

There is only one officially designated scenic highway that may be affected by the proposed project alternatives. This is the SR 160 (River Road), from SR 4 near Antioch to the southern city limit of Sacramento, at the northern edge of Freeport. The route, designated in 1969, meanders through historic Delta agricultural areas and small towns along the Sacramento River. SR 49 is listed as an eligible state scenic highway (not officially designated) throughout Amador and Calaveras Counties (California Department of Transportation 1999). However, these corridors will be treated with similar standards for protection of scenic resources.

Examples of visual intrusions that would degrade scenic corridors as stipulated by Caltrans include dense and continuous development, highly reflective surfaces, parking lots not screened or landscaped, billboards, noise barriers, a dominance of power lines and poles, a dominance of exotic vegetation, extensive cut and fill, scarred hillsides and landscape, and exposed and unvegetated earth (California Department of Transportation 1996).

Environmental Consequences

This section describes the construction- and operation-related impacts on visual resources that are expected to occur under each project alternative. The following discussion also includes a description of the methods and assumptions used to conduct the analysis and the criteria for determining significance of effects.

Methods and Assumptions

The evaluation of changes in the visual environment is based on the visual features of the landscape, their quality and character, and their importance to people. These features of the project landscape were assessed and described above. With this preliminary establishment of the baseline (existing) conditions, the project can be systematically evaluated for its degree of visual impact. The degree of impact depends both on the magnitude of change in the visual resource (i.e., visual character and quality) and on viewers' responses to and concern for those changes.

Numerous federal agencies and organizations have created or defined visual assessment methodologies to improve the quality and accuracy of visual analysis. The approach for this visual assessment is adapted from FHWA's visual impact assessment system (Federal Highway Administration 1983), in combination with other established visual assessment systems. These guidelines are easily transferred to other types of projects that could alter existing landscapes. The visual impact assessment process involves identification of:

- Relevant policies and concerns for protection of visual resources;
- Visual resources (i.e. visual character and quality) of the region, the immediate project area, and the project site;
- Important viewing locations and the general visibility of the project area and site using descriptions and photographs;
- Viewer groups and their sensitivity; and
- Potential impacts, mitigation for impacts, and other recommendations.

The following methods of data collection were used to evaluate the visual character of the various project alternative site regions, assess the quality and character of the various sites' visual resources, and describe views of and from the project sites:

- Ground-level reconnaissance, including field observation from adjacent residences, roadways, recreational resources, and the proposed project sites;
- Interpretation of the USGS topographic maps, the various site plans, and project construction drawings;
- Interpretation of general site photographs, as well as regional visual context; and
- Review of the proposed project in regard to compliance with state and local ordinances and regulations and professional standards pertaining to visual quality.

Significance Criteria

The criteria used for determining the significance of an impact on visual resources are based on Appendix G of the State CEQA Guidelines Environmental Checklist) and professional standards and practices. Impacts on visual resources may be considered significant if implementation of an alternative would:

- cause adverse impacts on a scenic vista or scenic highway;
- have demonstrable negative aesthetic effects;
- create adverse light or glare effects; and
- substantially damage scenic resources, including but not limited to, trees, rock outcroppings, and historic buildings along a state scenic highway.

Less-than-Significant Impacts

Alternative 1

Construction-Related Impacts

Alternative 1 would not result in any construction-related visual impacts associated with construction of FRWP facilities.

Operation-Related Impacts

Under Alternative 1, no FRWP facilities would be constructed and all impacts on visual resources associated with the project alternatives would be avoided.

Visual resource effects under future no-action conditions could occur as urban and suburban growth in the region and service areas results in visual quality changes associated with open space and agricultural land conversion.

Alternatives 2–5

Alternatives 2 through 5 differ only in the pipeline alignments from the Freeport intake facility to the FSC. Project construction and operation for Alternatives 2 through 5 are very similar. Impacts related to visual resources for each alternative differ only slightly from each other; therefore, the results for Alternatives 2 through 5 are presented together but are representative of each individual alternative, unless otherwise noted.

Construction-Related Impacts

Impact 16-1: Short-Term Changes to Views Associated with Construction of the Project Components

Construction activities associated with construction and installation of the project components would introduce a considerable amount of heavy equipment and associated vehicles, including cranes, bulldozers, graders, scrapers, and trucks into the viewsheds of public roadways, adjacent residences, commercial development, and open space areas. Safety and directional signage would also be a visible element. Because of the presence of equipment, vehicles, and construction personnel, construction of the project would temporarily degrade the visual quality of views in the area. Also, dust and emissions rising from the construction area may be visible.

All viewer groups would be affected by this change in the visual quality; however, residents would likely be more sensitive to this change. Residents would experience visual exposure to construction activities and equipment. However, because substantial development is currently occurring and encroaching within the urban areas and agricultural practices are common in the nonurbanized areas, the visible evidence of construction activities and equipment is not new or uncommon components of views in the overall project area. In general, there is a relatively low overall vividness, intactness, and unity along the project corridor. Even in the eastern portion of the corridor, viewers will have limited views where the pipeline alignment crosses the areas of rangelands and open space, or construction will occur within the roadways.

Because of the short-term nature of the construction at any given location and the viewers being relatively accustomed to similar activities, this impact is considered less than significant. No mitigation is required.

Operation-Related Impacts

Impact 16-2: Change in Views of the Freeport Intake Facility Site

Placement of the intake facility would change the visual character of this site from a riprapped levee and former sewage treatment plant site to a built area consisting of a large structure on the levee facing the river and a fenced compound surrounding several structures on the land-side of the levee. The intake facility would be visible from the levee recreation trail, some Pocket Area residences, the southbound lane of I-5, and by recreationists on the Sacramento River. From the levee trail at locations upstream of the site, the intake facility would be a prominent feature with views occasionally obstructed by existing vegetation along the levee. Views of the intake facility from Pocket Area residences would be limited to the second and third stories of those residences, with some views obstructed by existing vegetation. Views of the site from I-5 would be of short duration because of the traffic’s fast speed. The landward side of the intake facility would be visible from the levee recreation bike trail and some Pocket Area residences. The intake facility would be a prominent feature in views from the river. Views of the intake facility would be obstructed from most locations along both SR 160, an officially designated scenic highway, and South River Road, a Yolo County–designated in scenic route, because of trees and the steep levee slopes.

The visual quality of the site is low to moderate with moderate to high viewer exposure depending on the location of viewers, and the facilities would be located within the viewsheds of residences and recreational areas. However, given the current land use in the area and the proximity of the structure to the large water storage tank on the east bank of the river and the overpass for I-5 (both within 500 feet of the site), viewer sensitivity is moderate to low. This is further modified by the direction of views. For residents, the project site is located at an oblique angle and views generally would be directed at or across the river, away from the project site.

In general, the implementation of such a large structure as the intake facility will introduce a prominent element within the viewshed that will be a major change in views of the proposed specific location. However, construction of the intake facility at the Sacramento location would be generally visually consistent with existing development patterns in the river corridor. For example, there are two similar structures within the river corridor in the towns of Hood and Locke (downstream of Freeport). These structures are riverside dock warehouses that are relatively similar in architectural massing, proportion, and scale to the intake facility. These structures are shown in Figure 16-4 as Photos 8 and 9. The structures are bank-type structures built into the river-side of the flood control levee, with the floor level of the main structure constructed even with the top of the levee. For reference, the structure at Hood is approximately 150 feet in length, 35 feet in width, and 30 feet in height; while the structure at Locke is approximately 500 feet in length, 35 feet in width, and 35 feet in height (compared to the intake facility, which is proposed to be roughly 230 feet in length, 50 feet in width, and 40 feet in height).

In terms of visual context within the river corridor, the Sacramento site is similar to the towns of Hood and Locke in regard to existing levels and types of development and disturbance. The context of the river corridor has great relative importance in that the Sacramento River and downstream delta region are often experienced by motorists on the levee roads and boaters on the river as a gestalt of elements seen in motion rather than as disparate static elements (i.e., the viewer experience is typically based on movement through the corridor rather than being seen from a fixed location). Specific visual elements of development at each of the three locations include adjacent single-family residences, overhead utility lines and support poles, unvegetated areas, and adjacent structures. The intake facility site has the additional visually intrusive elements of the large elevated water storage tank and the elevated roadway of I-5. It is notable that all three locations are on the left bank of the river.

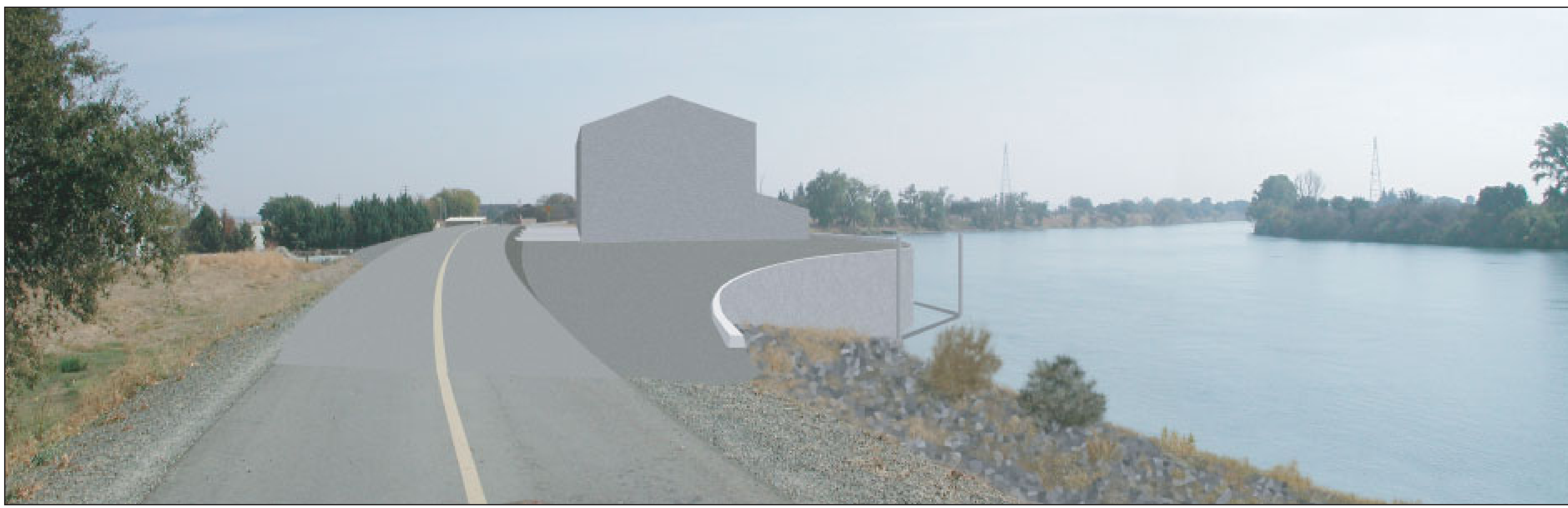
Two computer-generated photosimulations have been prepared demonstrating the change in view for the intake facility site. Figures 16-5 and 16-6show the existing conditions in the top photos, while the bottom photos are that same view with the proposed project. The first photosimulation (Figure 16-5) approximates

Photo 8. Looking across the Sacramento River at the riverside dock warehouse in the town of Hood. Note that this structure is relatively similar in architectural massing, proportion, and scale to the proposed intake facility. This structure is approximately 150 feet in length, 35 feet in width, and 30 feet in height.

Photo 9. Looking across the Sacramento River at the riverside dock warehouse in the town of Locke. Note that this structure is relatively similar in architectural massing, proportion, and scale to the proposed intake facility. This structure is approximately 500 feet in length, 35 feet in width, and 35 feet in height.

Figure 16-4
Views of Existing Riverside Dock Warehouses Along the Sacramento River

Existing V iew



Simulated Post-Project V iew

Note: This illustration is primarily for depiction of basic mass, scale, and proportion only. Architectural details will be incorporated based on final project design.

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Figure 16-5
Existing and Simulated Post-Construction View of Proposed Water Intake Site from the West

Existing View

Simulated Post-Project View

Note: This illustration is primarily for depiction of basic mass, scale, and proportion only. Architectural details will be incorporated based on final project design.

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Figure 16-6
Existing and Simulated Post-Construction Views of Proposed Water Intake Site from Opposite Side of River

the view from the levee recreation trail, and is also representative of views from adjacent residences (upstream of the intake facility). The second photosimulation (Figure 16-6) approximates the view from the Sacramento River. These views represent the greatest potential for change based on viewer sensitivity.

While placement of the new features along the river will change views of the site, the resultant changes in the viewscape will be minimized given the similarity in appearance between the intake facility and other on-river structures in the area. In addition, FRWA is committed to implementing a public process regarding the architectural design of the facility and addressing such issues as visual buffers and lighting standards. Overall, the visual impacts would be less than significant. No mitigation is necessary.

Impact 16-3: Change in Views along the Pipeline from the Freeport Intake Facility to Zone 40 Surface WTP/FSC

Regardless of the specific pipeline alignment alternative that is chosen for the project, installation and operation of the underground pipeline would result in some changes to visual resources in Sacramento City and the County of Sacramento. Construction would occur mainly in developed areas and stream channels in the western portion of the alignment corridor, and changes to visual resources would occur mainly in rural, open space, and grazing areas in the eastern portion. Construction would affect primarily city, county, and state roads and would cross through various stream channels. While many of these streams have been channelized in the western portion of the alignment corridor, they flow naturally in the eastern portion of the corridor. Because of the short-term nature of the construction activities and the limitation of construction activities primarily to existing roadways, visual impacts from construction are considered less than significant.

Similarly, operation of the underground pipeline would not result in substantial effects to visual resources. Operation of the pipeline would not limit or alter existing views from roads or residences in terms of vividness, intactness, or unity. This impact is less than significant. No mitigation is required.

Impact 16-4: Change in Views along the Pipeline from the FSC to Mokelumne Aqueducts

No matter which FSCC pipeline alignment alternative is chosen for the project, installation and operation of the underground pipeline would result in changes to visual resources in south Sacramento County and San Joaquin County. A permanent gravel access road would be constructed within portions of the pipeline corridor construction easement for full-time, year-round inspection and maintenance of the pipeline. These access road segments would require maintenance after construction. For those stretches of the alignments in which the pipeline corridor is adjacent to or within county roadways, no permanent access road will be required.

Installation of the pipeline would require the crossing of several drainages. Vegetation will be restored along the creek crossings where possible. The access road would include a permanent access bridge crossing Dry Creek.

The cross-country alignment of the FSCC pipeline would require a surge tank and rate control valve. The tank, approximately 56 feet in diameter and 32 feet high, would be located at a high point along the alignment. The nearest residence is approximately 2500 feet away.

In general, changes to visual resources associated with operation of the FSCC pipeline alignment would occur mainly in rural, open space, and agricultural areas where the permanent access road segments and the surge tank would be installed. Many of these sites along the corridor alternatives are inaccessible and have limited visibility to viewers. The permanent access road segments would appear similar to other rural and access roads in the area. The surge tank would be similar in size to other buildings in the area and the location of the tank would not change the visual character of the area. Also, installation of the pipeline under Liberty Road and SR 88 would not permanently diminish the visual quality of theses county-designated routes or corridors. Overall, installation and operation of the underground pipeline and surge tank would not result in substantial effects to visual resources, and visual impacts would be considered less than significant. No mitigation is required.

Alternative 6

As described in Chapter 2, “Project Description,” Alternative 6 consists of enlarging Pardee Reservoir and conveying water from the Sacramento River. Alternative 6 includes the following project components: enlarge Pardee Reservoir (which includes additional components), Freeport intake facility, pipeline from intake facility to the Zone 40 Surface WTP, and the Zone 40 Surface WTP. Though slightly different in size, the Freeport intake facility, the pipeline from the intake facility to the Zone 40 Surface WTP, and the Zone 40 Surface WTP project components are the same as those that make up Alternative 5. Therefore, several of the impacts associated with Alternative 5 (described above) are also associated with Alternative 6 and are restated below. Additionally, impacts associated with the enlarge Pardee Reservoir component of this alternative are described below.

Construction-Related Impacts

Impact 16-5: Short-Term Changes to Views Associated with Construction of the Project Components from the Freeport Intake Facility to Zone 40 Surface Water Treatment Plant

Visual changes associated with the construction and installation of the project components would be similar to those described in Alternatives 2–5. Because of the short-term nature of the construction at any given location and the viewers’ relative familiarity to construction activities, this impact is considered less than significant. No mitigation is required.

Impact 16-6: Short-Term Changes to Views Associated with Construction of the Enlarged Pardee Reservoir

Construction activities associated with the enlargement of Pardee Reservoir would introduce a considerable amount of heavy equipment and associated vehicles, including cranes, bulldozers, graders, scrapers, and trucks into the viewsheds of public roadways, recreational areas and facilities, and open space areas. Safety and directional signage would also be a visible element. Because of the presence of equipment, vehicles, and construction personnel, construction at the various sites around Pardee Reservoir would temporarily degrade the visual quality of views in the area. Also, dust and emissions rising from the construction site may be visible.

Construction activities would occur at various sites around the reservoir. Most staging areas would be located within the proposed inundation zone created by the enlarged reservoir. A new recreation area would be constructed and completed within one season, limiting viewer exposure. After the new recreation area is in use, the existing Pardee Recreation Area would be abandoned and demolished. Given the location of the new saddle dams, viewers would have limited views of the construction activities from Pardee Dam Road, the temporary detour route, and the reservoir. Construction of the new, relocated roads would be limited also. Construction of the intake facility tower would be phased. Relocation of SR 49 would require one year, while construction activities at the Middle Bar Bridge would require approximately one season. Construction activities necessary for the new dam and spillway would require the greatest amount of time; however, construction would be phased and views of the construction activities would be limited and obstructed by the location and distance of the new dam relative to vantage points.

All viewer groups would be affected by this change in the visual quality; however, recreationists and area residents would likely be most sensitive to this change. Recreationists and residents would have prolonged visual exposure to construction activities and equipment. However, for many of the various construction sites around the lake, viewers will have limited views. Also, construction at the various sites would occur in phases, overall limiting the extent of construction affecting viewsheds at any one time. This impact is less than significant. No mitigation is necessary.

Operation-Related Impacts

Impact 16-7: Change in Views of the Freeport Intake Facility Site

Visual changes associated with the location of the intake facility would be similar to those described in Alternatives 2–5. Overall, implementation of the intake facility at the Freeport site would result in visual impacts that would be less than significant.

Impact 16-8: Change in Views along the Pipeline from the Freeport Intake Facility to Zone 40 Surface WTP

Visual changes associated with operation of the pipeline would be similar to those described above. Operation of the pipeline would not result in substantial effects on visual resources. This impact is less than significant. No mitigation is required.

Impact 16-9: Changes in Visual Resources from Raising Pardee Reservoir Water Elevations

Enlarging the reservoir would increase the maximum controlled water supply storage by 33 feet (from 568 feet to 601 feet), resulting in the inundation of approximately 1,000 acres. Also, compared to the existing maximum water supply storage (i.e., 568 feet and a surface area of 2,250 acres), approximately 1,200 total acres would be inundated at top of the new flood control pool elevation of 614 feet. Lands around Pardee Reservoir between the 568-foot and 601-foot contours would be cleared of all vegetation, debris, and other materials that may conflict with reservoir operations. Lands between the 601-foot and 614-foot contours would not be mechanically cleared of vegetation or debris during project implementation.

Enlarging the reservoir and raising existing water elevations would change the visual character of the area. A computer-generated photosimulation has been prepared that illustrates the change in view of the enlarged Pardee Reservoir (Figure 16-7). The reservoir would continue to be a dominant feature in the landscape. The landscape change would not likely be visually intrusive for most viewers because viewers are often using the lake as a recreational resource, and because water features are often considered positive landscape features. Also, the overall effect of raising the water level at the reservoir would be relatively minor because substantial portions of the vegetated landscape would remain visually intact.

Fluctuations in the reservoir water level would create a continuous light-colored, unvegetated ring around the water edge. Visual impacts on views from exposing large areas of bare ground in the shallow arms of the reservoir would be severe because this exposed ground would contrast with the surrounding vegetated landscape and reduce visual intactness. The exposed ring around the perimeter of the reservoir is generally considered an objectionable view to the public, especially because recreational use causes scenic expectations to be high. However, operations on the existing reservoir currently result in the exposure of a ring of barren land during certain times of the year when the water level drops below 568 feet. The enlarged reservoir would be operated to maintain a water level of 601 feet during the summer months, minimizing the periods when barren slopes would be visible. Although the enlarged reservoir would be operated during the winter months to provide flood control storage up to 614 feet, then drop reservoir levels to 601 feet as quickly as possible, lands between the 601-foot and 614-foot contours would not be mechanically cleared of vegetation or debris. As described in Chapter 7, “Vegetation and Wetland Resources”, the infrequent and short duration that the area between 601 feet and 614 feet would be inundated may affect some vegetative communities, but will not have a

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Figure 16-7
Simulated View of Enlarged Pardee Reservoir

substantial impact on the overall visual character of this zone. In general, views of the unvegetated ring around the reservoir will be similar to views along the existing reservoir's shoreline. Operation of the new enlarged reservoir and the overall effect of a visible unvegetated ring along the reservoir's shoreline to recreation users and other sensitive viewer groups would likely be relatively minor because of the current exposure these viewers experience of the existing reservoir ring. This impact is considered less than significant. No mitigation is necessary.

Impact 16-10: Changes in Visual Resources from Inundation of the Area Downstream of the Existing Pardee Dam (Middle Mokelumne River)

In general, this impact is considered substantially different from impacts on the Upper Mokelumne River (discussed below) because the visual resources have less scenic quality and the viewer groups have less sensitivity. Therefore, although the physical effect of the inundation is similar, the visual significance and viewer response are different. The pastoral and natural aesthetic character of the existing valley, represented by riparian habitat along the river channel, oak woodlands and grasslands, and reservoir facilities, would be lost because of inundation. Views of the area from the existing Pardee Dam Road would be lost; however, relocation of this road will provide viewers with similar views downstream of the new dam. View of the area from other vantage points, such as the observation point and Pardee Center, will be altered. However, the overall effect of this change from these vantage points would likely be relatively minor.

As described above, inundation of this area will result in slightly increasing the reservoir's dominance within the landscape. This impact is considered less than significant. No mitigation is necessary.

Impact 16-11: Changes in Visual Resources from Changes in Camanche Reservoir Water Elevations

As described in Chapter 3, "Hydrology, Water Supply and Power," operation of the enlarged Pardee Reservoir could allow Camanche Reservoir's water pool level to be maintained more frequently. Camanche Reservoir would continue to be a dominant feature in the landscape, and may have a visual benefit in reduction of the fluctuation of the water level and resultant "bathtub ring" effect. Therefore, this impact is considered less than significant.

Impact 16-12: Change in Views of the Pardee Replacement Dam

The replacement dam would be located 4,200 feet downstream of the existing dam along the Middle Mokelumne River, just upstream of the confluence with Rag Gulch. With a crest elevation of 617 feet above msl, the replacement dam would have a structural height of 402 feet and an approximate length of 1,970 feet. The replacement dam would be 52 feet higher and approximately 640 feet longer than the existing dam. The façade of the replacement dam—a conventional trapezoidal cross-section with a vertical upstream face and a stepped face downstream constructed of gravity roller compacted concrete—will be similar to the existing dam, constructed of curved gravity concrete.

Just as with the existing dam, recreationists on the reservoir would have views of the new dam's crest. The height of the replacement dam and the enlarged water supply pool elevation will expose approximately 16 feet of the dam's crest to recreationists, approximately the same expanse of the dam's structural height as is currently visible to recreationists. However, given the location and the length of the replacement dam, recreationists on the reservoir will generally experience less intrusive views of the new dam. Enlargement of the reservoir will locate the replacement dam within a new inlet of the reservoir, and no longer along the edge of the reservoir's main body. Viewer exposure would be limited depending on the location of reservoir recreationists.

Roadway travelers along the new Pardee Dam Road would have views of the new dam similar to current views of the existing dam along the existing Pardee Dam Road. However, the height of the replacement dam's parapet walls (2.5 feet lower than those along the existing dam) would provide motorists with views of the reservoir, downstream river valley, and the surrounding open space, which they did not have before. Walkways along the crest of the new dam, which were not provided before, would also offer views of the surrounding area and the new dam structure. Also, as mentioned above, by combining the main dam and spillway, motorists along new Pardee Dam Road will be exposed to a shorter length of dam/spillway crest (approximately 160 feet less).

Observation point viewers would have limited views of the replacement dam and spillway given the natural topography of the area and the distance from these replacement structures. As is the case with the existing dam and spillway, views of the new structures from Pardee Center would be obstructed by the vegetation and natural topography of the area. Views of the dam and spillway from downstream locations would be limited to reservoir facility staff.

In general, views of the replacement dam and spillway will be similar to views of the existing dam and south spillway and no new viewer groups will be exposed to views of the replacement dam and spillway. In fact, viewer groups exposed to the existing dam and spillway will have less intrusive views of the replacement structure. Replacement and relocation of the main dam and spillway and the overall effect of this change to recreation users, motorists, rural residents and other visitors would likely be relatively minor because of the current exposure these viewers experience of the existing dam and spillway. This impact is less than significant. No mitigation is necessary.

Impact 16-13: Change in Views of the New Pardee Saddle Dams

Two saddle dams would be constructed on the reservoir perimeter to the north of the new replacement dam. Pardee Saddle Dam No. 1 would be approximately 1,000 feet to the north of the right abutment of the new dam. The dam would be an earthcore/rockfill embankment dam approximately 120 feet high. The dam crest would be 1,500 feet long at a crest elevation of 622 feet. Pardee Saddle Dam No. 2, located approximately 1,500 feet north of the first saddle dam, would be smaller. It would be 12 feet high by 200 feet long with a crest elevation of 622 feet. The dam would be an earth embankment dam, with a crest width of 30 feet to accommodate the relocation of Pardee Dam Road.

These two saddle dams will be constructed within a currently existing open space area. The saddle dams will be visible to recreation users and motorists traveling along the new Pardee Dam Road. Observation point viewers would have limited views of the saddle dams given the natural topography of the area and the distance to the sites. The dams will present a dominant visual presence to these viewer groups. However, the natural form presented by the earthcore/rockfill (uneven shapes and sizes) and the fact that the rockfill will be imported from areawide quarries (consistency in make-up and color between the rockfill and site soils) should minimize potential visual inconsistencies. Also, the natural form and use of natural materials will limit the reflectivity of the saddle dams. Over time, visual impacts associated with the saddle dams will diminish as the structure weathers. This impact is less than significant. No mitigation is necessary.

Impact 16-14: Change in Views of the New Jackson Creek Saddle Dams

Two saddle dams (Jackson Creek Saddle Dams Nos. 1 and 2) would be constructed on the divide between the Mokelumne River Valley and Jackson Creek Valley. Jackson Creek Saddle Dam No. 1 would be an embankment dam constructed just to the north of the present Jackson Creek Spillway. The dam would have a length of approximately 1,700 feet and would accommodate the relocated Stony Creek Road. The dam height from crest to toe would be approximately 97 feet. The existing spillway would be abandoned in place and inundated by the new reservoir. Jackson Creek Saddle Dam No. 2 would be a conventional zoned earthfill dam approximately 670 feet in length. The dam crest would be 30 feet wide to accommodate the relocated Stony Creek Road. The dam height from crest to toe would be approximately 67 feet.

Jackson Creek Saddle Dams No. 1 will be constructed just downstream of from the existing Jackson Creek Spillway, while the Jackson Creek Saddle Dams No. 2 will be constructed within a currently existing open space area. The saddle dams will be visible to recreation users and motorists traveling along the new Stony Creek Road. The dams will present a dominant visual presence to these viewer groups. However, the natural form presented by the earthfill/rockfill (uneven shapes and sizes) and the fact that the rockfill will be imported from areawide quarries (consistency in make-up and color between the rockfill and site soils) should minimize potential visual inconsistencies. Arguably, the earthfill/rockfill materials for the new Jackson Creek Saddle Dams No. 1 will constitute an improvement over the existing concrete Jackson Creek Dam. Also, the natural form and use of natural materials will limit the reflectivity of the saddle dams. Over time, visual impacts associated with the saddle dams will diminish as the structure weathers. This impact is less than significant. No mitigation is necessary.

Impact 16-15: Change in Views of the Raised Intake Tower

The intake tower would be left in place, and the height would be increased by 35 feet to accommodate reservoir surface water elevations up to 601 feet. The intake structure would be constructed of 375-foot high reinforced concrete with several sets of gates at different water levels. The intake tower would be similar in appearance to the existing tower consisting of concrete, with an operating deck, an access bridge, and a gatehouse similar to the present building.

Even with the enlargement of the reservoir's surface area, the location of the intake tower relative to the shoreline of the lake would remain relatively the same and no new viewer groups will be exposed to views of the intake tower. Raising the intake tower/shaft and the overall effect of this change to recreation users would likely be relatively minor because of the current exposure these viewers experience of the existing structure. This impact is less than significant. No mitigation is required.

Impact 16-16: Change in Views of the Raised or Relocated Utility Lines

Several existing power transmission lines cross the upper part of the reservoir and the new inundation area between the existing and replacement dams. The power lines would be either raised or relocated. Overall, views of the raised or relocated lines will resemble views of the existing utility lines. No new viewer groups will be exposed to views of these lines. Raising or relocating the utility lines and the overall effect of this change to recreation users, motorists, rural residents and other visitors would likely be relatively minor because of the current exposure these viewers experience of the existing utility lines. This impact is less than significant. No mitigation is necessary.

Impact 16-17: Change in Views of the New Roads and Bridges

Pardee Dam Road would be relocated to cross the crest of the new dam. The new alignment of the road would continue to follow the western side of the reservoir, connecting to the existing road at points approximately 1.2 miles north and 1.2 miles south of the existing Pardee Reservoir. The length of the new route would be approximately 2.6 miles. Stony Creek Road would be relocated to cross the crests of the new Jackson Creek Saddle Dams.

Overall, views of the new Pardee Dam Road and the new Stony Creek Road will resemble views of the existing roads. While some viewer groups will no longer be exposed to views of these roads, no new viewer groups will be exposed to views of these roads. Relocating Pardee Dam Road and Stony Creek Road and the overall effect of these changes to recreation users, motorists, rural residents and other visitors would likely be relatively minor because of the current exposure these viewers experience of the existing roads. This impact is less than significant. No mitigation is necessary.

At the upstream end of the reservoir, the SR 49 bridge crossing would be replaced with a new higher bridge structure and approaches that would clear high water, including reservoir backwater effects during high flows. The new bridge would be located 50–80 feet east of the existing bridge. Overall, views of the new SR 49 bridge will resemble views of the existing bridge. No new viewer groups will be exposed to views of this road. Relocating the SR 49 bridge and the overall effect of this change to recreation users, Mokelumne River Lodge visitors, and motorists would likely be relatively minor because of the current exposure these viewers experience of the existing road. This impact is less than significant. No mitigation is necessary.

The increased reservoir levels would inundate the Middle Bar Bridge. The bridge would be removed because it would become a hazard to navigation if left in place. A new fishing pier would be constructed near the head of the reservoir to replace the bridge. Turn-around areas would be constructed at the ends of Gwin Mine and Middle Bar Roads above the high water level on both sides of the reservoir. Removal of the Middle Bar Bridge, placement of the fishing pier, and roadway modifications at this site would not substantially alter the visual character and quality of this site. This impact is less than significant. No mitigation is necessary.

The powerhouse access road would extend from its intersection with the relocated Pardee Dam Road, approximately 1,000 ft southeast of the left abutment of the new replacement dam, and descend down a steep gradient following Rag Gulch to near its confluence with the Mokelumne River. Overall, views of the new access road will resemble views of the existing road and no new viewer groups will be exposed to views of this road. Relocating the powerhouse access road and the overall effect of this change to recreation users, motorists traveling along the new Pardee Road, and reservoir facility staff would likely be relatively minor because of the current exposure these viewers experience of the existing road. This impact is less than significant. No mitigation is necessary.

Impact 16-18: Change in Views from the New Pardee Recreation Area

The existing Pardee Recreation Area would be inundated by enlargement of Pardee Reservoir. Therefore, a new recreation area would be developed and relocated on the western shore of the reservoir’s southern arm. The facilities would be located on approximately 116 acres, with the current elevation of the area generally ranging from 600–780 feet. The site is an open space area, dominated by foothill pine-oak woodland, grassland, blue oak woodland, and interior live oak woodland. Placement of the recreation area at this site would change the visual character of this site from a vegetated, open space setting adjacent to the reservoir to a built area. Views of the new recreation area would be limited to recreationists on the South Arm of the reservoir, and rural residents and motorists traveling along Pardee Dam Road and Campo Seco Road/Paloma Road.

In general, views of the new recreation area will be similar to views of the existing Pardee Recreation Area. The new recreation area would provide visitors with the same recreation facilities as the current Pardee Recreation Area, plus some new amenities. Also, relocation of the Pardee Recreation Area and the overall effect of this change to recreation users and rural residents would likely be relatively minor because of the current exposure these viewers experience of the existing recreation area located on the reservoir’s north arm. This impact is less than significant. No mitigation is necessary.

Significant Impacts and Mitigation Measures

Alternatives 2–5

Construction-Related Impacts

Construction of Alternatives 2–5 is not anticipated to result in any significant impacts on visual resources.

Operation-Related Impacts

Impact 16-19: Change in Views of the Zone 40 Surface Water Treatment Plant Site

Although a specific site for the Zone 40 Surface WTP has not been identified, the area is relatively homogeneous and visual impacts would be similar to views and visual resources within area. The facility may include an operation building, a raw water reservoir, a grit basin, flocculation and sedimentation basins, filters, a clearwell, lagoons, and a corporation yard. The total site would be approximately 80–100 acres. It is assumed that the site would be fenced for security purposes. The maximum structure height would be 45 feet and would likely be the finished water reservoir. The facility would include lighting for safety and security purposes. An access road will extend to the site from a main county road, as well as overhead utility lines.

Placement of the WTP would introduce new features into a relatively rural, agricultural-residential setting, adding a contrasting element to the visual character with that more typical of a built, industrial area. While visual quality of these sites is low to moderate, these sites are visible to nearby residents and motorists traveling along the areas rural roads. These viewers have a high sensitivity to changes in views at these sites, and viewer exposure is increasing with the development of planned communities in this area of the County. Visual impacts, such as changes to viewsheds, changes to the character of the sites, vegetation removal, and new sources of light and glare, would result from the operation of the facilities at these sites. Implementation of the mitigation measures listed below would reduce any visual impacts to a less-than-significant level.

Mitigation Measure 16-1: Implement Measures to Reduce Visual Intrusion

- Prepare and implement design plans that are consistent with the rural visual character. Plans shall be consistent with local community plans and specific provisions. For example, the Vineyard Community Plan states that “industrial proposals should include efficient site plans which reflect the rural character.”

- Coordinate with Sacramento County regarding design requirements:

- Facility design plans would be coordinated with Sacramento County prior to construction.
- Exterior building materials on nonresidential structures shall be composed of a minimum of 50% low-reflectance, unpolished finishes.
- Bare metallic surfaces such as pipes, flashing, vents, and light standards on new construction shall be painted so as to minimize reflectance.

- Provide a vegetative buffer to visually screen the site:
  - The vegetative buffer plan shall be coordinated with mitigation planting and revegetation that will be implemented to mitigate for any affected vegetation and biological habitat areas (described in Chapter 7, "Vegetation and Wetland Resources," and Chapter 8, "Wildlife").
  - The vegetative buffer plan would be consistent with local policies and guidelines for native landscaping. In general, FRWA would coordinate with local counties as appropriate, including compliance with local tree ordinances and heritage tree programs.
  - A vegetative buffer would be integrated around the periphery of the project site to provide for substantial screening from adjacent residential or agricultural uses, such as is required by the Vineyard Community Plan. This landscaping would also reduce potential daytime glare.
  - The species composition should reflect species that are native and indigenous to the project area, in addition to species that are traditionally used in the area associated with farm complexes and rural houses.
  - The planting design should mimic patterns typical of farm complexes and rural houses in the area for screening, shading, and windbreak.
  - Vegetation should be planted within the first year following project completion.
  - An irrigation and maintenance program should be implemented during the plant establishment period.
  - It is recommended that a qualified landscape architect be retained to design and implement the vegetative buffer.

- Incorporate lighting design specifications for minimum maintenance and access safety standards:
  - Luminaires should be cut-off type fixtures that cast low-angle illumination to minimize incidental spillover of light onto adjacent properties and open space. Fixtures that project upward and horizontally should not be used.
  - Luminaires should be shaded and directed away from residential, roadway and open space areas adjacent to the project site.
  - Luminaire lamps should provide good color rendering, natural light qualities, and used only where necessary for safety and security purposes. Luminaire intensity should be low.

- Luminaire mountings should be downcast and the height of placement minimized to reduce potential for backscatter into the nighttime sky and incidental spillover into adjacent properties and open space. Luminaire mountings should have nonglare finishes.

Impact 16-20: Change in Views of the Canal Pumping Plant Site

The facility will include a canal intake structure, traveling screen structure, pumping plant building, and electrical substation. Within the canal will be the concrete intake structure. The concrete screen structure, pumping plant building, and electrical substation will reside within a 250-foot-by-600-foot area, fenced for security purposes. The pumping plant building will be the most prominent building at approximately 30 feet high. Aboveground sections will be constructed from either concrete or concrete masonry block walls. The facility would include luminaires, which would illuminate the currently unlit site for security and safety purposes. Main access will be along the canal levee road. Power will be supplied to the facility from existing nearby lines, potentially from the existing high voltage SMUD line located approximately 2.5 miles north of the proposed plant.

Placement of the canal pumping plant would change the visual character of this site from an open space and rural residential setting to a built area consisting generally of a fenced compound surrounding an approximately 30-foot-high structure. While visual quality of the site is low to moderate and viewer exposure could be low to moderate, depending on the location of viewers, the plant would be located within several hundred feet of residences and viewer sensitivity could be high. Visual impacts, such as changes to viewsheds, changes to the character of the site, vegetation removal, and new sources of light and glare, could result from the operation of the facilities at this site. Implementation of Mitigation Measure 16-1 listed above would reduce visual impacts to a less-than-significant level.

Extension of existing transmission lines and telecommunication lines to the electrical substation could result in some change to views within the area. Viewer exposure in this area would be relatively low, and only a small number of rural residents would be affected. In general, these features introduced into the viewsheds by the proposed project would not limit or alter existing views from the rural roads or residences in terms of vividness, intactness, or unity. Visual impacts attributable to overhead utility lines would be less than significant.

Impact 16-21: Change in Views of the Aqueduct Pumping Plant and Pretreatment Facility Site

Camanche Site. The facility will include a chemical building, treatment basins, tanks, a clearwell, and a pumping plant. At this site, the facilities may be partially underground and excess trench spoils from the FSCC pipeline construction could be contoured around the facilities as a visual screen, thereby reducing visibility of the built features. The chemical building will be the most visible building; however, as with all the facilities, it would maintain a low profile. The facility would include luminaires, which would illuminate the currently unlit site for security and safety purposes. Existing nearby transmission lines would be extended to the pretreatment and pumping plant facility, potentially from the 230-kV PG&E lines located approximately 2,500 linear feet east of the site. The flow control structure would be located at the Mokelumne Aqueducts and would also receive low voltage power and telecommunications from existing lines nearby.

Placement of the treatment facility and pumping plant would change the visual character of this site from an open space setting to a built area. The site is a relatively flat, with the Camanche Reservoir dike serving as a backdrop on one side. SR 12 is located approximately 3,600 feet south of the site, and the Camanche Reservoir dike access road is located just east of the site. Residences are more than 1,000 feet away. In general, only a small number of rural residents would be affected and the site would be relatively distant from SR 12, where views are of a short duration because of the traffic's fast speed. While visual quality of the site is moderate and viewer exposure could be low to moderate depending on the location of viewers, viewer sensitivity could be high from the residential perspective. Visual impacts, such as changes to viewsheds, changes to the character of the site, vegetation removal, and new sources of light and glare, could result from the operation of the facilities at this site. Implementation of the mitigation measures listed below would reduce any visual impacts to a less-than-significant level.

Extension of existing transmission lines to the site could affect views from rural residences and rural roadways. Viewer exposure in this area would be relatively low, only a small number of rural residents would be affected, and the transmission lines would be relatively distant from SR 12. In general, these new features introduced into the viewsheds by the proposed project would not limit or alter existing views from the roadways or residences in terms of vividness, intactness, or unity. Visual impacts attributable to overhead utility lines would be less than significant.

Optional Brandt Site. The facility will include a chemical building, treatment basins, tanks, a clearwell, and a pumping plant. At this site, the facilities would be fully buried in order to obtain the necessary hydraulic gradient for the treatment processes. The chemical building will be the most visible building; however, as with all the facilities, it would maintain a low profile. The facility would include luminaires to be installed, which would illuminate the currently unlit site for security and safety purposes. Power would be supplied to the pretreatment and pumping plant facility from existing transmission lines, potentially from the 230-kV PG&E lines located approximately 500 linear feet west of the site.

Placement of the treatment facility and pumping plant would change the visual character of this site from an open space setting to a built area. Because of the orientation and height, and natural vegetation and topography, views from the nearby residences and roadways toward the pretreatment and pumping plant facilities site are limited. Views of hilltops or oak groves from public roadways will remain. The residences and roadways are located approximately 5,000 feet to the northwest, and 1.5 miles to the southwest of the site. Perceived changes in the view would be minimal because of the relative distance to the site, the natural topography of rolling hills, and the dominance within the viewshed of the existing 230-kV PG&E transmission lines traversing the rural landscape. While visual quality of the site is moderate to high and viewer exposure could be low to moderate, depending on the location of viewers, the plant would be located within the viewsheds of residences and viewer sensitivity could be moderate to high. Visual impacts, such as changes to viewsheds, changes to the character of the site, vegetation removal, and new sources of light and glare, could result from the operation of the facilities at this site. Implementation of the mitigation measures listed below would reduce any visual impacts to a less-than-significant level.

Extension of existing transmission lines and telecommunication lines to the site could affect views from the nearby residences and rural roads. Viewer exposure in this area would be relatively low, only a small number of rural residents would be affected, the transmission lines would be relatively distant from the residences and roads, and the existing transmission line is a dominant feature within the viewshed. In general, these new features introduced into the viewsheds by the proposed project would not limit or alter existing views from the rural roads or residences in terms of vividness, intactness, or unity. Visual impacts attributable to overhead utility lines would be less than significant.

Mitigation Measure 16-2: Implement Appropriate Aesthetic Treatment at the Aqueduct Pumping Plant and Pretreatment Facility Site

- Excess trench spoils from the FSCC pipeline construction should be contoured around the facilities at the site to the extent feasible to create a naturalistic earthen berm. On and around the periphery of the berm, vegetation would be planted in order to reduce aesthetic impacts (see mitigation measure below). This would minimize visual impacts to nearby residents and roadway travelers. Placement of earthen material and vegetation, combined with the visual dominance within the viewshed of the existing reservoir dike behind the site, would allow perceived changes in the view to be minimal. With the implementation of this mitigation measure, the vividness, intactness, and unity of this area would not be substantially affected by the proposed project.
- Facility design plans shall be coordinated with San Joaquin County prior to construction.
- Implementation of the mitigation measures, similar to those listed previously under Mitigation Measure 16-1, would reduce visual impacts to a less-than-significant level.

Alternative 6

Construction-Related Impacts

Construction of Alternative 6 is not anticipated to result in any significant impacts on visual resources.

Operation-Related Impacts

Impact 16-22: Change in Views of the Zone 40 Surface Water Treatment Plant Site

Visual changes associated with the location of the Zone 40 Surface WTP would be similar to that described in Alternatives 2–5. This visual impact would be significant. Implementation of Mitigation Measure 16-1 would reduce this impact to a less-than-significant level.

Impact 16-23: Changes in Visual Resources from Inundation of the Area Upstream of the Existing Pardee Reservoir (Upper Mokelumne River)

Enlarging the reservoir and raising existing water elevations would inundate a portion of the upper Mokelumne River. The river would continue to be a dominant feature in the landscape. The pastoral and natural aesthetic character of the existing Mokelumne River Canyon, represented by various vegetation types and little built environment, would be maintained. However, inundation of portions of the upper Mokelumne River would result in more standing water than flowing water along this stretch of the river. While substantial portions of the vegetated landscape would remain visually intact, much of the existing riparian vegetation along the river's edge would be affected by inundation and is likely to not survive with project hydrologic management patterns. In general, there would be a decrease in riverine environment and riparian habitat, which are significant visual resources. Several viewer groups would be affected by this inundation. While SR 49 motorists experience fleeting views, recreationists (such as those engaged in rafting or fishing) and Mokelumne River lodge visitors represent sensitive viewer groups with a high visual exposure and sensitivity to the upper Mokelumne River. This impact is exacerbated by the introduction of a potentially denuded zone ("bathtub ring") from water level fluctuation where there presently is not one. Therefore, this impact is considered significant and unavoidable. There is no mitigation.

Chapter 17

Cultural Resources

Chapter 17

Cultural Resources

Affected Environment

The term *cultural resource* is a general term for what are defined under federal environmental laws as "historic properties" and under California environmental laws as "historical resources." These resources can include, but are not limited to, archaeological sites from both prehistoric and historic times, historical places, important or exemplary buildings or engineered structures, modified landscapes, or locations of culturally important community events.

Regulatory Environment

Section 106 of the National Historic Preservation Act

Section 106 of the National Historic Preservation Act (NHPA) of 1966 requires that federal agencies, prior to an undertaking, take into account the effects of their undertaking on historic properties and afford the Advisory Council on Historic Preservation (ACHP) the opportunity to comment on these actions. There are five basic steps to following the Section 106 process:

1. Identify and evaluate historic properties.
2. Assess effects of the project on historic properties.
3. Consultation between the agency and the State Historic Preservation Officer (SHPO), and any other consulting parties, to resolve adverse effects on historic properties, usually resulting in a Memorandum of Agreement (MOA).
4. Submit MOA to ACHP for comments.
5. Proceed accordingly.

The specific regulations regarding compliance with Section 106 state that while the tasks necessary for compliance may be delegated to others, the lead federal agency—in this case Reclamation—has the ultimate responsibility for ensuring that Section 106 is completed according to the statute.

National Environmental Protection Act

NEPA requires that cultural resources be considered in assessing environmental impacts of the proposed federal project. Additionally, NEPA requires federal agencies to integrate NEPA compliance responsibilities with other federal environmental review and consultation requirements, such as Section 106.

The California Environmental Quality Act

CEQA requires that before approving a discretionary project, the lead agency must identify and examine the significant adverse environmental effects that may result from a project. CEQA guidelines define a significant historical resource as "a resource listed or eligible for listing in the California Register of Historical Resources" (Pub. Res. Code Sec. 5024.1).

Freeport Intake Facility to Mokelumne Aqueducts

The Freeport intake facility to Mokelumne Aqueducts project area (see Figures 2-1 and 2-2) is within California's Central Valley in the vicinity of the Sacramento River and east to Camanche Reservoir. Alternatives 2–5 and portions of Alternative 6 affect this area. The general historical context of the project region is described below, followed by discussions of cultural resources in specific locales within the project region.

The first use of California's Central Valley by humans occurred more than 12,000 years ago at the end of the Pleistocene era. The Central Valley during the Pleistocene era is thought to have been colder and wetter than today. Parts of the valley, particularly the riparian zones along the rivers, were vegetated with alder, pine, and fir (West 1997). The Central Valley was not as arid as it is today, and lakes—some quite large—were present. The economy of these first people was based on hunting the large animals that roamed the region. Because parts of the Sierra Nevada mountain range were covered with large glaciers, the Central Valley was a major movement corridor for animals and people. People used valley locations to hunt and camp and for other daily activities.

Artifacts of these activities probably exist throughout the Central Valley, but they are rarely found because most are deeply buried in the gravels and silts that have accumulated from erosion and river flooding over the last 5,000 years. A few archaeological sites in the project region are thought to date to the Pleistocene era (Johnson 1967; Peak 1981; Treganza and Heizer 1953). Other valley sites from this period, such as those around Tulare Lake in the San Joaquin Valley, are closer to the surface and are much better known (Wallace and Riddell 1991).

Approximately 12,000 years ago, many large animals that were the major food source of the first Californians became extinct because of warming temperatures, rising sea levels, and changing precipitation patterns at the end of the Pleistocene. The Central Valley gradually became both warmer and drier. Pine and riparian forests were slowly replaced with vegetation similar to the grasslands and oak forest found in the valley today. To survive, valley inhabitants developed food procurement strategies to make use of a more diverse range of smaller plants and animals.

As population continued to increase, and group territories continued to become smaller and more defined, the population density of the Delta exceeded most other areas of North America (Chartkoff and Chartkoff 1984). Patterns in the activities, social relationships, belief systems, and material culture continued to develop during this period, taking forms similar to those described by the first Europeans entering the area. Today, the groups that developed are called the Valley Nisenan, Plains Miwok, and Northern Valley Yokut.

Spanish explorers first visited the Central Valley in the late 1700s searching for sites suitable for inland missions. In 1772, Pedro Fages passed through the San Francisco Bay and the Delta and reached the mouths of the San Joaquin and Sacramento rivers. In 1793, Francisco Eliza sailed into the as-yet unexplored Sacramento River. Between 1806 and 1817, several other mission site reconnaissance expeditions were conducted. Gabriel Moraga entered the area several times between 1805 and 1817, during which time he is believed to have reached the American, Mokelumne, and Cosumnes rivers. Other notable explorations were carried out by Jose Antonio Sanchez in 1811 and Father Narciso Duran in 1817, who were looking for stolen cattle and horses and for mission runaways. The first European American to travel through the area was Jedediah Strong Smith in the late 1820s, who reported to the Hudson's Bay Company on the quantity and quality of furs in California and established the Sacramento Trail. Joseph Walker and Ewing Young, during separate excursions in the 1830s, followed his general path. (Gudde 1969; Kyle 1990).

The Spaniards' establishment of Franciscan missions along the California coast during the 1700s did not affect the Nisenan living in the project region to the extent that other indigenous groups were affected. American and Hudson's Bay Company trappers who entered the area in the late 1820s also had only a minimal effect on the indigenous population. However, an epidemic believed to be malaria swept through the Sacramento Valley in 1833. This epidemic wiped out entire villages and prompted survivors to evacuate their homes and move into the hills for protection from the disease. Only 25–50% of the Sacramento Valley's population survived the epidemic (Cook 1955).

Domestic sheep and cattle were introduced to central California after the secularization of the missions in the 1830s. By the 1860s, areas that were not under cultivation were occupied by grazing cattle and sheep. At that time, the cattle population had exceeded one million in California, 40% of which was in the Sacramento and San Joaquin Valleys. During summer, cattle herds generally were moved to the high elevations of the Sierra Nevada mountain range, where the weather was cooler and water was more abundant (Burchum 1981).

Although the higher elevations of the Sierra Nevada proved to hold richer gold deposits than the valley, Tertiary gravel channels and riverbars along the lower American, Cosumnes, and Mokelumne Rivers did lead to notable placer strikes in the Gold Rush years. Hydraulic mining techniques for freeing placer gold deposits from buried river banks were practiced throughout the 1860s and 1870s, and finally the bucket-line and doodlebug dredges went to work on the valley floor. The Gold Rush served as the impetus for the development of freight and passenger roads, as well as the development of early towns and cities (Gudde 1969; Kyle 1990). Both freight and people funneled through Sacramento before dispersing to the goldfields of the eastern foothills of the Sierra Nevada.

After the transcontinental railroad was completed in 1869, many people were enticed to California by the railroad companies offering cheap fares and the promise of rich agricultural land and gold. Agricultural ventures in California that provided staples for nearby communities expanded to supply the eastern United States. Delta areas were subject to reclamation efforts that included levees, ditches, and mechanical pumps. Ranching and agriculture continued to be the economic base of the Central Valley and Delta through the first half of the twentieth century.

Methods

Established historical and archaeological research and field methods were used to identify cultural resources from the intake facility to Mokelumne Aqueducts. Background research methods included a search of records at the California Historical Resources Information System (CHRIS), including the National Register of Historic Places (NRHP), California Register of Historical Resources (CRHR), California State Landmarks, and California Points of Historical Interest, archaeological site data, historical maps, and cultural resource studies. A records search also was conducted with the California Native American Heritage Commission, followed by correspondence with Native American representatives identified by the Commission. A number of local historical societies and individuals with knowledge of local resources were consulted in both Sacramento and San Joaquin Counties. Field methods included inspections where facilities were planned, but not formal surveys, throughout the project area in order to check the locations and conditions of known cultural resources, characterize cultural history of the area, and provide a general measure of sensitivity for the presence of currently unknown cultural resources. A summary of identified and potential cultural resources is presented in Table 17-1.

Table 17-1. Identified and Potential Cultural Resources: Freeport Intake Facility to the Mokelumne Aqueducts

		Project Components[1]									
			Pipeline Alignments								
Cultural Resource Sites	General Location of Cultural Site	Intake Facility	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5	Alternative 6	Canal Pumping Plant	Aqueduct Pumping Plant and Pretreatment Facility (Camanche Site)	Aqueduct Pumping Plant and Pretreatment Facility (optional Brandt site)
Walnut Grove Branch of the Southern Pacific Railroad	Intake Facility Site	X		X	X	X	X	X			
CA-SAC-44 Klotz Mound	Intake Facility Site	X		X	X	X	X	X			
P-34-639 Victory Trees along Freeport Blvd.	Intake Facility Site	X		X	X	X	X	X			
Three Prehistoric artifact scatters	Along Segment R					X	X	X			
P-34-605 (historic house less than one-quarter of a mile from Gerber Road)	Middle Portion of Pipeline Alignment (Gerber Road)			X	X	X	X	X			
P-34-714 (1920s era house)	Middle Portion of Pipeline Alignment (Gerber Road)			X	X	X	X	X			
JSA-EBMUD-30	FSCC			X	X	X	X				
JSA-EBMUD-31	FSCC			X	X	X	X				
JSA-EBMUD-32	FSCC			X	X	X	X				
JSA-EBMUD-33	FSCC			X	X	X	X				
JSA-EBMUD-34	FSCC			X	X	X	X				
P-39-000002	FSCC			X	X	X	X				

		Project Components[1]									
			Pipeline Alignments								
Cultural Resource Sites	General Location of Cultural Site	Intake Facility	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5	Alternative 6	Canal Pumping Plant	Aqueduct Pumping Plant and Pretreatment Facility (Camanche Site)	Aqueduct Pumping Plant and Pretreatment Facility (optional Brandt site)
P-39-000056	FSCC			X	X	X	X				
P-39-000058	FSCC			X	X	X	X				
P-39-000059	FSCC			X	X	X	X				
P-39-000284	FSCC			X	X	X	X				
JSA-EBMUD-9	FSCC			X	X	X	X				
JSA-EBMUD-26	FSCC			X	X	X	X				
JSA-EBMUD-27	FSCC			X	X	X	X				
JSA-EBMUD-28	FSCC			X	X	X	X				
JSA-EBMUD-29	FSCC			X	X	X	X				
P-39-000519	FSCC			X	X	X	X				
JSA-EBMUD-19	FSCC			X	X	X	X				
Br. No. 29C0230	FSCC			X	X	X	X				
Br. No. 29C0246	FSCC			X	X	X	X				
Br. No. 29C0249	FSCC			X	X	X	X				
Br. No. 29C0253	FSCC			X	X	X	X				
Br. No. 29C0254	FSCC			X	X	X	X				
Ranch complex at 25994 N. Elliot Road	FSCC			X	X	X	X				
Ranch complex at 16121 Liberty Road	FSCC			X	X	X	X				

[1] survey coverage (percentage of site surveyed) varies for each of the project components

Identified Cultural Resources from Intake Facility to Mokelumne Aqueducts

Freeport Intake Facility

The intake facility site was visited and a pedestrian survey was conducted to identify potentially significant cultural resources. The intake facility (E630318 N4259189) is located in the vicinity of a prehistoric archaeological site (P-34-71/CA-SAC-44), known as the Klotz Mound. This mound site was last recorded in 1934 as a village site 50 yards in diameter and containing human burials. The mound is reported as having been leveled, presumably for agricultural use. Even though this location has undergone heavy modification during the twentieth century, remnants of archaeological sites of this type typically remain below the water surface or under river levees. No exploratory studies have been undertaken to identify or define cultural deposits in the vicinity of this location.

The Walnut Grove Branch of the Southern Pacific Railroad is an abandoned railroad line that runs 33 miles from Sacramento to Isleton along the Sacramento River and Freeport Boulevard. The railroad corridor was previously determined to be eligible to the NRHP under Criterion A at the local level of significance (Maniery 1991a). The period of significance is 1909–1934. The railroad follows Freeport Boulevard near the eastern boundary of the intake facility.

Zone 40 Surface Water Treatment Plant

A brief field inspection was conducted along Bradshaw Road, between Gerber and Florin Roads; along Florin Road from Bradshaw Road to Excelsior Road; and along Gerber Road from Excelsior Road to Bradshaw Road in the area of the potential Zone 40 Surface WTP location. In addition to the brief field inspection, a record search was conducted along the above mentioned corridors. The setting was primarily open space with intermittent residential, single-family houses. Four previous cultural resource surveys were conducted in this area with approximately 20% survey coverage. A review of the 1856 and 1866 U.S. General Land Office (GLO) maps revealed within this area four roads, five fences, one schoolhouse, and two houses just west of Bradshaw Road, and one house just south of Elder Creek Road (U.S. General Land Office 1856, 1866).

Terminal Facilities and Optional Terminal Facility Settling Basins

Terminal facilities are within the corridors of segments K and N discussed below. No previous cultural surveys have occurred and no cultural resources have been recorded at the facilities sites.

No previous cultural surveys have been completed and no cultural resources have been recorded at the sites of optional terminal facility settling basins.

Canal Pumping Plant

No known recorded cultural resources exist in the immediate vicinity of the proposed pumping station. The closest recorded cultural resources are JSA_EBMUD-31 and JSA_EBMUD-32. Both of these sites are segments of historic road alignments. Presence of a creek to the immediate north of the facility indicates a potential for buried prehistoric sites in the vicinity.

Aqueduct Pumping Plant and Pretreatment Facility

The aqueduct pumping plant and pretreatment facility (Camanche site and optional Brandt site) are located along the proposed Segment X. Approximately 70% of this area has been previously surveyed. No known cultural resources have been recorded in the location or vicinity of the proposed plant. The optional Brandt site is located where the pipeline adjoins the Mokelumne aqueducts and is in an area that has been partially surveyed. There are no previously recorded cultural resources in the immediate vicinity of the optional Brandt site. The closest recorded sites are P-39-000058, P-39-000056, and P-39-000059. These sites are approximately 0.75 mile northwest of the intersection of the FSCC pipeline and the Mokelumne aqueducts. The project area is between two unnamed drainages. There is the potential to encounter buried prehistoric sites in this area.

Freeport Intake Facility to Zone 40 Surface Water Treatment Plant/Folsom South Canal Pipeline

Segment A

Segment A runs from the intake facility and connects with segments B and P. This area has been covered by previous surveys (Peak 1979a; Bouey and Herbert 1990). The current environment is characterized by residential development, an abandoned water treatment plant, a large water tank, a drainage canal and railroad tracks. Potentially affected cultural resources include the Klotz Mound (CA-SAC-44), Walnut Grove Branch Line Railroad, and the Victory Trees (P-34-639).. The Victory Trees have been recommended as eligible for listing on the National Register of Historic Places. The Victory Trees run on both sides of Freeport Boulevard from the intake facility location to just south of Pocket Road. The trees are elm trees grown from seeds requested by the Sacramento Post No. 1051 of the Veterans of Foreign Wars and sent by the French Agriculture Department in 1925. The seeds were specimens of tree types from World War I battlefields where United States soldiers lost their lives.

Segment B

Segment B follows the edge of the Sacramento River along Freeport Boulevard from the water tank waste disposal site intake area north to the intersection of Meadowview Road. This segment adjoins segments A, C, and P. Four surveys have been conducted in the vicinity of this segment (Bass 1985; Hupp 2001a, 2001b; Peak 1980a) covering approximately 30% of the segment.

One cultural resource, the Victory Trees (P-34-639), has been recorded along the segment.

Other potential resources along this segment include the Sacramento River levee, and the Walnut Grove Branch of the Southern Pacific Railroad. One road labeled as "Road to Sacramento" appears on the 1859 GLO map (U.S. General Land Office 1859).

Segment C

Segment C follows Meadowview Road and adjoins segments B and D. One survey (Rondeau 1979) has been conducted in the vicinity of the segment and covers approximately 20% of the segment. No cultural resources have been recorded along this segment. The 1859 GLO map shows the presence of a schoolhouse just off the current road, near the intersection of Freeport Boulevard and Meadowview Road (U.S. General Land Office 1859).

Segment D

Segment D follows Mack Road and adjoins segments C and E. No previous surveys have been conducted in this area. No cultural resources have been recorded for this segment and no cultural features appear on the 1859 GLO map (U.S. General Land Office 1859).

Segment E

Segment E follows Mack Road and is located in a mixed residential and commercial area. This segment adjoins segments D, F, Option 2, and U. No cultural resources were identified for this segment. The entire segment has been previously surveyed (Peak 1980b) for cultural resources. The 1855 GLO map shows the Stockton & Telegraph Road and the Upper Stockton Road bisecting the segment (U.S. General Land Office 1855a).

Segment F

Segment F follows Elsie Avenue and Wilbur Way and adjoins segments Option 2, E, G, and U. No cultural resource surveys have been conducted along this segment. No archaeological sites have been recorded along this segment.

Segment G

Segment G follows Gerber Road and adjoins segments Option 2, F, and H. No cultural resources surveys have been conducted nor have any sites been recorded for this segment.

Segment H

Segment H follows Gerber Road and adjoins segments G and I. No cultural resource surveys have been conducted and no cultural resources are recorded along this segment. The 1855 GLO map shows two historic roads bisecting this segment (U.S. General Land Office 1855a). The Southern Pacific Railroad also bisects this segment.

Segment I

Segment I follows Gerber Road and adjoins segment H, J, and L. Three cultural resource surveys bisect this segment (Havelaar 2001; Johnson 1974; Peak 1979b). Approximately 25% of the segment has been surveyed. P-34-714, a 1920s-era single family dwelling, was recorded along this segment. P-34-605 is a historic house less than 1 mile from Gerber Road. The 1856 GLO map shows two roads bisecting, and one agricultural field adjacent to, this segment (U.S. General Land Office 1856). Two bridges were noted during field inspection; one is associated with the Central California Traction Railroad. The second is one quarter-mile east of the intersection of the Central California Traction Railroad along Gerber Road.

Segment J

Segment J follows Bradshaw Road and adjoins segments I, K, and L. Approximately 10% of this segment has been previously surveyed (Johnson 1974). No cultural sites have been recorded along this segment.

Segment K

Segment K follows Florin Road and adjoins segment J. Approximately 5% of this segment has been previously surveyed (Johnson 1974; Slaymaker 1988). No cultural resources have been recorded along this segment.

Segment L

Segment L follows Gerber Road and adjoins segments I, J, and M. Approximately 20% of the segment has been surveyed (Johnson 1974). No cultural resources have been recorded within this segment.

Segment M

Segment M follows Gerber Road and adjoins segments L and N. One cultural resources survey has been conducted in this segment (Johnson 1974) which covers approximately 60% of the segment. No cultural resources have been recorded along this segment. The 1856 GLO map shows one road bisecting this segment (U.S. General Land Office 1856).

Segment N

Segment N follows Gerber Road and adjoins segments M and O. One survey (Johnson 1974) covered approximately 25% of this segment. No cultural resources have been recorded for this segment. The 1856 GLO map shows one road bisecting the segment (U.S. General Land Office 1856).

Segment O

Segment O follows Grant Line Road and adjoins segment N. No cultural resource surveys have been conducted nor have any cultural resources been recorded along this segment. The 1871 GLO map indicates that this segment abuts the historic Rancho Omochumnes (U.S. General Land Office 1871).

Segment P

Segment P follows I-5 and adjoins segments A, B, and Q. Approximately 70% of the segment has been previously surveyed (Russo 1978; Chavez 1982). One cultural resource, Victory Trees (P-34-639) along Freeport Boulevard, has been recorded along this segment.

Segment Q

Segment Q follows I-5 and adjoins segments P, R, and Option 1. This entire segment has been previously surveyed (Russo 1978; Chavez 1982). No cultural resources were recorded.

Segment R

Segment R does not correspond to an existing roadbed. This segment adjoins segments Q, Option 1, and S. Four cultural resource surveys (Chavez 1982; Peak 1979a; Russo 1978; and Sikes and Tremaine 2002) have been conducted in the vicinity of this segment, and approximately 100% of this alignment has been surveyed for cultural resources. The 1855 and 1859 GLO maps indicate swampland in the vicinity of this segment (U.S. General Land Office 1855a, 1859). Three prehistoric archaeological sites (baked clay scatters) were discovered during a 2002 pedestrian survey conducted by Tremaine & Associates for the Interstate 5/Cosumnes River Boulevard Interchange Project, which includes segment R. In addition, Tremaine & Associates (Sikes and Tremaine 2002) identified six archaeologically sensitive areas in segment R through an electromagnetic survey. Jones & Stokes conducted archaeological excavations to determine whether buried archaeological sites are present in the areas identified as sensitive. No archaeological sites were identified as a result of the excavations. A draft report will be submitted to Caltrans in June 2003.

Segment S

Segment S does not follow a road and adjoins segments R, Option 1 and T. The entire segment has been previously surveyed (Derr 1997; Johnson 1974; Peak 1979a, 1980a). No cultural resources have been recorded along this section. Cultural features noted on the 1855 historic GLO maps include the Stockton & Telegraph Road and a field in the vicinity of Franklin Boulevard (U.S. General Land Office 1855a).

Segment T

Segment T follows Cosumnes River Boulevard and adjoins segments S and U. Three previous cultural resource surveys (Derr 1997; Johnson 1974; Walden 1997) have been conducted. No cultural resources were recorded along the surveyed portion of this segment.

Segment U

Segment U partially follows Power Inn Road and adjoins segments F, Option 2, and T. Approximately 5% of this segment has been previously surveyed

(Derr 1994; Johnson 1974). No cultural resources have been recorded along this segment. The 1855 GLO map shows the Upper Stockton & Sacramento Road bisecting this segment (U.S. General Land Office 1855a).

Segment Option 1

Segment Option 1 follows I-5 and partially follows Beacon Creek. Segment Option 1 adjoins Q, R, and S. According to the records search results, this entire segment has been covered by previous surveys (Chavez 1982, 1983; Russo 1978). No cultural resources have been recorded along this segment. No cultural features were noted on the historic maps in the vicinity of this segment.

Segment Option 2

Segment Option 2 follows Power Inn Road and Gerber Road and adjoins segments E, F, G, and U. No cultural resource surveys have been conducted along the Power Inn Road portion of this segment. Approximately 10% of the Gerber Road portion of this segment has been surveyed (Johnson 1974) for cultural resources. No archaeological sites have been recorded for Segment Option 2.

Folsom South Canal to Mokelumne Aqueducts Pipeline

Segment V

This segment passes through land used for ranching during the 1800s and most of the 1900s. Massive feedlots located west of Clay Station Road and extensive vineyards located south of Angrave Road indicate that this area continues to be an active agricultural area. The segment is characterized by a mix of low-density middle- and late-twentieth century single family houses. Skunk Creek crosses this segment indicating a moderate potential for both prehistoric and historic period resources.

Approximately 70% of this segment has been surveyed (Jones & Stokes Associates, Inc.1997) for cultural resources. Three cultural resources (JSA-EBMUD-30, JSA-EBMUD-31, and JSA-EBMUD-32) have been previously recorded for this segment. JSA-EBMUD-30 is described as a segment of a historic road. JSA-EBMUD-31 is a 100-foot segment of Clay Station Road located near the intersection of Clay Station Road and Borden Road. JSA-EBMUD-32 is a 100-foot segment of Borden Road near the intersection of Clay Station Road and Borden Road. These three resources have not been evaluated for their eligibility for listing on the National Register of Historic Places.

Segment W

This segment crosses several drainages, among them Dry Creek, Coyote Creek, and a number of unnamed streams. The proximity of this segment to these creeks increases the probability that prehistoric period archaeological sites may occur. Generally, this alignment features a mix of residential and agricultural uses.

Approximately 65% of this segment has been surveyed (Jones & Stokes Associates, Inc. 1997; Maniery 1991b; Napton 1993) for cultural resources. One cultural resource has been previously recorded for this alignment. This resource (JSA-EBMUD-19) is described as a 100-foot segment of Liberty Road. This segment includes the following five bridges: 29C0230 (Coyote Creek), 29C0249 (Dry Creek), 29C0253 (Dry Creek Overflow), 29C0254 (Coyote Creek), and 29C0246 (South Fork Coyote Creek). All of these bridges are ineligible for the National Register of Historic Places.

In addition to the above, two historic ranch complexes are located adjacent to this alignment. The first of these is located at 25994 North Elliot Road and consists of a house, a barn, a cattle chute, and various outbuildings. A second ranch complex is located at 16121 Liberty Road and consists of a house, a barn, and a cattle chute. Both ranch complexes appear to date to the first half of the twentieth century. Neither complex has been recorded or evaluated for inclusion on the National Register of Historic Places.

Segment X

This segment crosses the Mokelumne River and several unnamed drainages, suggesting the potential for prehistoric resources associated with fresh water sources. The alignment passes through a mix of agricultural and residential areas.

Approximately 70% of this segment has been surveyed (Derr 1981; Jones & Stokes Associates, Inc. 1997; Napton 1993) for cultural resources. Ten cultural resources have been previously recorded for this segment or are known to occur within one half-mile of this segment. These cultural resources include JSA-EBMUD-9, JSA-EBMUD-26, JSA-EBMUD-27, JSA-EBMUD-28, and JSA-EBMUD-29. JSA-EBMUD-9 is described as two segments of SR 12. JSA-EBMUD-26 is a late nineteenth century ranch archaeological site. JSA-EBMUD-27 is an early twentieth century mining site consisting of mining features, a refuse scatter, and a concrete water tank. JSA-EBMUD-28 is an early twentieth century ranch site containing a number of structure and feature remains. JSA-EBMUD-29 is described as a segment of an historic road. None of these resources have been evaluated for inclusion on the National Register of Historic Places.

In addition to these resources, the Kentucky Branch of the Southern Pacific Railroad (P-39-000002) crosses this alignment. This resource has been determined to be ineligible for listing on the National Register of Historic Places. Four previously recorded cultural resources (P-39-000056, P-39-000058, P-39-000059, and P-39-000284) occur within a one half-mile radius of this alignment. Government Land Office plat maps of this area from the 1850s through the 1870s show three historic roads in close proximity to this alignment. In addition to these resources, two bridges on Cord Road may be historic features.

Segment Option 3

The segment passes through a mix of agricultural lands and low-density middle- and late-twentieth century single family houses. The stream crossings at Dry Creek and Goose Creek suggest the potential for prehistoric period resources associated with stream crossings.

Approximately 70% of this segment has been surveyed (Jones & Stokes Associates, Inc. 1997) for cultural resources. Two cultural resources (JSA-EBMUD-33 and JSA-EBMUD-34) have been previously recorded for this segment. JSA-EBMUD-33 is described as a 200-foot segment of Mackville Road. JSA-EBMUD-34 is described as a 100-foot segment of an unnamed historic road. These two resources have not been evaluated for their eligibility for listing on the National Register of Historic Places. The 1855 GLO map shows four historic roads and at least one historic fence in close proximity to this alignment (U.S. General Land Office 1855b).

Enlarge Pardee Reservoir

Pardee Reservoir is located along the Mokelumne River in the foothill region of the Sierra Nevada Mountains (see Figure 2-3). A brief overview of the historical context of the project area, including a description of the prehistoric, ethnographic, and historical settings, follows.

Much of what is known of the project area’s prehistoric archaeology comes from studies associated with a series of water resources projects along the western foothills of the Sierra Nevada mountain range during the 1960s and 1970s. These projects are:

- Auburn Dam–American River
- Dry Creek–North of the Mokelumne River
- Camanche Reservoir–Mokelumne River
- New Melones–Stanislaus River
- New Hogan Reservoir–Calaveras River
- Pacific Gas & Electric–along the Mokelumne River

Prehistory in the Central Valley has been classified into distinct time intervals based on increased socioeconomic complexity and technological advancements. The earliest aboriginal people represent the Fluted Point and Western Pluvial Lakes Traditions, dating from approximately 11,500 to 7,500 years ago. The small, egalitarian, migrating groups had limited technology; their subsistence pursuits included hunting and exploiting resources along lakes and rivers. This was followed by an increase in Native American populations coinciding with the use of the mano and metate for seed grinding and wide-stemmed projectile points after 7,500 years ago (Moratto 1984).

The Early Horizon (6,500 to 4,500 years Before Present [B.P.]) is marked by a reduction in the size of projectile points, largely attributed to the use of the bow-and-arrow. Plant processing became intensified, and mortars and pestles were introduced. During this time, artifacts associated with ornamental and ritual use include *Olivella* beads (spiral loped and rectangular), *Haliotis* pendants, quartz crystals, and baked clay and alabaster charmstones. Mortuary practices included fully extended burials (ventral side) with western orientation and no cremation (Heizer 1949; Beardsley 1948).

The Middle Horizon (3,500 to 1,500 years B.P.) is characterized by increased exploitation of resources, including hunting, fishing, and plant gathering. Artifacts include large, unstemmed obsidian projectile points; bone artifacts; pigment mortar and pestles; Olivella spiral-loped and rectangle beads; and Haliotis pendants. Charmstones of the D5 form appear, and killing of mortuary objects is common. Tightly flexed burials were positioned on the side or back.

Artifacts associated with the Late Horizon (1,500 years B.P. to historic times) include small projectile points, Haliotis banjo-shaped ornaments, Olivella bead forms 3e and 3a, clam shell beads, baked clay objects, bird bone tubes, and wooden fish hooks. Mortuary practices are characterized by flexed burials and cremations (Lillard et al. 1939).

Pardee Reservoir is located within an area known to be inhabited by the Northern Sierra Miwok during ethnographic times. The Northern Sierra Miwok are considered to be closely related to four other groups collectively referred to as the Eastern Miwok, each having a distinct language and culture. Three tribes make up the Sierra Miwok language group: Northern, Central, and Southern Sierra Miwok. The Northern Sierra Miwok territory extends across the foothills and mountains of the Mokelumne River and Calaveras River drainages (Levy 1978).

It is believed that the Northern Sierra Miwok came into the Sierra Nevada mountain range and its foothills from the central California Delta region. Linguistic evidence points to a relatively late arrival (about 800 years ago) of the Northern Sierra Miwok. This corresponds to the Late Period of the Central California taxonomic sequence (Levy 1978).

Similar to ethnographically described populations throughout California, the Northern Sierra Miwok shared a common language with the Utian (Miwok-

Costanoan) language family, but were not united politically or otherwise. Instead, populations were organized within a series of autonomous tribelets that were composed of a principal village surrounded by a localized patrilineage (Levy 1978). Miwok settlement was tied into their subsistence strategies. They occupied permanent villages located at lower elevations than the foothills during the spring and summer. The Sierra Miwok would also descend into plains of the Central Valley to hunt large animals (such as antelope and tule elk) not present in the mountains. Wild plant food formed the bulk of their diet through most of the year. Acorns were the main staple, and were gathered and stored along with nuts and other seeds for consumption during the winter and spring. Levy (1978) lists the interior live oak and the blue oak as most significant for acorn resources in foothill communities, while black oak was important at higher elevations. The Miwok would annually burn their land in late summer to stimulate growth for food plants for the coming year. Hunting and fishing likewise had a seasonal rhythm based on animal migration and birthing patterns. Meat consumption was the highest in the winter months when plant resources were generally limited to stored food.

Calaveras County was one of California's original 27 counties, named by the Spanish explorer Gabriel Moraga during his 1808 expedition (Hoover et al. 1966). Throughout the following decades, the foothills in the region of the Calaveras and Mokelumne Rivers were utilized periodically by hunters and trappers from the Hudson's Bay Company, who established seasonal camps and trails along many rivers and streams that flowed from the Sierra Nevada mountain range. The name "Mokelumne" apparently was derived from the name of a Plains Miwok village located in what is now San Joaquin County. The name was applied first to the river itself during the United States Exploring Expedition of 1841, led by Charles Wilkes (Browning 1986; Gudde 1969).

The Pardee Reservoir is directly west of the Mother Lode Region of the Sierra Nevada and within the historic mining area identified geographically as the Campo Seco–Valley Springs district (Clark 1970). Miners first arrived in this area in 1849, and the banks of the Mokelumne River were quickly populated by dozens of mining camps. Gold was found in a variety of mineral deposits throughout the district, including recent stream gravels, Eocene terrace gravels, narrow quartz veins, and massive copper and zinc sulfide deposits in the Campo Seco area, where gold was later produced as a by-product of copper mining (Clark 1970).

During the late nineteenth century and the beginning of the twentieth century, the project location was the site of pioneering attempts to generate hydroelectric power and transport it over long distances (Chavez et al. 1984). Early attempts at hydroelectric power and transmission were promoted by Price Andre Poniatowski, a Polish-born nobleman with high connections and access to capital. (Poniatowski was married to Elizabeth Sperry who was the sister-in-law of a San Francisco banker, William Crocker.) Poniatowski and Crocker formed the California Exploration Company (Dean 1960). Old water systems originally used to generate power were used (Seele n.d.). The Blue Lakes power plant was built on the Mokelumne in 1897, and the Standard Electric Company was formed. Transmission lines supplied electricity to Mokelumne Hill, Angel Camp, local mines, and later Stockton (Chavez et al. 1984). The success of transmission of electricity over long distances spurred the construction of the larger Electra Powerhouse, which, in 1902, was the first hydroelectric powerhouse to supply electricity to San Francisco. Standard Electric Company later merged with other companies to form PG&E (Chavez et al. 1984).

Water conveyance systems in the project area began with the need for supplying water to mining efforts. Hundreds of miles of canals were built in the Sierra Nevada foothills during the height of hydraulic mining (JRP & California Department of Transportation 2000).

As the gold rush declined, existing water conveyance systems related to mining were opportunistically employed not only for hydroelectric power but for local agriculture (JRP & California Department of Transportation 2000).

EBMUD was formed in 1923 through the cooperative effort of nine communities: Oakland, Berkeley, Alameda, Piedmont, Emeryville, Albany, San Leandro, Richmond, and El Cerrito (Noble 1970). The first project to be undertaken by the new utility district was a monumental, as well as urgent, task: that of providing its customers with a continual supply of dependable, pure, fresh water that would have to be transported from the Sierra Nevada mountain range across the great Central Valley via aqueduct.

The site chosen for the reservoir was above the old mining town of Lancha Plana on the Mokelumne River, where the river flowed through a wide and deep natural ravine before plunging into a steep rock gorge ideally suited for damming and the generation of hydropower. Although 94 miles from Oakland, water from the reservoir could flow through the pipeline entirely by force of gravity all the way to the East Bay plain (Noble 1970). The increase in property values and taxation potential at the reservoir site was such that development was welcomed by the majority of residents and local government authorities. A $39 million district bond issue was awarded to begin financing the project, and after a number of skirmishes over the acquisition of land and water rights in the reservoir area, construction of the dam site began in July of 1927.

Construction camps just south of the dam site were readied to house the 1,500 men that would be employed during the peak of the construction activities. Nearby Campo Seco was transformed into a roaring camp reminiscent of the mining days, with places of prostitution and gambling set up in the remaining old adobes. The Jackson Creek and South spillways of the reservoir were completed early in 1928 and the water began to collect in the reservoir in March of that year. In June of 1929, the dam, powerhouse, and aqueduct were ready for operation and the first water from the Mokelumne River soon reached the East Bay to be stored for use in the nearly empty San Pablo Reservoir. The Pardee Reservoir was officially dedicated on October 19, 1929 (Noble 1970).

After the Gold Rush subsided, economic pursuits in the region diversified when some miners turned to agriculture-gardening and fruit growing (Chavez et al. 1984). In general the landscape of the region did not lend itself to large-scale agriculture. Some small scale agricultural production did occur through limited orchard and vineyard development and produce for local markets (JRP & California Department of Transportation 2000). Although farming was never on a large scale, there was considerable farming activity around the Middle Bar, Hunt Gulch, and Poorman Gulch areas.

Methods

Several methods were used to identify cultural resources within the Enlarge Pardee Reservoir project area that includes the expanded Pardee Reservoir, four saddle dams, one recreation facility, and the new replacement dam. The methods to identify cultural resources included a search of records at CHRIS, including the National Register of Historic Places, California Register of Historical Resources, California State Landmarks, California Points of Historical Interest, archaeological site data, historical maps, and cultural resource studies. A record search also was conducted with the California Native American Heritage Commission, followed by correspondence with Native American representatives identified by the Commission. Local historical societies were contacted. Information was gathered from files at the EBMUD's offices in Oakland, California. Previous cultural resource surveys cover more than 50% of the project area. This level of coverage is adequate to assess the types of cultural resources likely to be encountered in the unsurveyed portions of the project area. Available data on known cultural resources is summarized in the following section and in Table 17-2.

Identified Cultural Resources at Pardee Reservoir

The enlargement of Pardee Reservoir would affect two cultural resources that are listed on the NRHP: Pardee Dam and the Middle Bar Bridge. Two other cultural resources that are listed on the CRHR would be affected: Middle Bar and Big Bar mining sites. Other known cultural resources potentially affected by reservoir operation- or construction-related activities for enlargement of Pardee Reservoir are summarized in Table 17-2. There is a potential that inundation may flood existing mine shafts. A number of known sites have records that have not been assigned California trinomials, and CHRIS does not have those records. The sites summarized in Table 17-2 are at or below approximately 614 ft. It was noted in some cases that the elevation on the site record did not match the map location elevation.

Pardee Dam, Spillway, and Saddle Dams

The Pardee Dam, constructed from 1927 to 1930, was found to be significant at the State level under the NRHP criteria A and C. Criterion A *(associated with events that have made a significant contribution to the broad patterns of our* *history)* applies for its role in the public works history of California. Criterion C *(embodies the distinctive characteristics of a type, period, or method of construction, or represents the work of a master, or that possess high artistic values, or that represent a significant and distinguishable entity whose components may lack individual distinction)* applies as an important example of the curved gravity concrete dam and as an example of a master designer Arthur Powell Davis.

Under the NRHP, Pardee Dam is considered a discontinuous historic district with five contributing elements and no noncontributing elements. The five major interconnected elements include the dam, south spillway, Jackson Creek spillway, powerhouse, and intake facility tower.

The dam is 575 feet high at the crest and has a base that is 225 feet thick. Common to engineering structures completed in the 1920s and 1930s the dam is treated with architectural details to soften its massive appearance. Architectural details included a series of small towers along the crest of the dam each with a decorative light standard.

William Mulholland, General George Goethals, and the former director of the United States Reclamation Service, Arthur Powell Davis, were brought on board and formed a highly notable team for the project. Davis was to serve as the chief engineer and general manager for the project with Mulholland and Goethals serving as consultants. Although the building of Pardee Reservoir is considered an accomplishment of a highly qualified group of engineers, it is Davis who is attributed with the primary design authorship. Davis is considered a pivotal figure in twentieth century dam design (Mikesell 1994).

At the time of construction, Pardee was noted as being the tallest dam in California and the third tallest in the United States, and creating the third largest reservoir in the United States (Mikesell 1994). The sheer mass of Pardee makes it an exemplary model of a curved/arched gravity dam.

Other identified cultural resources in the vicinity include Sites DS-1 through DS-6. Site DS-1 is a mining-related site. Features at the site include a mine shaft, seven prospect pits, one foundation, one tent or cabin pad, waste rock piles, and a dirt road.

Site DS-2 is a historic-period site that includes a cement cylinder retaining wall, a structure pad, a dry-stacked fieldstone retaining wall, a level soil area with chicken wire, and a trash dump.

Site DS-3 is a historic dump. The dump is continuous and bisected by a dirt road that appears to have been present since the dump was in use. A ditch runs through the site (Site DS-6). There is a sparse scatter of garbage (metal wood, 1930s car) on the ridge, upslope of the drainage. It appears that the refuse was dumped from the ridge into the drainage area. The dump is likely associated with the construction of Pardee Dam (Ballard et. al. 1997).

Table 17-2. Identified and Potential Cultural Resources: Enlarge Pardee Reservoir

Site Type/Theme	Site No.	Reference	Site Features	Elev. (ft)	Area (m^2)	Quad Location	NRHP/CRHR Eligibility	Comments
Historic– Water Systems/ Engineering	Pardee Dam	JRP 1996, Mikesell 1994, Herbert and Mikesell 1995	Pardee Dam, South Spillway, Jackson Creek Spillway, powerhouse, intake facility tower	225	N/A	Jackson and Valley Springs	Yes, listed on NRHP, 710/95 Criterion A and C	HAER completed (Herbert and Mikesell 1995)
Historic–Mining Settlement	P-S-12	PAR 1992	French Bar; stone walls, foundations, rock walls and retaining walls for ditches and trails, tent or other mining related features	560–720	104,138	Jackson	Undetermined; recommended for eligibility by Parr, 1992.	Recommended archival research and possibly excavation.
Historic–Mining Settlement	D-3	Pacific Legacy 1997	Earthen ditch known as Kreth Ditch	580	Unknown	Jackson Creek	Undetermined; Pacific Legacy, 1997, suggests not eligible	None
Historic Settlement	PD-2	Pacific Legacy 1997	Nine formed concrete pier footings	580	Unknown	Jackson Creek	Undetermined: Suggested not eligible	None
Historic–Homestead	PD-1	Pacific Legacy 1997	Wooden barn, introduced ornamental plants and fruit trees, stacked rock alignments, small rock walls, historic debris	580-600	11,304	Jackson Creek	Undetermined; Pacific Legacy 1997 suggests not eligible	None
Historic–Placer Mining	P-S-11	PAR 1992	Linear rock wall, possible mining and diversion channel	600	11,190	Jackson	Undetermined; recommend further work (Parr 1992)	Potential for buried deposits, maybe old 1870s road
Historic–Mining Settlement	CA-CAL-956H	Chavez et al.1984	Big Bar; depression-era houses and older houses, historical bridge abutments, cables, concrete footings, toll house, roadbeds, adits, pits, pocket mines, terraces, ditch with penstock, concrete piers, tailing piles	600–700	117,750	Mokelumne Hill	Undetermined; Chavez, et al. 1984, suggest not eligible	California Historical Landmark No. 41

Site Type/Theme	Site No.	Reference	Site Features	Elev. (ft)	Area (m^2)	Quad Location	NRHP/CRHR Eligibility	Comments
Historic–Mining Settlement	CA-AMA-280H	Chavez et al. 1984	Adits, shafts areas of ground sluicing and placer mining, ditches, possible smelters, habitation terraces, dry-laid stone walls and stone lined ditch, penstock, possible stamp mill foundation, roadbeds, tailings, historic artifacts	600–800	98,125	Mokelumne Hill	Undetermined; Chavez et al. 1984 suggest not eligible	L.K. Hall and Confidence Quartz Mine
Historic–Structure, Truss Bridge	Middle Bar Bridge	OHP #055824	Bridge built by Clinton Bridge and Iron Works	600	N/A	Mokelumne Hill	Yes, Listed on NRHP 12/24/85	Bridge #306 16
Historic–Mining	P-S-1	PAR 1992	Two mine shafts, tailing pile, roadbed	605–710	30,656	Jackson	Undetermined; Parr 1992 suggest it is not	I.Q. Horton and J.P. Hase homestead and mine
Historic–Quartz Mine	CA-AMA-298H	Chavez et al. 1984	Adit, shaft, possible tent or house terrace, rock-lined ditch, waterwheel footing, concrete bridge footing, roadbed, tailings, historic artifacts	640–800 (mapped below 613)	54,940	Mokelumne Hill	Undetermined; Chavez, et al. 1984 suggest not eligible	Kearsing Mine
Historic–Placer Mine	CA-CAL-953H	Chavez et al. 1984	Two dry-laid stone foundations and terraces for structures, three concrete footings, and a platform for a pump, roadbed, ditch with flume pipe, power lines, rails, tailings	680 (mapped below 625)	35,325	Mokelumne Hill	Undetermined; Chavez et al. 1984 suggest not eligible	Placer mine
Historic–Industrial Site	CA-AMA-228H	Chavez et al. 1984	Blue Lakes Powerhouse, foundations, elements of the penstock, dry-laid stone retaining walls, dry-laid stone ditch	680	8,831	Mokelumne Hill	Undetermined; Chavez et al. 1984 suggest not eligible	Site of Blue Lakes Powerhouse

Site Type/Theme	Site No.	Reference	Site Features	Elev. (ft)	Area (m^2)	Quad Location	NRHP/CRHR Eligibility	Comments
Historic–Mining Settlement	CA-CAL-964H	Chavez et al. 1984	James Bar or Lower Bar; ruins of water-powered compressor plant, dry-laid stone walls and foundations for houses, stores, and other structure; excavated storage pit; mining shafts; adits; ditches; roadbeds; abundant historic artifacts	700–1200 (according to site map the site extends to Pardee Reservoir)	706,500	Jackson	Undetermined; probably eligible, see Chavez et al. 1984.	
Prehistoric–Native American Occupation	P-S-13	PAR 1992	Bedrock mortar station, lithic and groundstone scatter	540	667	Jackson	Undetermined; recommended for eligibility by Parr 1992.	None
Prehistoric–Native American Occupation	P-S-4	PAR 1992	Bedrock mortar station with three mortar holes	560	126	Valley Springs	Undetermined; Parr 1992 suggests not eligible	None
Prehistoric–Native American Occupation	P-S-5	PAR 1992	Two bedrock mortar stations	560	79	Jackson	Undetermined; Parr 1992 suggests not eligible	None
Prehistoric–Native American Occupation	CA-AMA-299	Chavez et al.	Three bedrock mortar stations with possible midden	580	600	Mokelumne Hill	Undetermined; probably eligible, see Chavez et al. 1984.	None

Site Type/Theme	Site No.	Reference	Site Features	Elev. (ft)	Area (m^2)	Quad Location	NRHP/CRHR Eligibility	Comments
Prehistoric	CA-AMA-18	Chavez et al.	Shallow midden	600	2,000	Mokelumne Hill	See CA-AMA-18(A)	CA-AMA-19/H(a), CA-AMA-19/H(b), CA-AMA-19, CA-AMA-18/H, CA-CAL-968/H, CA-AMA-18(a), CA-AMA-18(b) and CA-AMA-18 are all within close proximity. It is possible that some are duplicated site data.
Prehistoric–Native American Occupation	CA-AMA-18(A)	Chavez et al.	Midden, lithic scatter, groundstone fragments, faunal bone, hematite, charcoal, historic artifacts	600	1,099	Mokelumne Hill	Undetermined; probably eligible, see Chavez et al. 1984	This site is located within CA-AMA-18/CA-CAL-0968 site boundary
Prehistoric–Native American Occupation	CA-AMA-18(B)	Chavez et al. 1984	Dense midden, fire cracked rock, lithics, faunal bone, charcoal, hematite, groundstone fragments, historic artifacts	600	4,710	Mokelumne Hill	Undetermined; probably eligible, see Chavez et al. 1984	This site is located within CA-AMA-18/CA-CAL-0968 site boundary
Prehistoric–Native American Occupation	P-S-2	PAR 1992	Lithic and groundstone concentration	600	11,492	Jackson	Undetermined; recommended for eligibility by Parr 1992	None
Prehistoric–Native American Occupation	CA-AMA-282	Chavez et al. 1984	Two bedrock mortar stations; each station has one mortar cup	600	300	Mokelumne Hill	Undetermined; Chavez et al. 1984 suggests not eligible	None
Prehistoric–Native American Occupation	P-S-3	PAR 1992	Lithic scatter with bedrock mortar station consisting of four outcrops with one mortar cup each	620–640	2,426	Jackson	Undetermined; recommended for eligibility by Parr 1992	None

Site Type/Theme	Site No.	Reference	Site Features	Elev. (ft)	Area (m^2)	Quad Location	NRHP/CRHR Eligibility	Comments
Prehistoric–Native American Occupation	CA-CAL-951	Chavez et al. 1984	Bedrock mortar station with one outcrop with seven mortar cups	620	14	Mokelumne Hill	Undetermined; probably eligible, see Chavez et al. 1984	Possibly associated with CA-CAL-959-H
Prehistoric–Native American Occupation	CA-Cal-969	Chavez et al. 1984	Three bedrock mortar stations, one mano (stone with flat side used to grind food) fragment, possible midden	620	275	Mokelumne Hill	Undetermined; probably eligible, see Chavez et al. 1984	This site is located within CA-AMA-18/CA-CAL-0968 site boundary
Prehistoric	CA-AMA-19	Chavez et al 1984	Lithic scatter. Site recorded by J. Davis in 1953	600	1,000	Mokelumne Hill	See CA-AMA-19/H (A)	CA-AMA-19/H(a), CA-AMA-19/H(b), CA-AMA-19, CA-AMA-18/H, CA-CAL-968/H, CA-AMA-18(a), CA-AMA-18(b) and CA-AMA-18 are all within close proximity. It is possible that some are duplicated site data.
Prehistoric/Historic–Native American Occupation/ Placer Mining/ Homestead	CA-AMA-19/H(A)	Chavez et al. 1984	Shafts, mining cuts, ditches, tailings piles, walls for corral, probable house walls, bedrock mortar station	560–800	125,600	Mokelumne Hill	Undetermined; probably eligible, see Chavez et al. 1984	Location of Hunt Gulch (placer mining) and early homestead
Prehistoric/Historic –Native American Occupation/ Ranching	P-S-10	PAR 1991	1861 Wildermuth House; rock fences, sandstone building, barn, possible house pits, midden lithic scatter and bedrock mortar stations	585–665	68,571	Valley Springs	Undetermined; recommended for eligibility by Parr 1992	Building has been reconstructed

Site Type/Theme	Site No.	Reference	Site Features	Elev. (ft)	Area (m^2)	Quad Location	NRHP/CRHR Eligibility	Comments
Prehistoric/Historic–Native American Occupation/ Mining	P-S-7	PAR 1991	Piled and stacked rock, mining test pits, lithics	585–670	25,524	Jackson	Undetermined; recommended for eligibility by Parr 1992	Archival search for historic site
Prehistoric/Historic–Native American Occupation/Ethnic Mining Settlement	P-S-8	PAR 1991	Dwelling pads, waste rock reinforced rock trails, Asian or Italian ovens, bedrock mortar station, groundstone and lithic scatter	595–650	58,420	Jackson	Undetermined; recommended for eligibility by Parr 1992	None
Prehistoric/Historic–Native American Occupation/Placer Mining	P-S-6	PAR 1992	Two rock foundations, earthen pad, depression, two rock dams, five prospect pits, prehistoric artifact scatter	600–700	94,812	Valley Springs	Undetermined; recommended for eligibility by Parr 1992	Noted on 1870 Plat map; may contain subsurface material
Prehistoric/Historic–Native American Occupation/Mining Settlement	CA-AMA-18/H & CA-CAL-968/H	Chavez et al. 1984	Middle Bar Mine and settlement; shafts, adits, ditches, roadbeds, concrete stamp mill foundations, hoisting works ruins, tailing piles, dry-laid stone features (tent, ramada platforms, house and commercial structural foundations), abundant historic artifacts	600–760	1,036,200	Mokelumne Hill and Jackson	Undetermined; probably eligible, see Chavez 1984	Two historical burials recorded: child in Sargent graveyard and adult in the "little graveyard at Middle Bar;" California Historical Landmark No. 36. Within the site boundaries are three prehistoric sites: CA-CAL-0969, CA-AMA-18(A), and CA-AMA-18(B)
Prehistoric/Historic–Native American Occupation	CA-AMA-19/H(B)	Chavez et al. 1984	Dense midden with fire-cracked rock, lithics, faunal bone, historic artifact	560–800	4,710	Mokelumne Hill	Undetermined; probably eligible, see Chavez et al. 1984	This is a smaller prehistoric site within the larger historic site of CA-AMA-19/H(A)

Site Type/Theme	Site No.	Reference	Site Features	Elev. (ft)	Area (m^2)	Quad Location	NRHP/CRHR Eligibility	Comments
Prehistoric/Historic–Native American Occupation/Ranch	CA-CAL-967/H	Chavez et al. 1984	Garaventa Homestead and Ranch; house foundation and mud-mortared stone walls, dry-laid schist wall (baking oven), placer mining	600–760	196,250	Mokelumne Hill	Undetermined; probably eligible, see Chavez et al. 1984	CA-CAL-103 is within the boundary of CA-CAL-0967
Historic–Mining	DS-1	Pacific Legacy 1997	One shaft, seven prospect pits, one foundation, one tent or cabin pad, one dirt road	540–600	58,5216	Valley Springs	Undetermined; site record indicates integrity of site is substantially impaired	None
Historic	DS-2	Pacific Legacy 1997	Rectangular pad, small level area, fieldstone retaining wall, stacked cement cylinder retaining wall, and a dump	580	1,758	Jackson	Undetermined; site record indicates that integrity is poor	None
Historic–Dump	DS-3	Pacific Legacy 1997	Continuous historic dump situated on in a drainage most likely associated with Pardee Dam construction	445–290 according to site record. Note that USGS maps indicate elev is 445–600.	58,875	Jackson	Undetermined; site record indicates that the site integrity has been retained	None
Historic–Road System and Structures	DS-4	Pacific Legacy 1997	The northern locus consists of two stacked retaining walls three terraced roads, and a continuous trash scatter. The southern Locus consists of a formed concrete foundation and associated concrete footings, metal chutes, large sections and piles of concrete slurry, and a continuous trash scatter	400–500	9,146	Jackson	Undetermined; site record indicates that site integrity is impaired	None

Site Type/Theme	Site No.	Reference	Site Features	Elev. (ft)	Area (m^2)	Quad Location	NRHP/CRHR Eligibility	Comments
Historic– Logging	DS-5	Pacific Legacy 1997	Wooden structure, possible loading dock, associated skid trails, a road, and a section of cement	330	5,417	Jackson	Undetermined; site record indicates that site integrity is impaired	None
Historic– Linear Water Conveyance	DS-6	Pacific Legacy 1996	Ditch, minimally several hundred meters of ditch is supported on the north side by stacked retaining wall	380	Undeter-mined	Jackson	Undetermined; site record indicates that the overall integrity has been impaired	None
Prehistoric– Bedrock Mortar Stations	DS-7	Pacific Legacy 1997	Three bedrock mortar stations with a total of four bedrock mortars	620 (from site map)	5,672	Valley Springs	Undetermined; site record indicates that site integrity has been impaired	None

Site DS-4 is a historic site with the remnants of a road system structure foundations associated with the construction of Pardee Dam. The site is divided into north and south loci. Features at the southern locus include a concrete foundation and associated concrete footings. The northern locus contains two stacked-rock retaining walls. Both southern and northern loci have three terraced roads with road cuts and talus piles.

Site DS-5 is associated with logging. Features recorded at this site include a wooden wharf-like structure built into a hill, a road, a dendric system of skid trails and associated soil berm (all trails fan out from the wooden Wharf-like structure), and a section of formed concrete embedded into the hillside.

Site DS-6 is described as a linear water conveyance system. The site is situated along the 380foot contour interval on the south side of the Mokelumne River along the east side of Rag Gulch. The linear water conveyance system is described as having been destroyed in places from construction of the Pardee Dam.

Inundation Zone 601 Feet Elevation to 614 Feet Elevation

A total of fifteen historic sites, 16 prehistoric sites, and five multi-component sites, excluding the sites described in this section, were identified in the inundation zone below 614 feet elevation (Table 17-2).

The Middle Bar Bridge (Bridge #30C-16) was built in 1912 and is listed on the NRHP. The bridge is located at the upstream end of the reservoir. The bridge, spanning 204 feet across the Mokelumne River, is near the town of Paloma. It is an example of a steel Pratt truss bridge with a one-lane single span. This is one of two remaining bridges in California built by Clinton Bridge and Iron Works. The Clinton Bridge and Irons Works built thousands of bridges in the West. The Middle Bar Bridge is significant under Criterion A and Criterion C.

Although not listed on the NRHP or CRHR, both Big Bar (No. 41) and Middle Bar (No. 36) mining sites are listed as California Historical Landmarks. The site of the mining town of Middle Bar is currently inundated by Pardee Reservoir part of each year. Middle Bar is located 2.8 miles south of SR 49 on Middle Bar Road at the Mokelumne River, 4.5 miles south of the town of Jackson. The site is on both sides of the Mokelumne River, connected by Middle Bar Bridge.

After a visit in 1850, Friedrich Gerstaecher described Middle Bar as a “little town or mining place.” The remains of the Middle Bar archaeological site (CA-AMA-18/H and CA-CAL-0968/H) is on private property according to the 1980 Survey of California Registered Historical Landmarks. This landmark was listed on the California Register of Historic Landmarks in 1932. Middle Bar is probably eligible for CRHR (Chavez et al. 1984).

Big Bar (CA-CAL-956H), also on the Mokelumne River, was established in 1848. Ferry boats operated at this location until 1852 when the first bridge was built. Big Bar is probably not eligible for CHHR (Chavez et al. 1984).

CA-AMA-18/H and CA-CAL-0968/H (one site located at the border of two counties) was recorded by Chavez in September of 1983 (Chavez et al. 1984). The site is described as the Middle Bar settlement and hard-rock mining complex, although it is known that the area was first the site of placer mining. Features recorded at the site include dry-laid stone walls, excavated tent platforms, a trench, artifact scatter, mining shaft and depression, mud-mortared stone building, shallow dug-out terrace, ferry anchor, house depression, brick pile and pit, stamp mill foundation, house/mansion remains, a round pit, structure pit and artifact scatter, structural remains, house depression, walls, terraces and pits, feature area of walls, shafts and an oven, a feature area consisting of house walls, a well, and a ditch. Although the Middle Bar Bridge forms a link between the historic components of the site on either side of the Mokelumne River, this is not considered a feature of this site.

One feature described as walls, shafts, and terraces may be associated with the "Middle Bar Quartz Mines" indicated on the General Land Office map of 1886.

Within the boundaries of CA-AMA-18/H and CA-CAL-0986/H there are multiple prehistoric sites (CA-CAL-0969, CA-AMA-18(A) and CA-AMA-18(B)). These sites are summarized in Table 17-2. In addition, two features described under the historic component of the site contain prehistoric artifacts. These features with prehistoric artifacts include a predominant historic artifact scatter with two possible metate "slabs" and a feature area with walls, a well, and an oven described as containing three prehistoric pestles.

New Pardee Recreation Area

Site PS-6 is a large multi-component site located in the vicinity of the facility. This site may be affected by construction of the New Pardee Recreation Area.

Wildermuth House (PS-10) is suggested to be eligible for inclusion on the NRHP (PAR Environmental Services Inc. 1991). Although the site records states that an architectural evaluation has been completed, no documentation regarding the evaluation was found. This site also contains a prehistoric component with possible house pit feature and dark greasy midden. There is a high possibility that this site possesses human remains and it is probably eligible for CRHR and NRHP (PAR Environmental Services Inc. 1991).

Site PS-10 is a multi-component site consisting of the 1861 Wildermuth House and associated features and a prehistoric occupation/village site that was occupied into the ethnographic period. The site is located within the Valley Springs, California, USGS Quadrangle (T4N R10E, section 1), Calaveras County. The site setting is an open meadow on the west shore of Pardee Reservoir, with an unnamed spring located at the site. The elevation of the site is between 585 feet and 665 feet. No indication is given on the site record of the elevation of the prehistoric component of this site. Further site recordation would be necessary to determine whether the prehistoric component of this site would be affected by the enlargement of Pardee Reservoir.

The site was inhabited by the Central and Northern Miwok before and after the Gold Rush (PAR Environmental Services Inc. 1991). Features include possible house pits, dark greasy middens, artifact scatter, and bedrock mortar stations. Prehistoric artifacts recorded on the surface of the site include debitage, groundstone fragments, and lithic tools (no diagnostic tools). The site record states there is no physical evidence of Native American or Euroamerican interments at the site, but dark greasy middens usually signify human interments (PAR Environmental Services Inc. 1991). The site record stresses that no subsurface testing was conducted and the evaluation of the site was cursory.

The historic component of the site is the Wildermuth home constructed in 1861. Along with the home, there are several associated features such as rock fences, a sandstone building used as a granary, and the remnants of a bar. The house was built on top of the prehistoric component of the site. Although no architectural evaluation of the property was available, the site record states that this house appears to meet NRHP criterion C, representing the work of a master. The house, classified as Vernacular Georgian, was built by Scottish master stonecutter William A. Watt and is one of five known examples of his work (PAR Environmental Services Inc. 1991).

Jackson Creek Saddle Dams

Identified cultural resources in the vicinity of Jackson Creek saddle dams include PD-1, PD-2, D-3 and two isolated finds.

Site PD-1 consists of a number of historic features including a wooden barn, three stacked rock alignments, a rectangular earthen pad, a rock retaining wall, a possible trash pit, and a single course rock alignment.

Site PD-2 is a historic period site consisting of nine formed concrete pier footings.

Site D-3 is a segment of an earthen ditch known as the Kreth Ditch. The ditch is oriented roughly east/west and follows the 580-foot contour in the vicinity of the Jackson Creek spillway. There is also a small arm of the ditch that shoots off the main ditch and runs along the 540-foot contour. The earthen ditch cuts across Carson Creek at the point where the creek drains into the north arm of Pardee Reservoir. The ditch is approximately 6–7 feet wide.

Environmental Consequences

Significance Criteria

The criteria used for determining the significance of an impact on cultural resources are based on Appendix G of the State CEQA Guidelines (Environmental Checklist) and professional standards and practices. Impacts on cultural resources may be considered significant if implementation of an alternative would:

- cause a substantial adverse change in the significance of a historical resource as defined in Guidelines Section 15064.5,
- cause a substantial adverse change in the significance of an archaeological resource pursuant to Guidelines Section 15064.5,
- directly or indirectly destroy a unique paleontological resource or site or unique geologic feature, or
- disturb any human remains, including those interred outside of formal cemeteries.

Under California regulations, adverse effects need only be analyzed if a resource meets the eligibility criteria for listing on the California Register of Historical Resources. Impacts are considered to be significant when they may change the significance of a resource. Demolition, replacement, substantial alteration, and relocation of historical resources are examples of actions that may change the significance of a historical resource.

Under federal regulations, adverse effects need only be analyzed if a resource meets the eligibility criteria for listing on the National Register of Historic Places.

The criteria for eligibility (36 CFR 60.4) states that:

> The quality of significance in American history, architecture, archaeology, engineering, and culture is present in districts, sites, buildings, structures and objects that possess integrity of location, design, setting, materials, workmanship, feeling, and association. Federal eligibility criteria include the following:
>
> - that are associated with events that have made a significant contribution to the broad patterns of our history; or
> - that are associated with the lives of persons significant in our past; or
> - that embody the distinctive characteristics of a type, period, or method of construction, or that represent the work of a master, or that possess high artistic values, or that represent a significant and distinguishable entity whose components may lack individual distinction; or

- that have yielded, or may be likely to yield, information important in prehistory or history.

Federal regulations define an adverse effect to a resource when the effect may diminish the integrity of the property's location, design, setting, materials, workmanship, feeling, or association. Adverse effects on historic properties can include:

- Physical destruction or alteration of all or part of the property;
- Isolation from or alteration to the property's setting when that character contributes to the property's qualification for the National Register of Historic Places;
- Introduction of visual, audible, or atmospheric elements that are out of character with the property or that alter its setting;
- Neglect of a property resulting in its deterioration or destruction; and
- Transfer, lease, or sale of the property.

Summary of Cultural Resources Significance Findings

Of cultural resources discussed above, Walnut Grove Branch of the Southern Pacific Railroad and Victory Trees have been evaluated and determined eligible for the NRHP or the CRHR. Pardee Dam and Middle Bar Bridge are both listed on the NRHP.

Segment A from the intake facility crosses the Walnut Grove Branch of the Southern Pacific Railroad at Freeport Boulevard. Although there are additional elements in the entire historic district, at Freeport Boulevard contributing elements are limited to the railroad grade. The project would not affect the Walnut Grove Branch because the pipeline would tunnel under the feature.

The Kentucky Branch of the Southern Pacific Railroad (P-39-000002) crosses Segment X near Camanche Reservoir. This resource has been determined to be ineligible for listing on the NRHP. Also, along Segment W, five bridges (29C0230 [Coyote Creek], 29C0249 [Dry Creek], 29C0253 [Dry Creek Overflow], 29C0254 [Coyote Creek], and 29C0246 [South Fork Coyote Creek]) are ineligible for the NRHP.

Neither Middle Bar nor Big Bar settlement is included in the NRHP or CRHR though both are California Historical Landmarks. Today, all California Historical Landmarks are automatically included on the CRHR. Big Bar settlement is probably not eligible for CRHR, while Middle Bar settlement is probably eligible.

No other sites in the project area have been evaluated for eligibility.

Less-than-Significant Impacts

Alternative 1 would not result in any construction-related or operation-related cultural impacts associated with construction of FRWP facilities. Alternatives 2–5 and Alternative 6 would not result in less than significant impacts on cultural resources.

Significant Impacts and Mitigation Measures

Alternatives 2-5

Impact 17-1: Disturbance of Known Cultural Resources

Construction of project components could affect known cultural resources described above under "Affected Environment" and listed in Table 17-1. Generally, impacts of Alternatives 2–5 would be significant. To resolve adverse effects to historic properties and reduce impacts to less-than-significant levels, implement Mitigation Measure 17-1.

Mitigation Measure 17-1: Prepare and Implement a Cultural Resources Significance Evaluation, Effects Analysis, and Mitigation and Monitoring Plan for Known Cultural Resources

As required by Section 106 of the NHPA, ACHP Regulation 36 CFR Part 800: Protection of Historic Properties, and CEQA, known cultural resources must be avoided or their significance evaluated according to federal and state criteria. The impacts of the project alternatives on these resources must then be determined. The following steps should be taken to fulfill these requirements:

- Known cultural resources should be avoided if doing so is feasible.
- If avoidance is not feasible, then the significance of these resources should be assessed using federal and state criteria. If the resources are determined to be significant, the adverse effects to historic properties should be resolved through consultation with the SHPO and the ACHP, resulting in an MOA. For archaeological sites, mitigation usually consists of data recovery excavations to retrieve the data that would be lost through disturbance. For extant cultural features, mitigation usually consists of photographic, graphical, and text documentation to record the data that would be lost through disturbance.

Mitigation 17-1 would apply to sites where records are old or incomplete, and materials recovered during previous investigations are not sufficient to evaluate the site's significance. For example, Klotz Mound (site P-34-71/CA-SAC-44) located near the Freeport Intake site, was recorded in 1934, may contain human burials and has been heavily disturbed during this century.

Impact 17-2: Disturbance of Unidentified Cultural Resources

Portions of the project were not surveyed for the presence of cultural resources. Buried or previously unidentified cultural resources are likely to be discovered during construction. Impacts on buried or unidentified cultural resources are significant. To resolve adverse effects to historic properties and reduce this impact to a less-than-significant level, implement Mitigation Measures 17-2 and 17-3.

Mitigation Measure 17-2: Prepare and Implement a Cultural Resources Inventory, Significance Evaluation, Effects Analysis, and Mitigation and Monitoring Plan for Unidentified Cultural Resources

As required by procedures outlined in Section 106 of the NHPA, ACHP Regulation 36 CFR Part 800: Protection of Historic Properties, and CEQA, cultural resources must be located and evaluated and the impacts of the project on these resources must be determined. The following steps can be taken to fulfill these requirements:

- Conduct a records search at CHRIS to identify known cultural properties within the project region (records searches have been completed).
- Federal regulations require consultation with the SHPO, federally recognized Native American tribes, and interested members of the public during the Section 106 compliance process. Tribes are also consulted regarding the presence of sites of religious or cultural significance.
- Under state regulations, the California Native American Heritage Commission identifies Native American groups and individuals who may wish to be involved in the effort to identify cultural resources of importance to the Native American community.
- Conduct a cultural resources survey in unsurveyed areas as identified and recommended by CHRIS.
- Avoid newly identified cultural resources if it is feasible to do so.
- If avoidance is not feasible, implement Mitigation Measure 17-1.

Mitigation Measure 17-3: Prepare and Implement a Plan for the Unanticipated Discovery of Cultural Resources

Because of changes to the landscape of the project region during prehistoric and historic periods, the limitations of surface survey techniques, and obstructions to the visibility of the ground surface, previously unknown cultural resources likely will be discovered during pipeline construction. A plan to manage these resources should be developed and, at a minimum, should include the following components:

- If cultural resources—such as chipped or ground stone, historic debris, building foundations, or human bone—are inadvertently discovered during construction activities, the construction contractor should adhere to the following:

- stop work immediately in that area within 100 feet of the find;
- notify FRWA, City of Sacramento, and Reclamation; and
- retain a qualified archaeologist to assess the significance of the find and, if necessary, to develop appropriate treatment measures in consultation with the SHPO.

- If human bone is found as a result of any construction activities, the construction contractor will stop work and notify the appropriate county coroner in compliance with the California Public Resources Code Section 5097. On federal land, the federal land manager will be notified.

Alternative 6

As described in Chapter 2, "Project Description," Alternative 6 consists of enlarging Pardee Reservoir and conveying water from the Sacramento River. Alternative 6 includes the following project components: enlarge Pardee Reservoir (which includes additional components), Freeport intake facility, pipeline from the intake facility to the Zone 40 Surface WTP, and the Zone 40 Surface WTP. Though slightly different in size, the intake facility, pipeline from the intake facility to the Zone 40 Surface WTP, and the Zone 40 Surface WTP project components are the same as those that make up Alternative 5. Therefore, several of the impacts associated with Alternative 5 (described above) are also associated with Alternative 6 and are restated below. Additionally, impacts associated with the enlarge Pardee Reservoir component of this alternative are described below. The types of significant impacts on cultural resources and mitigation measures recommended to resolve adverse effects and reduce impacts to less-than-significant levels are provided below. Impacts to cultural resources include inundation from the expansion of the existing reservoir. All resources at or below the maximum flood level of the enlarged reservoir at 614 feet are subject to this impact. Fluctuation of the reservoir elevation would have the greatest impact on archaeological sites. Site disturbance can include weathering, erosion and displacement of artifacts. Other impacts to cultural resources in the project area that may not be impacted directly by inundation are those associated with the construction of a new dam, spillways, and recreation sites. Construction activities would involve building access roads, borrow pits, quarry sites for building materials, and utility lines. New roads may also affect archaeological sites by increasing public access to sites.

Impact 17-3: Disturbance of Known Cultural Resources at Pardee Reservoir that are Listed on the National Register of Historic Places

The proposed enlargement of Pardee Reservoir would have significant impacts on Pardee Dam (JRP 1994) since construction of a new dam would require breaching and flooding the existing dam. The project would also have significant impact on Middle Bar Bridge since raising the reservoir level would require removing the structure. Both are historic properties listed on the NRHP. To resolve adverse effects to historic properties and reduce these impacts to less-than-significant levels, implement Mitigation Measure 17-4.

Mitigation Measure 17-4: Develop and Implement a Data Recovery Plan and Prepare Historic American Engineering Record Documentation on Pardee Dam and Middle Bar Bridge

Where avoidance to structures is impossible, typical mitigation to reduce the impact would be to develop and implement a data recovery plan including preparation of Historic American Engineering Record (HAER) documentation. Pardee Dam was previously documented (HAER Survey Number CA-168, CA-168-A, CA-168-B, CA-168-C, CA-168-D). Prior to any impact on the Pardee Dam, an update to the original HAER documentation may be needed. Additional elements of the data recovery plan may include an interpretive display at the site with historic photos of the original dam along with textual displays on the history and significance of the site. Also, significant architectural features of the new dam could reflect the original dam. The name of the new dam should be differentiated from Pardee Dam.

Mitigation for removing Middle Bar Bridge would also include development and implementation of a data recovery plan including HAER documentation. Middle Bar Bridge has not been previously HAER documented. An interpretive display in the vicinity of the bridge may also be a component of the data recovery plan to reduce the impact to this resource. This mitigation would apply for both CEQA and NHPA compliance, reducing these impacts to a less-than-significant level and resolving the adverse effects to this historic property.

Impact 17-4: Disturbance to Other Known Cultural Resources from the Freeport Intake Facility to the Zone 40 Surface Water Treatment Plant and at Pardee Reservoir

Impacts associated with the project components from the Freeport intake facility to the Zone 40 Surface WTP would be the same as for Alternatives 2–5, described above.

Construction of the enlarge Pardee Reservoir component could affect the known cultural resources described under Affected Environment and listed in Table 17-2. This impact is significant. To resolve adverse effects to historic properties and reduce impacts to a less-than-significant, implement Mitigation Measure 17-1 as described above.

Impact 17-5: Disturbance of Unidentified Cultural Resources from the Freeport Intake Facility to the Zone 40 Surface Water Treatment Plant and at Pardee Reservoir

Impacts associated with the project components from the Freeport intake facility to the Zone 40 Surface WTP would be the same as for Alternatives 2–5, described above.

Buried or previously unidentified cultural resources may be discovered in areas of proposed construction activity associated with new dam construction or inundation areas. Approximately 50% of the proposed project area has been surveyed for archaeological resources. An impact on buried or unidentified cultural resources is significant. To resolve adverse effects to historic properties and reduce this impact to a less-than-significant level, implement Mitigation Measures 17-2 and 17-3 as described above.

Chapter 18

Programmatic Evaluation of a Groundwater Banking/Exchange Component to the Freeport Regional Water Project

Chapter 18

Programmatic Evaluation of a Groundwater Banking/Exchange Component to the Freeport Regional Water Project

Background

As fully documented in Volume 2, Appendix B, "Alternatives Screening Report," groundwater banking and exchange in the Sacramento area does not constitute a feasible stand-alone alternative. To implement such a program, facilities such as those contemplated as part of the FRWP or similar facilities would be required to allow the surface water diversions needed to make such a program physically capable of being implemented. As also fully documented in the Alternatives Screening Report, there are major institutional and legal issues that must be resolved before it would be feasible to implement a groundwater banking and exchange program within Sacramento County. These issues make the addition of a groundwater banking or exchange component to the FRWP infeasible at this time.

As discussed in the Alternatives Screening Report, over the past several years, Sacramento-area interests have been undertaking various investigations as to the feasibility of implementing groundwater banking and exchange programs. One groundwater banking program has been placed into limited service north of the Lower American River. The purposes of these processes are varied and each of the efforts is in very preliminary stages at this point.

In addition, FRWA received a small number of comments during the scoping process suggesting that a groundwater banking program be addressed in the EIR/EIS process (Volume 2, Appendix E, "Public Scoping Report"). The primary focus of these comments was to suggest that FRWA determine whether implementation of a groundwater banking element or program would meaningfully reduce water supply and water quality changes to downstream waterways and water users (see Chapters 3 and 4) that may result from implementation of the FRWP.

Based on this information, FRWA has determined that, although groundwater banking and exchange is not a feasible alternative to the FRWP, some further discussion of groundwater banking and its potential benefits and impacts is appropriate for inclusion in this EIR/EIS. The discussion below is drawn from information contained in Volume 2, Appendix F, "Wet Year/Groundwater Storage Conceptual Alternative—Programmatic Evaluation." As also documented in the Alternatives Screening Report, groundwater banking in San Joaquin County is clearly not a feasible alternative to the FRWP. Therefore, this discussion focuses on Sacramento County groundwater basins.

Groundwater Basins for Potential Storage and Recovery

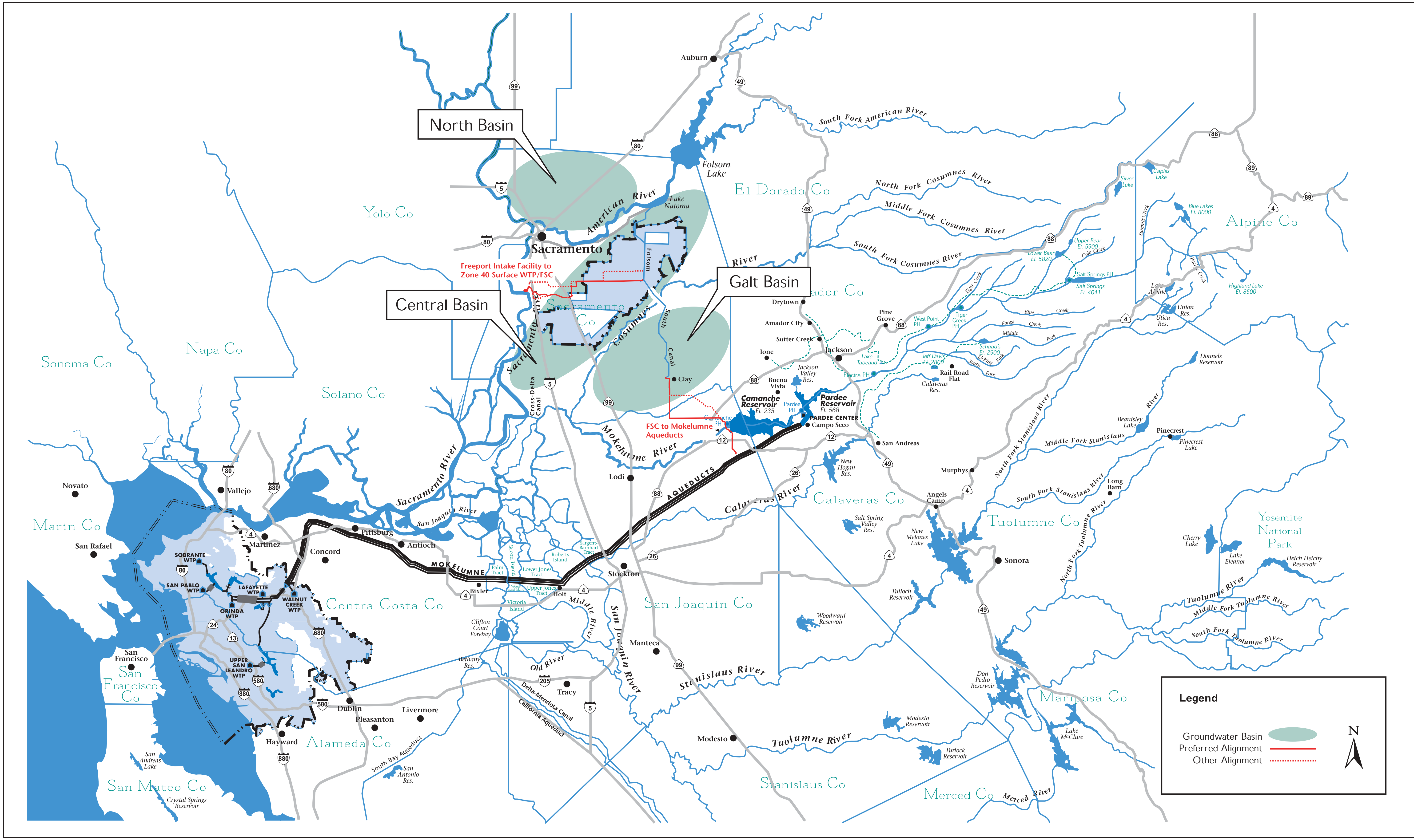
There are three groundwater basins in Sacramento County being considered within the context of the Water Forum for the long-term storage of surface water identified in this alternative: the North, Central, and Galt Basins. A brief summary of the available information for each basin is provided below. A map of each basin is presented in Figure 18-1. For purposes of this analysis, the areas being investigated within these groundwater basins will be as defined by the Water Forum in its 2001 Annual Report. Several key factors apply to these each of these basins because of their specific location.

North Basin

Within Sacramento County, the North Basin is generally bounded by the American River to the south and east, the Sacramento River to the west, and the county line to the north. The basin itself extends into Placer County where it is bounded by the Feather River on the west, the Bear River on the north, and the edge of the Sierra Nevada foothills on the east. DWR characterizes the groundwater quality as marginal in some portions of this basin. In the southern part of the basin, the groundwater is generally of good quality with moderate mineral content and low disinfection by-product concentrations, though some areas have elevated levels of minerals. The North Basin has three major known groundwater contamination sites: McClellan Air Force Base, the United Pacific Roseville Rail Yard, and the Aerojet Superfund site. The Aerojet site is located in the Central Basin, but its contamination plume extends into the North Basin.

Historical extractions from this basin have greatly exceeded natural and artificial recharge. DWR estimated the natural recharge to be 83,800 AFA, and artificial recharge of 29,800 AFA. Annual extraction was estimated to be 399,000 AFA for urban and agricultural uses. The Water Forum has estimated the sustainable yield of this of the North Basin to be 131,000 AFA. The North basin is in an overdraft condition. The North Basin has existing groundwater banking programs in place with the Placer County Water Agency and two local water districts. The quantity of water banked in the North Basin through this artificial recharge totals 29,800 AFA.

The Sacramento North Area Groundwater Management Authority (recently renamed Sacramento Groundwater Authority [SGA]) was created in 1998. This



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Jones & Stokes

Figure 18-1
Groundwater Basins

joint powers authority is responsible for the protection of the regional groundwater basin, and is comprised of sixteen public and private water agencies, including the City of Sacramento and SCWA.

Central Basin

The Central Basin underlies the area from the Lower American River to the north, the edge of the Sierra Nevada foothills to the east, Cosumnes River to the south, and the Sacramento River to the West. Groundwater is typically a calcium magnesium bicarbonate or magnesium calcium bicarbonate groundwater. TDS ranges from 24-581 mg/L, with an average of 221 mg/L.

There are seven major known groundwater contamination sites in the Central Basin Area. They include three Superfund sites: Aerojet, Mather Field, and the Sacramento Army Depot. The other sites include the Kiefer Boulevard Landfill, an abandoned PG&E site in Old Sacramento, the inactive Rancho Cordova Test Site located just south of Aerojet, and the Southern Pacific and Union Pacific Rail Yards near downtown Sacramento. Central Basin inflows historically total approximately 257,000 AFA. Extraction rates have been estimated to be approximately 230,000 AFA for urban and agricultural uses. The Water Forum has estimated the Central Basin annual sustainable yield to be 273,000 AFA.

The Water Forum has formed the Central Sacramento County Groundwater Forum in partnership with DWR and the California Center for Public Dispute Resolution. This forum was assembled to develop a management plan to protect available groundwater supplies and quality. Most recent estimates by the Central Sacramento County Groundwater Forum for completion of the Negotiation Phase, including deciding on an Action Plan for Implementation, is June 2004.

There are no known artificial banking programs in the Central Basin. The basin is not generally considered to be in an overdraft condition, but portions of the Basin (e.g., Elk Grove area) have significant cones of depression in the groundwater table.

Galt Basin

The Galt Basin Area lies to the South of the Central Basin, and generally extends from the Cosumnes River south to the County line. The basin itself extends into San Joaquin County to the south and Amador County to the east. Available information about the Galt Basin is limited. Groundwater level trends since the 1980s have shown declines followed by recoveries in groundwater levels, except in the eastern portion of this basin. TDS levels in the 20 water supply wells ranged from 140–438 mg/L, with an average of 218 mg/L. There appear to be no known major contamination sites.

Basin inflows have historically exceeded extraction rates. Natural and applied water recharge rates have totaled approximately 269,000 AFA. Urban and agricultural extractions have totaled approximately 129,000 AFA. The difference indicates the quantity of subsurface outflows to surface water and to other groundwater basins. The sustainable yield of the Galt Basin has been estimated to be 115,000 AFA.

There are 13 separate water agencies actively involved in utilizing groundwater in the Galt Basin. The Sacramento Metropolitan Water Authority filed a Notice of Intent in 1994 to adopt an AB 3030 plan for the Omochumne–Hartnell, Galt Irrigation District (ID), Clay Water District (WD), and the City of Galt. These agencies subsequently drafted a joint powers agreement (not including the City) to work cooperatively on water resources issues. However, a formal AB 3030 plan was never prepared. During 2002, these agencies decided to create the Southeast Sacramento County Agricultural Water Authority (Authority), and formally organize their activities. This Authority has the ability to manage water resources within the three agencies service areas, but not throughout the basin. The ability of the Authority to implement a groundwater banking project is unknown, due to their very recent creation; and the lack of a collaborative stakeholder process, as proscribed in the Water Forum Agreement, has limited the potential implementation of a banking and exchange program. This process would have to be undertaken in order to clearly define the parameters within which such a program could be developed.

Regulation of Groundwater Storage and Recovery

Three state regulatory agencies have authority over groundwater banking and exchange programs. They are the RWQCB, the SWRCB, and the Department of Health Services (DHS). The State Resources Agency (including DWR) is also an important source of information. The agency roles, responsibilities, and potential involvement are further described below. Various other permits would likely also be required from other jurisdictions or agencies, depending on the specific program.

Regional Water Quality Control Board

The Central Valley Region RWQCB is responsible for the preparation and adoption of Basin Plans, enforcement of the Clean Water Act and the California Water Code. The Basin Plans designate beneficial uses for the waters within the basin, their water quality objectives, and identify strategies to attain these objectives. All groundwater in Sacramento County is considered to be suitable for a municipal or domestic water supply, agricultural supply, industrial service supply, and industrial process supply.

Each Basin Plan in Sacramento County incorporated the maximum contaminant level water quality objectives as defined in Title 22 of the California Code of

Regulations. These objectives include limiting coliform concentrations to below 2.2 most probable number (MPN)/100 ml, and waters free from taste- or odor-producing substances, and radioactivity. The RWQCB also has a nondegradation policy, such that any new supply of water recharged into the basin must not degrade the existing groundwater basin. Any project proposing to store surface waters in the groundwater basins will be required to obtain a permit from the RWQCB for the design, operation, and construction of all facilities.

State Water Resources Control Board

The SWRCB has jurisdiction over the RWQCBs. In addition, the SWRCB has jurisdiction over the surface water rights that would be an essential element of any groundwater storage program. The SWRCB would be responsible for approving any changes in places of use, purposes of use, or points of diversion that would be required to implement a groundwater banking program.

Department of Health Services

The DHS regulates the operation of potable and recycled water systems; issues operating permits for these facilities; reviews plans and specifications for new facilities; enforces existing laws and regulations, including the Safe Drinking Water Act; and reviews water quality monitoring results. Furthermore, the DHS also conducts source water assessments, and evaluates projects utilizing injection and extraction into potable groundwater basins.

For any groundwater storage concept, the DHS would be heavily involved in the conceptual design and planning of all water treatment facilities. The DHS would primarily defer to other regulators for all nontreatment-related issues, except those related to the impact of long-term storage of treated surface waters in the groundwater basin. These issues include the following:

- "Bubble" formation: how close does the injected water "bubble" come to impacting the surface, and where does it migrate?
- Would the extracted water be retreated?
- What is the proximity of the stored water to known contamination sites?
- The impact of long-term storage on existing groundwater, e.g. presence of THMs.

These issues would need to be resolved with DHS prior to the approval to operate any groundwater program. The DHS would also need to approve the design of any treatment facilities. Water quality requirements for injected and extracted water would likely be addressed by a combination of the DHS and RWQCB.

The Department of Water Resources (State Resources Agency)

The State Resources Agency includes DFG, the Coastal Conservancy, and other resource-oriented departments, including the DWR. DWR prepares the State Water Plan (Bulletin 160); manages and operates the State Water Project; assists in monitoring the State's water resources; and protects, restores, and enhances the natural and human environments. In relation to groundwater, the DWR prepares the Bulletin 118 report, which defines the existing conditions of each basin.

The DWR monitors groundwater levels in approximately 2,000 wells in central California. This tracking has shown that groundwater levels in the North Basin are steadily decreasing. Water levels in the Galt Basin have largely recovered to their 1980 levels, and there is no consistent pattern in the Central Basin, although some decreases have been measured and the Elk Grove area has experienced significant groundwater level declines. The DWR is studying several areas in the lower Sacramento Valley where conjunctive use operations may be possible. It appears that the State Resources Agency is an interested party, but not a permitting agency with respect to water transfer, exchange, or conveyance, with the exception of construction permits such as Streambed Alteration Agreements with the DFG.

Other Agency Jurisdiction

At this time, there are no additional agencies with known jurisdiction or permitting authority over a groundwater banking program, other than those already having jurisdiction over the FRWP.

Institutional Issues

Several institutional issues would need to be resolved prior to implementation of any groundwater banking program. These questions include:

1. Is there a legislative or legal framework for groundwater storage and recovery of stored groundwater?
2. Can a groundwater bank be implemented?
3. What is the level of control over groundwater overpumping by overlying agencies and pumpers?
4. Would EBMUD be allowed to export stored groundwater out of Sacramento County?
5. Is there a strong local authority with clear boundaries and sufficient powers to partner?

6. Does local/regional consensus desire exist for implementation of a groundwater storage project?
7. What is the ability to avoid potential injury to existing groundwater users?

These questions are addressed in Table 18-1. This institutional analysis describes the institutional feasibility of the FRWP along with possible groundwater banking programs in the North, Central, and Galt Areas.

Table 18-1. Institutional Analysis—Degree of Feasibility for FRWP and Alternative Concepts for Groundwater Storage

Issue	FRWP	North Area	Central Basin	Galt Basin
1. Legislative/ legal framework for groundwater storage and recovery of stored groundwater	YES. Zone 40 Master Plan is consistent with water forum solution.	YES. Appendix 66 of State Water Code allows it in Sacramento County.	YES. Appendix 66 of Water Code allows it in Sacramento County.	YES. Appendix 66 of State Water Code allows it in Sacramento County.
2. Implement-ability of a groundwater bank	YES. Zone 40 Master Plan is consistent with Water Forum solution.	YES. Pilot water banking projects demonstrate potential feasibility of establishing long-term project.	YES. Conjunctive use of groundwater basin in Zone 40 contemplated in Water Forum solution; banking and exchange (B/E) not explicitly stated; Groundwater Forum is vehicle to address B/E in Central Basin.	Not Yet Clear. Joint Powers Authority formed, but not bank. Pilot projects needed. Will take three years to determine.
3. Control of groundwater overpumping by overlying agencies and pumpers	YES (incomplete). Sacramento County has legal authority to establish regulatory controls over pumping in all basins, including Zone 40 area, but has not yet exercised or delegated that authority.	YES (partial). Although basin not adjudicated, Sacramento Groundwater Authority (JPA) has some authority, but expressly provided that it will control only with economic incentives.	YES (incomplete). Although basin not adjudicated, Sacramento County has clear authority in Zone 40, but has not exercised or delegated that authority. EBMUD's stored water could be protected if there were an allocation of groundwater storage to existing users and a mechanism for enforcing those limitations (not yet in place).	YES (incomplete). Groundwater Management Plan established at a preliminary level. Full Basin Management Plan not yet in place. Sacramento County has authority but not yet delegated that authority.

Issue	FRWP	North Area	Central Basin	Galt Basin
4. Ability to export stored groundwater out of Sacramento County to EBMUD	N/A	Not yet clear. AB 3030 plan not yet in place (required for export per Water Code Section 1220). No known political obstacles. Pilot to export not yet done. Two to five years to establish necessary framework.	NO. No AB 3030 Plan in place (required for export, per Water Code Section 1220). Political support for exports uncertain. Central Groundwater Forum started. County Ordinance passed in 2000, Title 3, Chapter 3.40.090 authorizes Director of Water Resources to issue permit to export groundwater and surface water. Probably will take 5 to 10 years to establish necessary framework to implement groundwater export.	NO. Groundwater Management Plan established at preliminary level, but no AB 3030 specific authority for exports (required for groundwater export per Water Code 1220). Collaborative stakeholder process not yet begun to extent contemplated in Water Forum. Probably will take 5 to 10 years to establish necessary framework to implement groundwater export.
5. Presence of strong local authority with clear boundaries and sufficient powers to partner	N/A	Not Likely. Can partner but does not yet have enforceable program acceptable internally to JPA to make partnering likely.	Partial YES. SCWA is strong local authority, has established service area. Has powers to partner. Deferring to Groundwater Forum (GWF) process for comprehensive plan for governance. FRWA not yet a formal stakeholder.	Not Yet Clear. JPA formed. Partially staffed. Clear boundaries. No collaborative process yet started.
6. Local/ regional consensus that groundwater storage project is desirable	YES. Consistent with Water Forum solution.	YES	NO. Not yet explored within County. Due to large number of farmers and other institutions affected, probably will take one to two years to determine with full time vetting; validation through GWF process (two to five years).	NO. Preliminary exploration in 1998. Not yet explored within community. Due to large number of farmers within three districts, probably one to two years with full-time vetting. Collaborative stakeholder process still needed.
7. Ability to avoid potential injury to existing groundwater users	YES. Zone 40 Master Plan developed to accomplish this objective.	Not Clear. Basin is relatively small (131,000 af); may not be sufficient to do additional banking.	Not Clear. Basin may be large enough to bank SCWA water during wet year diversions, but detailed modeling needed to verify. Basin not large enough to bank both agencies water through injection and extraction without large water level fluctuations (50 feet or more).	Not Clear. Basin may be large enough to bank EBMUD water during wet year diversions, but detailed modeling needed to verify.

Feasibility of Banking/Exchange in North Area

Banking in the North Area is already established institutionally and several pilot projects have been undertaken. Staff at SGA have indicated that FRWA could buy up to 40,000 AFA from SGA. However, FRWA is not part of SGA, and there are significant institutional obstacles to implementation of a reliable water supply project dependent on banking and exchange with the north area, summarized as follows:

- SGA has not yet set a baseline for groundwater pumping for its member agencies in the basin, so there is not a reliable baseline for existing and future conditions of the baseline upon which FRWA could depend.
- SGA is composed of 15 independent agencies, and the JPA for the North Area expressly identifies that local control of groundwater resources will remain in the hands of the local agencies and control of pumping will be exercised through economic incentives and disincentives. Because the missions of the local agencies do not necessarily parallel those of FRWA, FRWA cannot yet rely on the as yet unestablished incentives and disincentives and a unanimous vote of 15 independent agencies.
- Because SGA has not developed an enforceable groundwater banking program to ensure water deliveries, partnering with SGA for a Banking/Exchange project as a component of the FRWP is not feasible at this time (see Issue No. 5 in Table 18-1).

Feasibility of Banking/Exchange in Central and Galt Areas

While groundwater banking in the Central Basin and Galt Basin is technically feasible, the establishment of a groundwater management plan for the Central Basin has only recently begun under the Groundwater Forum process. The Collaborative Stakeholder process is quite extensive and will take several years to develop its ultimate product of a “solution package and implementation plan” (from the Negotiation Phase, currently underway), a basin management plan, and a framework for governance. A similar and parallel process for the Galt Basin is also contemplated under the Water Forum Agreement but has not yet begun. Therefore, for institutional reasons, it is not feasible to implement either scenario at this time.

Program Timing

The progress and current status of the North Area Groundwater Bank is indicative of the complexity of establishing a groundwater management program and generally describes the effort that would be required to establish programs in the Central and Galt basins (see Table 18-2).

Table 18-2. Comparison of Status of Groundwater Management Efforts in North Area with Central and Galt Areas

	North Area	Central Area	Galt Area
Organizational Infrastructure	Formed SGA to Manage Basin; formed Regional Water Authority (RWA) to provide regional forum for project development. Have full-time Executive Director and consultants providing staff support.	SCWA is in place, but not yet organized for banking. SCWA is participating in GWF process to develop a basin management plan.	JPA of Omochumne-Hartnell, Galt ID and Clay ID; no full-time staff or consultants working for JPA. Water Forum contemplates developing a Galt Basin management plan, but it has not yet begun.
Delivery Infrastructure	Pipeline in place to deliver American River water for recharge.	None. FRWP would provide delivery pipelines and treatment to enable banking.	None. FRWP would provide delivery pipelines to enable banking
Pilot Projects	Completed two pilot projects; SAFCA with Reclamation and Storage for the Environmental Water Account	None. Some feasibility investigations done.	None
Funding Status	Raised $2 million; obtained $22.5 million construction grant for facilities.	None for groundwater bank.	None

For the North Area groundwater program to reach the stage described in Table 18-2 required three to four years of efforts by the Water Forum stakeholders and others. It is estimated that it will take the North Area another five years to establish a long-term program that could accommodate outside participants. For the Central Area, because they have begun the collaborative process through the Central Sacramento County Groundwater it is estimated that it will take nearly two years to reach the end of the negotiation phase, and another seven years to have an established plan and long-term program for a total of approximately nine years. For the Galt Area, it would be estimated to take about five years within a process like the Groundwater Forum Process to progress to where the North Area was when they formed the organizational infrastructure and began to implement the banking program, and another five years to get to an established plan and long-term program, for a total of 10 years.

Once a plan and program are in place, a project could be developed and a public/environmental documentation process could be commenced. To meet the project objectives of delivering water supplies to SCWA and EBMUD by 2008, the wet year/groundwater storage alternative cannot be implemented in place of the FRWP. Rather, implementing FRWP enables the future implementation of such a plan.

General Description of Groundwater Banking Component

For purposes of this programmatic analysis, the groundwater banking component assumes the diversion of both EBMUD and SCWA water primarily in wet and above normal years from the Sacramento River at Freeport through facilities essentially identical to those described for the FRWP alternative. The SCWA water would be treated at the Zone 40 Surface WTP and distributed throughout its service area in Zone 40 to demand points and to injection wells near the existing and planned extraction wells. During dry, below normal, and normal years, most demands in Zone 40 would be met through groundwater, stored surface water and other (non-FRWP) surface water. EBMUD water would be conveyed to the FSC for conveyance to the Galt Area for in lieu recharge and percolation. Subsequent extraction would be managed as proposed for Scenario 2 as well.

This analysis evaluates shifting surface water diversions as much as possible from the dry and critical years to the wet and above normal years. This analysis is intended to provide for evaluation of the greatest possible minimization of water supply and environmental effects during drier years.

The overall amount of surface water assumed to be diverted by EBMUD and SCWA for direct storage or in lieu of recharge is the same as for the FRWP alternatives. However, it is assumed that only 90% of the water injected can be extracted. This is because recharged (injected and percolated) water typically cannot be recovered completely; some moves away from the recharge area as groundwater flow and is no longer available for extraction. This analysis assumes that EBMUD would only extract stored surface water (and nonnative groundwater). This operational assumption would serve to minimize the potential of “injury” to other groundwater users in the Basin. Water Code 1220 prohibits the export of groundwater from the combined Sacramento and Delta-Central Sierra Basins, as defined by DWR Bulletin 160-74, unless the pumping is in compliance with a groundwater management plan adopted by the County or the portion of the County that overlies the groundwater basin. The boundaries of these protected basins include Sacramento County (including North, Central, and Galt areas).

Required Facilities

There is a wide range of possible approaches to facility construction and operation that could facilitate a groundwater banking/exchange component. In general, however, facilities would be needed to:

- divert surface water supplies,
- convey surface water supplies to the groundwater bank area,
- inject or percolate surface water supplies into the groundwater basin,

- extract groundwater, and
- convey the extracted water to its point of use.

For purposes of this programmatic analysis, the following assumptions are made:

- The FRWP would provide the surface water diversion and primary conveyance facilities;
- Surface water could be either actively injected through wells or percolated through large (approximately 300–500 acres) percolation basins;
- Some in-lieu recharge may also be incorporated;
- New extraction wells would be constructed; and
- Injection and extraction wells would be at different locations.

Depending on a variety of factors, the following general assumptions can be made:

- Approximately 200,000 feet of new, approximately 36-inch pipeline would be required;
- approximately 40 injection wells may be required;
- Up to 300–500 acres of percolation basins may be required;
- Approximately 20 extraction wells would be required; and
- Other appurtenant facilities would also be needed.

Based on these assumptions, the incremental cost of a groundwater banking component is on the order of $100–200 million, in addition to the costs associated with the basic FRWP. There also do not appear to be substantial offsetting cost savings associated with a groundwater banking component.

Programmatic Assessment of Potential Environmental Effects Associated with a Groundwater Banking Component

As noted above, no detailed plans are available for a groundwater banking component, and there is a wide range of potential facilities and facility locations that could be conceivably be implemented at part of such a component. However, as noted above, some assumptions can be made regarding the general type and location of such facilities. Based on that information, a general discussion of potential environmental effects is provided below. The discussion focuses on the potential incremental effects of adding a groundwater banking component to the FRWP, where appropriate. It is important to note that actual site-specific impacts would need to be addressed in a subsequent environmental assessment document if and when a specific project has been identified and appropriately defined.

Hydrology, Water Supply, and Power

Table 18-3 provides results of hydrologic modeling conducted for this programmatic analysis. In terms of the net changes to the availability of water to downstream water users, and the overall system storage in the CVP and SWP systems, the FRWP with a groundwater banking/exchange component does not vary considerably from the FRWP, or from the No Action Alternative.

CVP deliveries to users north of the Delta are largely unaffected. CVP deliveries to users south of the Delta were slightly higher with a groundwater banking/exchange component, primarily in dry years, but this difference was very minor (approximately 0.7%). SWP total deliveries reflect similar results.

The overall maximum and minimum change to the X2 position throughout the entire simulation was virtually unchanged.

As shown in Table 18-3 the effects of adding a groundwater banking/exchange component to the FRWP are generally beneficial, but very slight. It should be noted that the modeling for this analysis was conducted using a slightly earlier version of CALSIM II than the FRWP alternatives analysis. The differences between the model versions are minor, and any differences in results for comparative purposes are negligible.

Table 18-3. Comparison of Downstream Delta Effects of FRWP Base Project and Wet Year/Groundwater Storage Scenarios to 2001 CALSIM Baseline (No Project under FRWP)

	Freeport Regional Water Project				Freeport Regional Water Project with Conjunctive Use Element[1]			
Parameter	No-Action Alternative		Proposed Project		No-Action Alternative		Conjunctive Use	
Water Year	All Years	Dry Year[2]	All Years	Dry Year[2]	All Years	Dry Year[2]	All Years	Dry Year[2]
Tracy Pumping (af)[3]	2,299,000	1,626,000	2,302,000	1,636,000	2,256,000	1,662,000	2,255,000	1,662,000
North of Delta CVP Storage (af)[4]	4,469,000	3,098,000	4,444,000	3,043,000	4,315,000	2,343,000	4,306,000	2,348,000
Oroville Storage (af)[5]	2,100,000	1,528,000	2,100,000	1,662000	2,063,000	1,505,000	2,072,000	1,506,000
CVP Total Deliveries—North (af)[6]	2,209,000	1,959,000	2,209,000	2,067,000	2,199,000	1,959,000	2,201,000	1,958,000
CVP Total Deliveries—South (af)[6]	2,516,000	1,646,000	2,513,000	1,641,000	2,441,000	1,643,000	2,441,000	1,644,000
SWP Total Deliveries (af)[6]	2,945,000	1,934,000	2,942,000	1,946,000	2,980,000	1,946,000	2,978,000	1,951,000
Maximum and minimum change in X2 position (km)[7]	89.7 km—Nov 1993 42.0 km—Apr 1983		89.7 km —Oct 1932 42.0 km—Apr 1983		89.7 km—Oct 1932 42.0 km—Apr 1983		89.7 km —Oct 1932 42.0 km—Apr 1983	

Notes:

1 This analysis was conducted with the October 29, 2002, official release of CALSIM II. The results would be essentially identical if the analysis was conducted using the March 2003 version of CALSIM II, although individual values may vary.

2 Dry years were modeled as the 1928–1934 Water Years.

3 Tracy Pumping is measured at the Tracy Pumping Plant.

4 Based on the sum of storage within the Trinity, Shasta, and Folsom Reservoirs during September.

5 Average September Oroville storage during the 73 year simulation.

6 Total Deliveries during water year (October–September).

7 X2 is measured as the distance away from the Golden Gate Bridge. It was not assumed to be accurate to a level of detail less than 0.5 km. The values presented here are the maximum and minimum distances for the duration of the simulation.

Modeled period was the historical runoff from WY 1922–1994. Average period during that period listed

Source: data provided by CH2M Hill, 2002 and 2003. All modeling is based on the 2001 hydrology.

Water Quality

Table 18-4 shows the results of water quality modeling conducted for this analysis. The analysis uses CCWD's g-model. Based on this model, the average change in chloride concentration at Rock Slough would be 0.3 mg/l. The maximum increase in chloride concentration is 10 mg/l, while the maximum decrease in chloride concentration is 8 mg/l. The standard deviation is 1.4 mg/l.

At Jersey Point, changes in salinity typically are described in terms of electrical conductivity. The average change in electrical conductivity would be 2.4 : S/cm.

The maximum increase in conductivity is 150 : S/cm, while the maximum decrease is 73 : S/cm. The standard deviation is 14.4 : S/cm.

Table 18-4 also compares the g-model results for the FRWP with the g-model results for the FRWP with an additional groundwater banking/exchange component. As clearly demonstrated in the table, there is no substantial difference between the results. The addition of a groundwater banking/exchange component does not result in substantial reduction in the minor water quality effects of the FRWP.

Table 18-4. Summary of Chloride and EC Differences at Selected Delta Locations

	FRWP Alternative		FRWP with Groundwater Banking/Exchange	
	Rock Slough Cl (mg/l)	Jersey Point EC (: S/cm)	Rock Slough Cl (mg/l)	Jersey Point EC (: S/cm)
Average	0.3	2.4	0.3	2.4
Minimum	-4.2	-48	-7.7	-73
Maximum	9.8	126	10.4	150
Std. Deviation	0.9	10.1	1.4	14.4
No Action Range	36–234	208–2189	36–234	208–2189

Fisheries

The effects of the FRWP are very minor on all fish species. There is no evidence to suggest that increasing the proportion of surface water that is diverted during wet years and during wet periods would reduce the minor impacts on fish described in Chapter 5. In addition, fish abundance can also be higher near the intake facility during wetter years, potentially increasing the number of fish exposed to the risk of entrainment.

Recreation

No incremental effects on recreation are anticipated.

Vegetation and Wetland Resources

The facilities required for conveyance and groundwater recharge would include pipelines, injection wells, extraction wells, and potentially percolation basins. The construction of such facilities has the potential to temporarily affect vegetation and wetland resources in ways similar to those described in Chapter 7, depending on facility locations. It is assumed that most facilities could be sited to avoid or minimize effects on vegetation and wetland resources. The percolation basins, if implemented, would have the greatest potential to affect vegetation and wetland resources because of the large amount of land disturbance involved, and because the percolation basins would be actively managed, thereby preventing the reestablishment of natural vegetation.

Wildlife

The facilities required for conveyance and groundwater recharge would include pipelines, injection wells, extraction wells, and potentially percolation basins. The construction of such facilities has the potential to temporarily affect wildlife in ways similar to those described in Chapter 8, depending on facility locations. It is assumed that most facilities could be sited to avoid or minimize effects on these resources. The percolation basins, if implemented, would have the greatest potential to affect wildlife because of the large amount of land disturbance involved, and because the percolation basins would be actively managed, thereby preventing the reestablishment of natural vegetation. Certain wildlife species, however, may benefit from operation of the percolation basins.

Geology, Soils, Seismicity, and Groundwater

Construction associated with a groundwater component would not be expected to have any effect on geologic conditions. The areas under consideration are relatively flat and generally not subject to unstable conditions.

Facilities would be sited in areas that are currently agricultural. As described in Chapter 9, soils in this area are generally productive, and construction and operation of the facilities would require the conversion of a relatively small amount of land to nonagricultural uses.

The area is not considered to be highly active seismically, but facilities would be subject to potential damage from earthquakes. This risk is considered very slight, and standard engineering design practices would minimize such risks.

Generally, operation of a groundwater banking component would be expected to result in higher average groundwater levels. Operation of a groundwater bank would also likely result in greater annual fluctuations of groundwater levels as compared to existing conditions. This effect is considered beneficial.

Land Use

The incremental effects associated with a groundwater banking component would be expected to be minor. As discussed above, minor changes in land use may result from construction and operation of conveyance, recharge, and extraction facilities. These facilities are generally similar to other facilities in the area and with agricultural land uses. Therefore, these facilities would not be expected to result in substantial effects beyond those described in Chapter 10.

Agricultural Resources

The incremental effects associated with a groundwater banking component would be expected to be minor. It is anticipated that relatively minor losses of agricultural land would result from the construction and operation of facilities. Effects are dependent on the actual location of facilities and would require further analysis. These facilities would not be expected to result in substantial effects beyond those described in Chapter 11. Potential effects include slight increases in temporary and permanent loss of croplands.

Transportation and Circulation

The incremental effects associated with a groundwater banking component would be expected to be minor. Construction of facilities would be expected to have minor effects on traffic and transportation similar to those described in Chapter 12 but at different and additional locations. Potential effects include minor and temporary disruptions to area roadways and circulation patterns.

Air Quality

The incremental effects associated with a groundwater banking component would be expected to be minor. Construction of facilities would be expected to have minor effects on air quality similar to those described in Chapter 13 but at different and additional locations. Potential effects include minor and temporary increases in emissions related to construction equipment and activities.

Noise

The incremental effects associated with a groundwater banking component would be expected to be minor. Construction of facilities would be expected to have minor effects on noise similar to those described in Chapter 14 but at different and additional locations. Potential effects include minor and temporary increases in noise related to construction equipment and activities.

Public Health and Safety

The incremental effects associated with a groundwater banking component would be expected to be minor. Construction of facilities would be expected to have minor effects on public health and safety similar to those described in

Chapter 15 but at different and additional locations. Potential effects include the possibility of encountering undocumented sources of contamination during construction.

Visual Resources

The incremental effects associated with a groundwater banking component would be expected to be minor. Construction of facilities would be expected to have minor effects on visual resources similar to those described in Chapter 16 but at different and additional locations. Potential effects include introduction of new constructed elements to the landscape. These elements could potentially include pumping plants, wells, and percolation basins. However, these facilities are generally consistent with the local environment and would not likely be considered a detriment.

Cultural Resources

The incremental effects associated with a groundwater banking component would be expected to be minor. Construction of facilities would be expected to have minor effects on cultural resources similar to those described in Chapter 17 but at different and additional locations. The area contains known and likely contains unknown historic and archeological sites. It is anticipated that facilities could be sited to avoid known facilities. However, the potential for impacts on currently undiscovered sites would remain. Appropriate construction management techniques and preparation of a cultural resource discovery treatment plan would minimize the potential for significant effects.

Conclusion

Based on the information presented in Volume 2, Appendix B, "Alternatives Screening Report," and the additional analysis above, the following conclusions can be made:

- While groundwater banking is viable conceptually and technically, there is no existing or near-term reasonably foreseeable groundwater banking program that could be implemented as a component of the FRWP.
- Opportunities for groundwater banking as a component of the FRWP are largely limited to the Central and Galt basins.
- There are substantial institutional, legal, environmental, and operational issues that must be resolved before groundwater banking in the Central and Galt basins could be considered feasible.
- Implementation of any groundwater banking program in the Central or Galt basins would require construction of surface water diversion and conveyance

facilities essentially the same as those proposed under the FRWP and would therefore not reduce impacts associated with those facilities.

- Implementation of any groundwater banking program in the Central or Galt basins would require construction of the surface water diversion and conveyance facilities as proposed for the FRWP, and the construction of additional conveyance, recharge, injection, and extraction facilities not already proposed for the FRWP.
- Implementation of a groundwater program would result in small reductions in the already minor effects on downstream water quality and water supply described in Chapters 3 and 4.

While groundwater banking in the Central Basin and Galt Basin is technically feasible, the establishment of a groundwater management plan for the Central Basin has only recently begun under the Groundwater Forum process. The Collaborative Stakeholder process is quite extensive and will take several years to develop its ultimate product of a "solution package and implementation plan" (from the Negotiation Phase, currently underway), a basin management plan, and a framework for governance. A similar and parallel process for the Galt Basin is also contemplated under the Water Forum Agreement but has not yet begun. SCWA will continue to investigate groundwater banking/exchange programs through the Central Sacramento County Groundwater Forum.

Chapter 19
Cumulative Effects

Chapter 19
Cumulative Effects

Approach to Cumulative Impact Analysis

Legal Requirements

State CEQA Guidelines and NEPA regulations require that the cumulative impacts of a proposed project be addressed in an EIR/EIS when the cumulative impacts are expected to be significant and, under CEQA, when the project's incremental effect is cumulatively considerable (15130[a], 40 CFR 1508.25[a][2]). Cumulative impacts are impacts on the environment that result from the incremental impacts of a proposed action when added to other past, present, and reasonably foreseeable future actions (15355[b], 40 CFR 1508.7). Such impacts can result from individually minor but collectively significant actions taking place over time.

Section 15130 of the State CEQA Guidelines states that the discussion of cumulative impacts need not provide as much detail as the discussion of effects attributable to the project alone. The level of detail should be guided by what is practical and reasonable.

Methodology

According to the State CEQA Guidelines (Section 15130), an adequate discussion of significant cumulative impacts should contain the following elements:

- an analysis of related future projects or planned development that would affect resources in the project area similar to those affected by the proposed project,
- a summary of the expected environmental effects to be produced by those projects with specific reference to additional information stating where that information is available, and
- a reasonable analysis of the cumulative impacts of the relevant projects. An EIR shall examine reasonable, feasible options for mitigating or avoiding the project's contribution to any significant cumulative effects.

To identify the related projects, the State CEQA Guidelines (15130[b]) recommend either:

- the list approach, which entails listing past, present, and probable future projects producing related or cumulative impacts, including, if necessary, those projects outside the control of the agency; or
- the projection approach, which uses a summary of projections contained in an adopted general plan or related planning document, or in a prior environmental document that has been adopted or certified, which described or evaluated regional or area-wide conditions contributing to the cumulative impact.

NEPA and Reclamation's NEPA Handbook do not provide specific guidance as to how to conduct a cumulative impact assessment. The cumulative impact assessment requirements under CEQA do provide specific guidance and are consistent with and more stringent than under NEPA. Therefore, this assessment focuses on meeting the requirements of CEQA as discussed in the State CEQA Guidelines. For the FRWP, cumulative impacts are analyzed both quantitatively and qualitatively. The following sections describe each approach.

Those actions that are truly considered "reasonably foreseeable" and that would, along with the FRWP alternatives, contribute to potential cumulative impacts are included in the quantitative analysis of cumulative impacts discussed below. This quantitative analysis focuses largely on water-related issues because the anticipated future cumulative conditions have been established through the CALSIM II modeling process. The FRWP alternative facilities themselves are relatively minor and are independent of other projects. In addition, most of the effects associated with the facilities would be temporary and would be associated with the project construction phase only. Therefore the FRWP alternative facilities have little potential to contribute substantially to cumulative effects.

The qualitative analysis of cumulative effects below attempts to take into account other projects that are being discussed by various entities but which have not been sufficiently defined to be considered "reasonably foreseeable." The qualitative analysis also addresses non-aquatic resource cumulative effects to which the FRWP alternatives could conceivably contribute. This analysis is qualitative because most of the effects would be temporary and occur during the construction phase, because to the extent more permanent effects could occur the impacts of other projects are not currently quantifiable, and because it is unlikely that the FRWP alternatives' contribution to such cumulative effects, to the extent they could occur, would be considered cumulatively considerable.

Quantitative Cumulative Impact Analysis

Cumulative impacts of both action alternatives considered in this EIR/EIS on the CVP, including impacts on hydrology and water supply, water quality, and fisheries, are discussed quantitatively in Chapters 3, 4, and 5, respectively. This quantitative analysis takes into account reasonably foreseeable future increased water use by water rights holders, other CVP contractors, the SWP, and representations of system-wide operations under the Environmental Water Account and Central Valley Project Improvement Act requirements. The technical approach for conducting the cumulative impact assessment involved comparing CALSIM II hydrologic model output for the 2020 level of development with the FRWP and project alternatives (CALSIM II 2020 benchmark study) to the existing condition (2001 level of development without the FRWP or alternatives per DWR's Bulletin 160-98). This 2020 level of development is representative of long-term future land use patterns and related water demands projected under DWR's Bulletin 160-98 (California Department of Water Resources 1998). Examples of actions included in the quantitative cumulative analysis include Reclamation's Operating Criteria and Plan and Trinity River Mainstem Restoration Program, and increased diversions within the American River Basin consistent with Sacramento Area Water Forum projections. To assess the incremental contribution of the FRWP and project alternatives to cumulative impacts, the operation of the FRWP and the project alternatives were then subtracted from the 2020 benchmark study and an assessment was made of environmental conditions without the project. That scenario represents the appropriate disclosure of cumulative impacts on the CVP, SWP, other water users, and environmental resources. By subtracting the FRWP from the overall cumulative scenario, the incremental contributions of the FRWP can be defined.

A detailed description of CALSIM modeling assumptions for the cumulative impact analysis is contained in Volume 3. Based on the CALSIM modeling conducted for the project as discussed in the subject chapters, the project alternatives have little potential to add to cumulative impacts that are projected to occur regardless of whether any of the project alternatives are implemented.

This quantitative assessment of cumulative impacts includes the likely projected water use by agencies holding entitlements for water in the basin. Use of these assumptions defines the extent to which cumulative impacts of the FRWP can reasonably be analyzed quantitatively. Cumulative impacts that may be associated with other future actions that cannot be defined quantitatively at this time are discussed below.

Qualitative Cumulative Impact Analysis

Other Projects and Programs

EBMUD Bayside Groundwater Project

This project would provide EBMUD a supplemental water supply and would reduce the frequency and severity of rationing required of customers. The project includes deep aquifer injection/extraction wells, associated piping, treatment as needed, and a transmission pipeline in the San Lorenzo/San Leandro area.

In 2001, a draft EIR was released. Concerns voiced during the comment period included: safety of air emissions from the proposed treatment plant, potential subsidence issues related to pumping, and water quality. The Alameda County Water District (ACWD) and the City of Hayward also expressed concern about the potential effect of the Bayside Groundwater Project on the Niles Cone Groundwater Basin.

As a result, a regional aquifer test was completed and groundwater modeling will be completed in 2003. This modeling will confirm the degree of connection between the Niles Cone (Fremont) and South East Bay Plain (San Lorenzo) groundwater basins. The current schedule for the Bayside Project includes project design and construction in 2004 and 2005 with the project in service in 2005.

The Bayside Groundwater Project is not anticipated to contribute to cumulative impacts. The amount of water injected and extracted is exceedingly small. The injection/extraction area is already highly developed and the required facilities would be minimal. No cumulative impacts would result.

San Joaquin County–Freeport Interconnect Project

Project Water Supply

In 1990, San Joaquin County submitted an application to the State Water Resources Control Board (SWRCB) to appropriate wet-year water by direct diversion (105,000 AFA) and storage (190,000 AFA) from the American River under Application 29657 for a total combined diversion and storage of 322,000 AFA. The application included two diversion alternatives, (1) to divert water at Nimbus Dam through the FSC to San Joaquin County, and (2) to divert water from the South Fork of the American River and convey it through two planned reservoirs facilities to the FSC and then to San Joaquin County. Over the next 10 years, the development and construction of planned water conveyance and storage facilities, including the Auburn Dam, the Countyline and Clay Station Reservoirs, and the extension of the FSC into San Joaquin County were never completed.

In December 2001, the county appealed to the SWRCB for an extension in processing of Application 29657 and acknowledged that the county may amend the original application to move a point of diversion from the American River to the Sacramento River to coincide with the FRWP diversion at Freeport. By moving a point of diversion from the American River to the Sacramento River at Freeport, there is a potential that the county could divert water in wet years to San Joaquin County through the use of FRWP pipeline facilities. It is anticipated that in wet years, with a December to June diversion period, the county could receive between 30,000 and 60,000 af of water to meet future supply needs for conjunctive use and groundwater banking projects in the county. Other wet-year supply to the county could potentially be developed through additional diversion, sales, exchanges, transfers, and partnerships.

This project is in the very early planning stages. No specific details have been identified at this time. Three general project concepts have been discussed. These concepts are outlined below.

Project Concepts

Preliminary concepts for the Freeport Interconnect Project include the development of various regulatory storage and conveyance facility options.

Concept A: Regulating Storage Reservoir with Conveyance to Local Conjunctive Use Facilities. From the terminus of the FSCC, the installation of a pipeline, pumping plant, inlet structure, and dam facility to wheel water from the FSCC, prior to going into the Mokelumne Aqueducts, south approximately 5 miles to the proposed Duck Creek Reservoir. This reservoir with a potential storage capacity of up to 200,000 af would act to store and regulate flows through the Bellota Weir and into the Calaveras River and Mormon Slough to supply water to local groundwater banking and conjunctive use projects within the county.

Concept B: Pipeline Turnouts with Conveyance to Local Conjunctive Use Facilities. Preceding the terminus of the FSCC, the installation of pipeline facilities to wheel water from the FSCC before it enters the Mokelumne Aqueducts, including a series of pipeline turnout structures located near local creeks and/or rivers including Dry Creek, Bear Creek, Duck Creek, Mokelumne River, and/or Calaveras River to supply water directly to local groundwater banking and conjunctive use projects within the county.

Concept C: Direct Delivery to Local Cities and Conjunctive Use Facilities. The installation of pipeline facilities to convey water from the terminus of the FSCC or the Mokelumne Aqueducts for direct delivery to city water treatment facilities, groundwater banking projects (including in-lieu, direct recharge, injection), or other conjunctive use facilities within the County.

South Sacramento Corridor Phase 2 Project

The Sacramento Regional Transit District is proposing to extend the South Line light rail system into the southern Sacramento region. Currently, the system is being expanded into the City of Folsom and into south Sacramento with the construction of South Line Phase 1, a 6.3-mile extension to Meadowview Road. The South Line Phase 1 extension is scheduled to open for service by September 2003. The South Sacramento Corridor Phase 2 Project would accommodate transportation needs associated with population and employment growth in the congested south corridor area by increasing transit capacity and providing faster, more convenient access throughout the Sacramento metropolitan region.

The alignment of portions of this proposed light rail extension and certain segments of the FRWP pipeline alignments could be located within the same general corridor. Construction may occur within the same general timeframe, depending on how these projects proceed through the environmental review and engineering design phases.

Interstate 5/Cosumnes River Boulevard Interchange and Extension

The City of Sacramento, in conjunction with Caltrans and the FHWA, is proposing to construct the I-5/Cosumnes River Boulevard interchange in the southwest portion of the city. The project includes extending Cosumnes River Boulevard from its current westerly terminus at Franklin Boulevard to I-5 and possibly farther west to Freeport Boulevard and the currently unincorporated Town of Freeport. The primary purpose of the project is provide an east-west connector between I-5 and SR 99, which improves mobility within the southerly limits of the City of Sacramento. The secondary purpose of the project is to provide access to developable land adjacent to I-5, possibly affording economic development opportunities. The interchange project and roadway extension are needed because east-west roadways within the southern portion of the City of Sacramento are insufficient to meet traffic demand, and currently only limited access is available to the developable properties. The project is currently undergoing environmental review, and a draft EIR/EIS is anticipated to be circulated in early 2004.

The preferred alignment of the proposed I-5/Cosumnes River Boulevard extension and certain segments of the FRWP pipeline could be located within the same general corridor. Construction may occur within the same general timeframe, depending on how these projects proceed through the environmental review and engineering design phases.

Lower Northwest Interceptor Project

The SRCSD is proposing a 20-mile-long pipeline and related facilities to convey wastewater from the existing Natomas Pump Station in northwestern Sacramento County to the SRWTTP in southern Sacramento County. The alignment of portions of the interceptor project and the FRWP facilities could be located within the same general corridor, depending on the alternatives selected. Construction may occur within the same general timeframe, depending on how these projects proceed through the environmental review and engineering design phases.

South Sacramento Streams Group Flood Control Project

The Corps and SAFCA are in the process of increasing flood protection to the south Sacramento County area by modifying existing levees or channels and constructing new levees at the SRWWTP and along portions of Morrison, Elder, Union House, and Florin Creeks, and retrofitting bridges on these creeks. Construction on these improvements is beginning and most of the work will be completed before the scheduled completion of the FRWP alternatives.

Sacramento Regional Wastewater Treatment Plant Regional 2020 Master Plan

The Master Plan, proposed by the SRCSD, provides a phased program of recommended wastewater treatment facilities and management programs to accommodate planned growth and to meet existing and anticipated regulatory requirements through the year 2020. The Master Plan addresses both public health and environmental protection issues while ensuring reliable service at affordable rates for SRCSD customers.

CALFED Bay-Delta Program

The CALFED Bay-Delta Program (CALFED) involves collaboration between state and federal agencies and stakeholders from key interest sectors created to address and resolve resource management issues in the Bay-Delta system. The mission of CALFED is to develop and implement a comprehensive plan that addresses resource problems in the Bay-Delta estuary related to fish and wildlife, water supply reliability, natural disasters, and water quality. The CALFED Record of Decision (ROD) was signed in late 2000. The ROD directs that a number of specific studies be implemented to address identified resource management issues. Several of these studies include feasibility studies of major water resources projects and programs that could interact cumulatively with the FRWP and other cumulative actions assumed and included in the CALSIM II modeling. These potential projects include:

- Sites Reservoir, a study of a major water supply storage reservoir in northern California;
- Shasta Lake enlargement, a study to explore the expansion of the lake to increase yield;
- In-Delta storage options, which is examining the potential for water storage on islands in the Delta (this project is essentially identical to the Delta Wetlands Project that recently obtained water rights for storage on Delta islands);
- San Luis Reservoir Low Point Improvement Project, which is exploring alternatives for addressing water quality problems in the reservoir during periods of low storage;

- South Delta Improvements Program, which involves developing a project and alternatives that would allow increased exports from the Delta while minimizing effects on water quality, fisheries, and water levels in the south Delta;
- SWP/CVP Intertie, which would involve developing a new pipeline connection between DWR's California Aqueduct and the CVP's Delta-Mendota Canal to improve operational flexibility for both the CVP and the SWP; and
- Los Vaqueros Reservoir Expansion Project, which is exploring the benefits and opportunities associated with expanding the Los Vaqueros Reservoir;
- Upper San Joaquin River Storage, which is studying the potential to increase storage capacity by raising Friant Dam or a similar storage program;
- Environmental Water Account, which is intended to acquire water assets and use them to buffer water supplies, especially in dry years;
- Bay Area Water Quality and Supply Reliability Program, which is intended to develop and coordinate regional blending and exchange concepts that can improve water quality and water supply reliability for several Bay Area water agencies (including EBMUD);
- Old River and Rock Slough Water Quality Improvement Projects (Veale/Byron Tract Drainage Reduction), which are intended to minimize salinity and other constituents of concern in drinking water by relocating or reducing agricultural drainage in the south Delta to improve drinking water quality for CCWD;
- Ecosystem Restoration Program, which involves extensive habitat restoration throughout the Sacramento and San Joaquin Valleys.

Each of these programs is in the very early planning and feasibility stages. They have not been adopted in any planning document or official plan beyond a highly programmatic environmental document. No firm description of these projects and programs is available, and many do not have a schedule for environmental compliance or project implementation. It is highly unlikely that all of these projects will move forward into the implementation stage. In addition, those that are ultimately implemented likely will be staged over a period of several years. It is therefore speculative to include a discussion of these projects and programs in this analysis. However, because of the inherently interrelated nature of major water resources programs in northern California, they are included in this qualitative analysis.

There are other actions and programs being evaluated and implemented by CALFED and CALFED agencies that could conceivably contribute to cumulative impacts. However, these are also relatively undefined at this time, and it would be speculative to attempt to include these other programs in a cumulative impact analysis.

Aquatic Resources

As indicated above and detailed in the respective resource chapters, the FRWP alternatives have little potential to contribute to any significant cumulative impacts. Overall, contract water withdrawals cumulatively have the potential to affect water availability for consumptive uses or instream beneficial uses throughout the Central Valley river system. The potential significant cumulative effects within the regional area could include the following:

- changes in Delta outflow,
- changes in reservoir levels and carryover storage,
- changes in water quality,
- impacts on sensitive species, and
- changes in water supply.

Reclamation, along with the State of California, is obligated to meet specific Delta outflow requirements. Implementation of the FRWP would not have a substantial effect on Delta outflows and would not contribute to any cumulative impacts. Most of the projects described above would substantially increase water availability in the CVP and SWP system. It is possible that instream flows in affected streams would also be increased.

The cumulative effects of the FRWP alternatives in combination with implementation of other potential future projects conceivably could substantially increase the amount of water available to the CVP and SWP. Such increases would completely offset any minor reductions in water supplies that may result from the FRWP alternatives.

Implementation of the FRWP alternatives in combination with implementation of the 2020 Master Plan for the SRWWTP could result in a minor degradation in water quality downstream when viewed in isolation because of increased wastewater flows projected by the master plan, together with minor infrequent decreases in Sacramento River flows caused by the FRWP alternatives. These effects would be very minor, and all instream flow and water quality criteria would continue to be met. In addition, several of the projects discussed above could result in improved water quality throughout the system and particularly within the Delta. These projects would generally result in increased flows into the Delta, increased exports from the Delta for water supply purposes, and increased Delta outflows for environmental and water quality purposes. These improvements are expected to greatly outweigh any minor decreases in water quality. In particular, the Rock Slough and Old River Water Quality Improvement Projects would substantially improve water quality for CCWD.

Use of available FRWP capacity by others, such as San Joaquin County, would result in increased diversions and additional impacts likely similar in type and relative magnitude to those discussed for the FRWP alternatives in Chapters 3–

17 of this EIR/EIS. Because no specific proposal has been made, it is not possible to discuss potential cumulative impacts in any greater detail.

The CALFED Bay-Delta Program includes specific objectives to restore and protect sensitive species such as winter-run chinook salmon and delta smelt. The programs include monitoring and enforcement actions that increase the potential for restoring these species to acceptable population levels. Implementation of the FRWP would not affect state or federal commitments to such restoration programs.

The current use of CVP water supplies is about 6.1 million af per year. The CVP's maximum contractual obligation to deliver water is about 6.6 million af per year. Therefore, the annual demand for CVP water under existing contracts could increase over time by more than 500,000 af. About 50% of this potential increase in contractual water deliveries by the CVP would be from the American River watershed. This increase in deliveries could decrease the reliability of CVP deliveries to the existing water users and reduce the water available to meet instream flow and temperature requirements in the lower American River. These increases in demands are addressed in Chapters 3, 4, and 5.

Terrestrial Resources

Many of the projects listed above would result in impacts on land-based resources. For example, Sites Reservoir (which has been under consideration for at least 50 years) would inundate hundreds of acres of habitats including annual grasslands, some of which support vernal pools, riparian woodlands, chaparral, and oak woodland. However, most of the projects are not located near the FRWP alternatives and habitats are not contiguous. Therefore the FRWP does not contribute to cumulative impacts on habitats and related resources except with those projects that are within reasonable proximity.

In addition, impacts related to construction and operation of water conveyance pipelines associated with the project alternatives would generally result in minor and temporary impacts. Because of the minor and temporary nature of most impacts, they are not considered additive to other ongoing regional impacts. Discussed below are those resource areas to which the FRWP could contribute to ongoing regional impacts.

Vegetation, Wetlands, and Wildlife

Implementation of the FRWP in combination with other local and regional projects, and general growth in the region would contribute to the cumulative loss of identified sensitive resources, including wetlands, riparian woodlands, and habitats for sensitive wildlife species. As described in Chapters 7 and 8, the effect of the FRWP alternatives on these resources is relatively minor and is likely not cumulatively considerable. Cumulative effects associated with

Alternative 6 on these resources are greater than those associated with Alternatives 2–5 because of the habitats that would be inundated by the enlarged Pardee Reservoir. Implementation of the mitigation measures recommended in Chapters 7 and 8 would reduce the FRWP's contributions to these cumulative impacts to a level well below the "cumulatively considerable" threshold.

Agriculture

Implementation of the FRWP in combination with other local and regional projects, and general growth in the region would contribute to the cumulative loss of prime agricultural lands. As noted in Chapter 11, the alternatives would result in an extremely small amount of impacts on prime farmland as a result of conversion when taken in the context of the amount of such farmland in the region. Alternative 6 would contribute less to this cumulative impact because of shorter pipelines and because there is no prime farmland within the enlarged Pardee Reservoir inundation zone. However, the loss of prime farmland is an issue of statewide concern. Therefore, the project alternatives would contribute a minor amount of loss to greater ongoing regional losses. The conversion of prime farmland is considered a significant cumulative impact that cannot be reduced to a less-than-significant level.

Cultural Resources

A number of cultural resources have been identified within the areas potentially affected by the project alternatives. Additionally, other as-yet-unknown resources may be discovered during project construction. Implementation of the FRWP alternatives would contribute to the cumulative loss of cultural (archeological and historic) resources in the region resulting from other projects and general growth within the region. Cumulative effects associated with Alternative 6 on these resources are greater than those associated with Alternatives 2–5 because of the inundation effects associated with the enlarged Pardee Reservoir. Implementation of the mitigation measures described in Chapter 17 would reduce FRWP's contribution to these cumulative impacts to a level below the "cumulatively considerable" threshold.

Construction-Related Effects

On a more site-specific level, implementation of the FRWP alternatives in combination with the Lower Northwest Interceptor and the Sacramento Regional Transit District South Sacramento Corridor Phase 2 projects could result in temporary "cumulative" construction-related effects. Although it is difficult to determine when each of these major projects will be constructed, they may be considered to have cumulative impacts because if they occur during the same timeframe, the magnitude of effects will be greater, and if they occur sequentially, the construction-related effects will be drawn out for an extended period. These effects include issues typical of large-scale construction projects such as noise, dust, and traffic disruption.

Chapter 20

Growth-Related Effects

Chapter 20
Growth-Related Effects

Legal Requirements

Section 15126(d) of the State CEQA Guidelines and Reclamation's NEPA handbook require that growth-inducing effects of a proposed action be addressed in an EIR. The State CEQA Guidelines state the following:

Discuss ways in which the proposed project could foster economic or population growth, or the construction of additional housing, either directly or indirectly, in the surrounding environment. Included in this are projects that would remove obstacles to population growth (a major expansion of a wastewater treatment plant might, for example, allow for more construction in service areas). Increases in the population may further tax existing community service facilities so consideration must be given to this impact. Also discuss the characteristics of some projects which may encourage and facilitate other activities that could significantly affect the environment, either individually or cumulatively. It must not be assumed that growth in any area is necessarily beneficial, detrimental, or of little significance to the environment.

A project EIR need not evaluate general growth within a community if that growth is not caused, in part, by the project being evaluated.

Section 1508.8(b) of the Council on Environmental Quality NEPA Regulations states that the definition of effects includes:

Indirect effects, which are caused by the action and are later in time or farther removed in distance, but are still reasonably foreseeable. Indirect effects may include growth inducing effects and other effects related to induced changes in the pattern of land use, population density or growth rate, and related effects on air and water and other natural systems, including ecosystems.

Methodology and Assumptions

Evaluation of growth-inducing effects of the FRWP is based on a qualitative analysis of the indirect effects that could result from use of the water supply within the EBMUD ultimate service boundary (USB) and the service areas of the

City and County of Sacramento, City of Elk Grove, and City of Rancho Cordova. Indirect growth effects in the EBMUD USB are based on the analysis in the WSMP EIR (EDAW 1993, Chapter 13, pp. 13-1 through 13-13 and Exhibits 13-1 and 13-2) because the WSMP fully described anticipated growth within the USB. The evaluation of growth effects assumes that the project would improve EBMUD's drought water supply and the water system reliability as presented in Chapter 1. Estimates of growth within the USB are based on the WSMP projections and ongoing service area water demand projections developed by EBMUD.

Water supply growth effects from information provided by the City of Sacramento (Franck pers. comm.) and the County of Sacramento are summarized from the CVP Water Supply Contracts draft EIS/EIR (U.S. Bureau of Reclamation and Sacramento County Water Agency 1997) and the Sacramento County General Plan (county general plan) Update Draft Environmental Impact Report (EIP Associates, DKS Associates, and Engineering Science, Inc. et al. 1992).

This evaluation of potential growth-inducing impacts addresses whether the project would directly or indirectly

- foster economic, population, or housing growth;
- remove obstacles to growth;
- tax community service facilities; or
- encourage or facilitate other activities that cause significant environmental effects.

The analysis evaluates the potential for growth-inducing effects to result from construction of water system facilities and from use of water supplies made available under the FRWP.

Service Area Growth

East Bay Municipal Utility District Service Area

The existing EBMUD service area is located in the San Francisco Bay Area (Figure 1-1). The District Board of Directors has adopted a formal policy to oppose annexation to the EBMUD service area of properties located outside EBMUD's USB. In its Updated WSMP EIR, EBMUD estimated that the number of housing units in its USB by 2020 will grow by approximately 79,000 units, accommodating a projected population increase of approximately 137,000. EBMUD also projects that it will serve more than 5,600 new commercial, institutional, industrial, and irrigation accounts by 2020. Most of the population growth (59%) would occur as urban infill in the urbanized western regions of the USB. Household growth in the less urbanized eastern regions of EBMUD's service area is expected to occur mostly on currently undeveloped land. However, the available area is very limited based on local city and county general plans. Although the total population served is anticipated to grow by approximately 10%, much of this will occur through increased densities in already developed areas. Development through buildout of local general plans will increase the total developed area within the USB by only 4%. Only a portion of that 4% will be on lands that could currently be considered relatively natural areas.

County of Sacramento Unincorporated Areas

Sacramento County has until recently been relatively unique among California counties in that a large percentage of the population has been living in unincorporated areas. The county has become one of the fastest growing areas in the state. Recent growth is generally attributable to comparative geographic and economic advantages, such as good highway access, competitively priced land and housing, an expanding and diversifying economy, labor availability, and proximity to recreational and other cultural amenities.

Urban communities will accommodate most of the new development in the unincorporated areas of Sacramento County. Near-term urban development will be accommodated through the buildout of planned communities because it is in these areas that urban infrastructure and public services already exist. The infill development, however, cannot accommodate all the development projected during the planning period, and the county general plan also identifies and designates new urban growth areas. These urban growth areas are primarily located in the area between the American and Cosumnes Rivers within the Sacramento County Water Agency’s Zone 40 area.

Under Alternatives 2–6, facilities would be used to supply surface water for the Expanded Zone 40 area, as defined in the Central Valley Project Water Supply Contracts EIS/EIR (Bureau of Reclamation and Sacramento County Water Agency 1997). The Expanded Zone 40 area, now known as the Zone 40 area, encompasses 83,000 acres of land within the county general plan designated USB. Approximately 46,600 acres are expected to be urbanized and receive water service from the SCWA by the year 2030.

Urban growth has been conditioned on the planning and growth policies of the county general plan. Growth projections in turn establish the amount of water needed to accommodate the projected growth. Additional water supplies are needed to support projected growth.

Current annual groundwater production within Zone 40 is approximately 20,400 af. Future water supplies for the SCWA Zone 40 2030 study area would consist of up to 45,000 AFA of firm surface water, a long-term average of approximately 41,000 AFA of groundwater, and additional surface water supplies when surplus water is available.

In recent years, a number of changes have occurred within the Zone 40 area. The City of Elk Grove and the City of Rancho Cordova have incorporated. These new cities cover a large portion of the Zone 40 area. A description of these new cities is provided below.

City of Rancho Cordova

Rancho Cordova residents voted to incorporate as a city on the November 2002 ballot. The city is a large section of the eastern part of SCWA Zone 40. According to the Census 2000 population profile for the Cordova planning area, there are a total of 96,260 persons residing within the planning area. Using the 1990 Census information and 2000 as the base year, Sacramento Area Council of Governments (SACOG) projects that housing in the Rancho Cordova planning district (including Rosemont and Gold River) will increase from 37,757 dwellings to 41,100 (9%) by 2010, and to 54,148 (43%) by 2020. Population in the area is projected to increase from 96,099 to 104,868 (9%) by 2010, and to 136,284 (42%) by 2020.

A city general plan is being developed, but in the meantime the city is operating under the Cordova Community Plan, adopted in 1978 and updated in 2002. The plan supports the influx of businesses, particularly business parks like those along the Highway US 50 corridor. Housing has not kept pace with employment in Rancho Cordova, and the plan encourages the building of subdivisions that would attract business park employees at all economic levels. Concurrently, a goal of the plan is to "provide a reliable, contaminant-free, long-term source of water to serve the community, which protects the groundwater aquifer(s) from long-term damage attributable to drawdown by the use of public/private wells." The implementation of the FRWP would support this goal and remove an obstacle to the planned growth of the City of Rancho Cordova.

City of Elk Grove

The City of Elk Grove was incorporated on July 1, 2000, establishing local control over land use and development services. Since incorporation, both residential and nonresidential development in Elk Grove has increased.

Originally planned as a bedroom community for residents employed in Sacramento, the City of Elk Grove has a new vision. On October 16, 2002, the City Council of Elk Grove adopted policies implementing a draft general plan until the final general plan is approved. As expressed in the draft plan, the city plans to increase the jobs/housing balance in Elk Grove and to match the numbers and types of workers living in Elk Grove with job opportunities in the city. To that end, General Plan Land Use Element map amendments increased the amount of land designated for commercial and office development and incorporated a regional commercial land use category.

According to projections by SACOG, population and employment growth rates in Elk Grove are expected to peak during the 2000–2005 period, at rates of 6.2% and 13.1%, respectively. However, SACOG projection assumptions are based on historical growth rates and jobs/housing balance data from before Elk Grove's incorporation. Because it is Elk Grove's intent to increase the jobs/housing ratio and to expand the existing commercial and industrial growth trends, the city anticipates a higher growth rate.

Evaluation of Growth-Inducing Effects

East Bay Municipal Utility District Ultimate Service Boundary

EBMUD can meet its projected USB demand during most years (See Chapter 1). However, during dry years, runoff amounts are insufficient to meet full user demands even with aggressive conservation and water recycling programs and the EBMUD supply must be drawn from reservoir supplies stored during previous years. During dry periods, storage supplies may be insufficient to supply all consumptive needs of EBMUD customers without significant rationing. Therefore, the EBMUD portion of the FRWP water supply would be used primarily to ensure that sufficient water supply is provided to reduce customer deficiencies during droughts and to ensure system reliability in case of damage to EBMUD's existing water supply and distribution system. Because the FRWP is intended to provide a supplemental water supply during drought years and to improve system redundancy and reliability, it would not contribute to new growth-inducing effects because it would not cause or remove an obstacle to growth.

Updated Freeport Regional Water Project Growth Effects

Although the FRWP alternatives do not meet the definition of "growth inducing" under either CEQA or NEPA, the overall environmental consequences of projected growth within the EBMUD USB are discussed briefly below. These effects are expected to include land use, traffic, biological, socioeconomic, and other impacts. Growth-related land use effects are expected to include urban infill and higher densities or mixed uses in the western portion of the service area with new development projects and growth areas occurring mainly in the eastern undeveloped areas (including a small amount of land used for agriculture) of the USB.

Traffic impacts in the USB along the Interstate 80 and Interstate 680 corridors are expected to increase significantly with and without new projected growth. Significant increases in traffic will likely occur in the East Bay even if no new growth occurs in the USB because of projected increases in commuter traffic throughout the East Bay from rapidly growing bedroom communities in Solano, San Joaquin, and Stanislaus Counties.

Air quality conditions in the USB are expected to continue to decline as a result of growth, although air quality conditions in the San Francisco Bay Area Air Basin (SFBAAB) are generally superior to other air basins in the state. Currently the SFBAAB is designated as an attainment area for carbon monoxide and a severe nonattainment area for ozone. The Bay Area Air Quality Management District (BAAQMD) is implementing a Clean Air Plan to attain the ozone standard.

Biological resource effects in the USB associated with loss of native vegetation and wildlife habitat will occur as a result of urban and suburban development. Habitat losses are expected to be greatest in the eastern portion of the USB, where some new development would occur in undeveloped open space and agricultural areas. As noted above, however, the extent of these areas to be developed is limited. The Updated WSMP EIR indicates that up to 13 special-status species occur in the USB that could be adversely affected by urban and suburban growth.

Socioeconomic effects of growth in the USB could include positive economic growth resulting in new employment and business opportunities and less desirable financial effects of needed investments in infrastructure improvement projects such as roads, water distribution and wastewater treatment facilities, and education and recreation facilities.

Other growth-related impacts in the USB include possible urban runoff effects of new development from increased impermeable surfaces, increased noise levels along major transportation corridors, visual resource effects from conversion of open space and agricultural areas to urban development, and possible effects on known or unknown archaeological or historical resources.

Freeport Regional Water Project Growth Effects in the East Bay Municipal Utility District Ultimate Service Boundary

Use of water under the FRWP would likely have no additional growth-inducing effects in the USB because it would not foster additional economic, population, or housing growth. This growth is projected to occur regardless of whether the FRWP is implemented because EBMUD has adequatewater supplies during normal years. The FRWP will reduce rationing during droughts and provide an emergency backup supply to EBMUD’s existing Mokelumne River system.

Use of the water supply under the FRWP would not directly or indirectly tax community service facilities because growth within the USB has been planned for in city and county general plans and is not dependent on implementation of the FRWP alternatives; new development projects would not be served by the

FRWP. As mentioned above, EBMUD's policy is to oppose annexation of and service to developments outside of its USB, and EBMUD is not the preferred water service provider to the project.

The FRWP could, in theory, be considered to indirectly facilitate growth decisions by service area cities and counties by reducing the amount of uncertainty that exists related to system reliability and the availability of water supply during drought conditions. However, this indirect effect is speculative and unquantifiable.

East Bay Municipal Utility District Growth Policies

The Updated WSMP EIR findings indicate that potential growth-inducing impacts could be mitigated through measures imposed by the planning agencies of city and county jurisdictions. The EBMUD Board of Directors has determined that it will continue to work with other jurisdictions to assist in mitigating the impacts of growth by:

- participating in efforts to improve regional planning in the Bay Area;
- encouraging local land use planning agencies to coordinate land use planning functions and the provision of utility services; and
- encouraging cities and counties to adopt general plans and zoning ordinances that favor high-density development and urban infill (which tends to minimize per-capita water use and environmental impacts of water delivery systems); provide incentives for more housing near public transit; and adopt ordinances that conserve open space, protect wildlife habitat, and conserve energy and water resources (EDAW 1993).

Sacramento County Water Agency Service Area

While implementation of the FRWP is intended to accommodate projected growth in the service area with Zone 40 through the next 20 years, growth accommodation will have significant, and significant and unavoidable, effects on transportation, air quality, loss of farmland, water supply, groundwater quality, biological resources, and visual quality. Provision of public services and the noise environment of the county also would be affected by growth. These effects are discussed below. No loss in public recreation uses, including community and County parks or activity areas along the Sacramento River or American River Parkway, is expected from growth in the Zone 40 area. Future increases in use of existing recreation resources may result in a gradual decline in the quality of the recreational experiences.

Transportation

Planned growth in Sacramento County, even with full implementation of all the transportation improvements identified in the Circulation Element and Transportation Plan of the county general plan, would result in significant effects. All of the major traffic impacts are considered significant and unavoidable. Mitigation measures proposed in the county general plan and the plan draft EIR could lessen their magnitude but are not likely to reduce effects to a less-than-significant level. Projected effects include:

- LOSs would exceed LOS E, the county standard, at many intersections and on freeway and roadway links.
- Volume to capacity ratios (V/C) on segments of major freeways would exceed 1.00, with some exceeding 2.00.
- Roadway improvements to reduce LOS and V/C ratios to acceptable levels could require doubling the capacity of some area freeways.

Air Quality

Removing an obstacle to growth by implementing the FRWP to accommodate growth projected in the county and city general plans would result in significant and unavoidable effects on air quality even with full implementation of the guidelines and alternative transportation modes included in the Circulation Element of the county general plan. Those effects include:

- Substantial increases in air pollutants would result from increased traffic and development.
- Reduction in emissions and air pollutants that are required by the California Clean Air Act for areas such as Sacramento County that are in nonattainment for ozone and carbon monoxide will be difficult to achieve with increased traffic generated by accommodating growth.

Noise

Growth consistent with the county general plan in southern and central Sacramento County could result in four significant noise impacts:

- exposure of noise-sensitive land uses to excessive aircraft noise as a result of infill development near Executive Airport and the former Mather Air Force Base, now an air freight transport facility;
- exposure of noise-sensitive land uses to excessive exterior noise levels as a result of proximity to industrial uses;

- increased traffic noise levels; and
- increased exposure of noise-sensitive development to railroad noise.

Policies in the county general plan mitigate these impacts to less-than-significant levels.

Loss of Farmland

Approximately 4,000 acres of farmland of statewide significance exist within Expanded Zone 40. Loss of this farmland, estimated at half, as a result of projected growth is a significant and unavoidable impact. The county general plan does not contain a policy that development must take place on nonagricultural land, a policy that would impose severe restriction on growth and could result in noncontiguous and inefficient development.

Water Supply

Overall demand for surface water is considered a significant effect. The county general plan limits development in areas if surface water supplies are not available. Groundwater overdraft is of particular concern in the Franklin-Laguna area and the City of Elk Grove and the southeast part of the county. Use of surface water rather than groundwater in all of these areas could alleviate overdraft conditions. Therefore, implementation of the FRWP could remove an obstacle—the absence of surface water supply—to growth in those areas.

Water Quality

Growth in the service area could result in greater risk of contamination in the underlying groundwater aquifer. Recent trichloroethene (TCE) and perchlorate detections in wells in the Sunrise Industrial Service Area, on Mather Field, and in the Arden-Cordova Water Service Area are examples of this increasing risk. Ongoing efforts such as Aerojet's long-term cleanup of the American River Study Area will continue and could be supplemented with additional efforts in the future.

Although efforts are currently underway across the county to stabilize the regional groundwater aquifer, it is reasonable to assume that groundwater supplies will be continually relied on, within the constraints of the Water Forum agreement, to meet water needs in Sacramento County. Increased urbanization would also result in a greater risk of surface water quality degradation from more non-point-source pollutant runoff from urban areas.

Biological Resources

A biological assessment prepared for county service areas (Bureau of Reclamation and Sacramento County Water Agency 1997) indicates that three special-status plant species and 16 animal and fish species could potentially be affected by growth in the service area and only small amounts of riparian, vernal pool, and woodland habitats that support wildlife species would be affected.

Sacramento County is developing the South Sacramento County Habitat Conservation Plan (SSHCP). Once adopted, the SSHCP is intended to be a regional approach to addressing issues related to urban development, habitat conservation, agricultural protection, and open space planning. It was initiated in 1992 and revised to its current scope in 1996. The SSHCP boundaries encompass the area south of US 50 and east of I-5, which includes unincorporated county land and the cities of Rancho Cordova and Elk Grove. It excludes the cities of Galt and Sacramento, and the Delta. The plan area holds about 317,000 acres of land both inside and outside the county's USB, of which approximately 50,000 acres are considered developable. The major goals of the SSHCP are to ensure long-term habitat viability, accommodate development of appropriate sites with fair and reasonable mitigation, protect agricultural lands, and streamline the permitting process. It is anticipated that the draft plan will be released in 2005. CEQA analysis and public hearings will follow release.

The SSHCP will provide strategies to conserve habitat for nine plants and 42 animal species using various habitats, including vernal pool grasslands, which are the dominant habitat in the SSHCP area. Additional habitat for federally listed giant garter snake and the state-listed Swainson's hawk are prominent in the HCP planning process. Habitats for these species serve as an umbrella, of sorts, for most of the other species and habitats to be covered under the HCP.

The intent of the SSHCP is to address regulatory requirements for issuance of an ESA Section 10 permit, a CWA Section 404 permit, and a DFG 1601 permit. Upon adoption of the SSHCP, the county will hold the permits. The county or another yet-to-be-decided entity will be responsible for SSHCP implementation. To mitigate impacts, land developers who convert habitat within the USB will pay a defined per-acre fee that will be used to protect, restore, maintain, and monitor habitat to mitigate development impacts.

Although the county general plan has policies that protect the urban edge and maintain migration corridors, projected growth would result in significant effects on biological resources, including:

- loss of moist grassland, emergent wetland, and riparian wetland acreage and/or habitat values;
- loss of vernal pools, including some that support special-status plant, invertebrate, and amphibian species;
- removal or degradation of riparian habitat resulting from development surrounding seasonal creeks;

- loss of individual trees, oak savanna, oak woodland, and mixed oak-conifer woodlands; and
- loss or severe degradation of habitat critical for foraging and reproduction of special-status wildlife species.

Conservation element policies included in the Sacramento County General Plan Update Draft EIR as mitigation measures would reduce most significant adverse effects to less-than-significant levels. Other significant adverse effects would be compensated for by contributions to mitigation banks or creation and enhancement of preserves.

Visual Quality

Two significant and unavoidable impacts on visual quality of the Sacramento County environs could result from planned growth:

- alteration of the visual character of Sacramento County and
- limited visual access to large areas of open space.

Public Services

The significant effects on provision of public services resulting from removing an obstacle to planned growth are listed below. All of the effects can be mitigated by policies specified in the county general plan and/or the Sacramento County General Plan Update Draft EIR. Effects on public services generated by growth include:

- Development anticipated under the county general plan could diminish the ability of police and fire protection districts to maintain current service standards.
- Some school districts would be adversely affected by the concentration of new growth within their boundaries; growth would also increase the need for affordable licensed childcare slots.

Chapter 21
Impact Conclusions

Chapter 21
Impact Conclusions

Significant and Unavoidable Impacts

Significant and unavoidable impacts associated with the project alternatives are listed below. Unavoidable impacts are those impacts that would result even when the mitigation measures incorporated into the project description and the mitigation measures described in each resource chapter of this EIR/EIS are implemented.

Alternatives 2–5

Significant and unavoidable impacts under this alternative are:

- short-term increases in construction noise levels during daytime hours,
- exposure of noise-sensitive land uses to general construction noise at night, and
- increase in noise levels from facility operation.

Alternative 6

Significant and unavoidable impacts under this alternative are:

- loss of whitewater boating on the upper Mokelumne River between the Middle Bar Bridge and SR 49 bridge,
- loss of whitewater boating on the upper Mokelumne River Electra Run,
- short-term increases in construction noise levels during daytime hours,
- exposure of noise-sensitive land uses to general construction noise at night,
- increase in noise levels from facility operation, and
- changes in visual resources from inundation of the area upstream of the existing Pardee Reservoir (upper Mokelumne River).

Less-than-Significant Impacts

Each resource chapter throughout this EIR/EIS identifies impacts found to be less than significant.

Irreversible or Irretrievable Commitments of Resources

Irreversible commitments of resources would result from implementing any of the project alternatives. These resources include:

- construction materials;
- labor;
- energy needed for construction, operation, and maintenance; and
- minor land conversion of open space, agricultural, and natural environments.

Land uses that would be irreversibly committed include prime agricultural lands that are used to grow row crops, vineyards, and orchards; annual grasslands used for grazing; oak woodlands; riparian habitats; and wetland areas. The loss of oak woodland, riparian habitat, wetland resources, and some agricultural lands could be mitigated by creating new habitats as part of the project. The conversion of some agricultural lands to nonagricultural uses, and not mitigated, is considered an irreversible and irretrievable commitment of resources.

Relationship between Local Short-Term Uses of the Environment and the Maintenance and Enhancement of Long-Term Productivity

NEPA requires that the local short-term benefits of implementing any of the project alternatives be compared to the maintenance and enhancement of long-term productivity (42 U.S.C. 4332; 40 C.F.R. 1502.16). While many of the benefits listed below are intended to be realized over many years, they are considered local short-term benefits as required by NEPA. The local short-term benefits include:

- provision of water supplies to the Zone 40 area to support development approved under the Sacramento County General Plan,
- provision of a surface water supply to use conjunctively with groundwater supplies within the Zone 40 area,
- reduced deficiencies to EBMUD customers, and

- improved system reliability for EBMUD customers.

Long-term productivity refers to the values of the existing environment. The values of the existing environment affected by the project alternatives would be relatively minor, as described throughout this EIR/EIS.

Mitigation Measures

Each topical chapter of the EIR/EIS contains a description of mitigation measures that could be implemented to reduce identified impacts to less-than-significant levels. Please refer to Tables S-1 and S-2 of the Summary chapter for a list of all mitigation measures, including those for the preferred alternative (Alternative 5).

Mitigation Monitoring and Reporting Plan

Public Resources Code Section 21081.6 requires that a reporting and monitoring program be adopted to ensure compliance with project mitigation measures identified in an EIR or other conditions requiring monitoring. According to that section, "the reporting or monitoring program shall be designed to ensure compliance during project implementation." The Mitigation Monitoring and Reporting Plan will identify the impacts and present the mitigation measures contained in the final EIR/EIS.

Chapter 22

Consultation and Coordination

Chapter 22
Consultation and Coordination

Public and Agency Involvement

Public involvement in the FRWP has been significant. FRWA and Reclamation have made substantial efforts to solicit public input on the project through public hearings, public workshops, small group meetings, and scoping meetings. Since initiation of the project, FRWA has continually updated the public on the progress of the project by conducting small group meetings and publishing fact sheets.

Notice of Preparation/Notice of Intent

In March 2002, FRWA and Reclamation issued an NOP of an EIR and a notice of intent (NOI) to prepare an EIS for the FRWP informing agencies and the general public that a joint EIR/EIS was being prepared and inviting specific comments on the scope and content of the document. The NOP and NOI also requested participation at public scoping meetings.

Scoping Meetings

Section 15083 of the State CEQA Guidelines authorizes and encourages an early consultation or scoping process to help identify the range of actions, alternatives, mitigation measures, and significant effects to be analyzed in depth in an EIR and to help resolve concerns of affected agencies and individuals. In addition, the U.S. Council on Environmental Quality EIS regulations (40 CFR Section 1501.7) require "an early and open process for determining the scope of issues to be addressed and for identifying the significant issues related to a proposed action."

The NOP/NOI was mailed to an extensive list of recipients. Approximately 3,800 notices of public scoping meetings were sent to residents in the greater Sacramento area and in areas potentially affected by the project. FRWA held five formal scoping meetings in April 2002 to solicit public comments in determining the scope of the FRWP EIR/EIS. Scoping meetings were held in Oakland, Sacramento, and Herald. Before the meetings, notices were published in local newspapers announcing the time, date, location, and purpose of the meetings. Each scoping meeting included an overview of the meeting's purpose, the proposed project and alternatives, and potentially significant environmental issues. Attendees were given the opportunity to provide both written and oral comments. Agencies and other groups or individuals that provided comments during the scoping process include the following:

Federal Agencies

U.S. Fish and Wildlife Service
U.S. Environmental Protection Agency

State Agencies

California Department of Transportation
California State Lands Commission
California Reclamation Board

Local Agencies

Sacramento Municipal Utility District
County of Sacramento, Public Works
City of Sacramento
Sacramento Area Flood Control Agency
Sacramento Regional County Sanitation District
Sacramento Regional Transit District
Metropolitan Water District of Southern California
Delta Water Users
Santa Clara Valley Water District
Westlands Water District
City of Stockton
Contra Costa Water District

Other

West County Toxics Coalition
State Water Contractors
California Rural Water Association
Sacramento Area Bicycle Advocates
Save the American River Association
Clay Station Road Homeowners Association
Freeport Boulevard Improvement Committee
Meadowview Development Committee
Zebra Neighborhood Association
Bordeau Ranch

Fred Kirtlan and Sons
Jim and Rhonda Bergum
Mary Brill
Tom Burroes
Walter Hoppe
Dick Johnson
John Leadbetter
Joe Mertin
Anna M. Mesquita
Beverly Nesbitt
Brian Nunes
Jesse Reese
Gene Robinson
Betty Robinson
Judy and Dan Serpa
Felix E. Smith
Judy Thomas
Diane Watkins
George and Judy Waegell
Bob Kirkland, Jr.
Keith Watts
Ray Harold

A scoping report has been prepared to document this process. The scoping report is included in Volume 2 of this EIR/EIS as Appendix E. All comments received during the scoping process have been considered during preparation of this EIR/EIS.

Consultation Requirements

Federal Endangered Species Act

Reclamation has been informally consulting with USFWS and NOAA Fisheries regarding the project. Reclamation initiated informal consultation with USFWS by means of a letter dated February 3, 2003. USFWS responded to Reclamation in May 2003 with a memorandum requesting more information regarding the project. Reclamation is providing the requested information. Chapter 5, "Fisheries," Chapter 7, "Vegetation and Wetland Resources," and Chapter 8, "Wildlife," describe the potential for species listed or proposed for listing and other sensitive species to occur in areas affected by the alternatives. Meetings are being conducted with USFWS and NOAA Fisheries to determine the scope, identify species of concern, and develop an appropriate approach to addressing listed and proposed species as part of the Section 7 consultations required by the federal ESA. Reclamation has prepared a biological assessment and submitted that report to USFWS and NOAA Fisheries along with requests to initiate formal consultation.

Fish and Wildlife Coordination Act

This act requires federal agencies to provide equal consideration of fish and wildlife resources in the planning of and proposals for water resource development projects. FRWA and Reclamation have coordinated with USFWS and DFG. This EIR/EIS is intended to serve as the vehicle for compliance with the Fish and Wildlife Coordination Act.

National Historic Preservation Act

Chapter 17, "Cultural Resources," describes the potential effects of project alternatives on cultural resources and identifies measures that may be necessary to avoid or reduce impacts on cultural resources. An MOA outlining the mitigation measures to be implemented will be prepared once surveys have been completed and effects have been assessed. The Section 106 process is proceeding concurrently with the draft EIR/EIS and will continue through preparation of the final EIR/EIS.

Farmlands Protection Policy

Memoranda from the U.S. Council on Environmental Quality to heads of agencies dated August 30, 1976, and August 11, 1980, and the Farmlands Protection Policy Act of 1981 require federal agencies to include farmlands assessments in their EISs designed to minimize adverse impacts on prime and unique farmlands.

The U.S. NRCS will be requested to consult on the effects of the project. The results of this consultation will be included in the final EIR/EIS.

As described in Chapter 11, "Agricultural Resources," the project alternatives would cause only minor permanent losses of farmland acreage in the project area. The environmental analysis of the project alternatives includes a thorough discussion of impacts on prime, statewide important, and unique farmlands. The analysis includes an evaluation of farmlands using CDC classifications and an evaluation of the project's effects on prime and unique farmlands as determined by CDC's Farmland Mapping and Monitoring Program.

Executive Order 11988 (Floodplain Management)

Executive Order 11988 requires federal agencies to prepare floodplain assessments for proposed projects located in or affecting floodplains. An agency proposing to conduct an action within a floodplain must consider alternatives to avoid adverse effects and incompatible development in the floodplain. If the only practicable alternative involves siting in a floodplain, the agency must minimize potential harm to or development within the floodplain and explain why the action is proposed within the floodplain.

Although project features are located in floodplains, they are designed to avoid effects on flooding. Construction of pipelines within the floodplain of various creeks, streams, and rivers would be temporary, and the stream channels would be restored to their original condition immediately following construction. No effects from these facilities are anticipated. The only feature with the potential to affect flooding is the intake facility associated with all project alternatives. This facility must be located within the floodplain and will be designed to have no measurable effect on floodflows or capacity of the current floodplain area.

Executive Order 11990 (Protection of Wetlands)

Executive Order 11990 requires federal agencies to prepare wetlands assessments for proposed projects located in or affecting wetlands. Agencies must avoid undertaking new construction in wetlands unless no practicable alternative is available and the proposed action includes all practicable measures to minimize harm to wetlands.

The project alternatives would result in direct impacts on wetlands. All project alternatives were evaluated for their impact on wetlands and other resources. The mitigation measures specified for the project alternatives require avoidance, replacement, and enhancement measures that would replace all wetland acreage and habitat values affected. For a detailed discussion of the project alternatives' impacts on wetlands, see Chapter 7, "Vegetation and Wetland Resources."

Executive Order 12898 (Environmental Justice)

Executive Order 12898, "Federal Actions to Address Environmental Justice in Minority and Low-Income Populations," requires each federal agency to identify and address disproportionately high and adverse human health or environmental effects of their actions on minorities and low-income populations and communities. Reclamation policy requires that NEPA documents include a determination of whether a project will have any adverse impacts on minority or low-income populations.

To comply with Reclamation direction for the environmental justice assessment, U.S. Census demographic data were analyzed at a geographic scale commensurate with the potential impact area. The results of this analysis are included in Chapter 10, "Land Use."

Clean Water Act

The federal Clean Water Act requires a permit to be obtained from the Corps for the discharge of dredged or fill materials to waters of the United States, including adjacent wetlands. The Corps reviews applications for Section 404 permits in accordance with guidelines for Section 404 of the Clean Water Act. The Corps must also determine that the project is not contrary to the public interest (33 CFR 323.6). The project alternatives likely are consistent with nationwide permits adopted by the Corps, particularly Nationwide Permit 12—Utility Crossings.

Indian Trust Assets and Native American Consultation

The U.S. Department of the Interior is responsible for ensuring that its actions do not negatively affect assets held in trust by the United States for Native Americans. Reclamation's Indian Trust Asset Coordinator has confirmed that no Indian Trust Assets are located within the project study area or would be affected by the project alternatives under consideration. Chapter 17, "Cultural Resources," describes consultation to date with the Native American community.

Consultation and Notification List

During preparation of the EIR/EIS, resource agencies and interest groups were notified and consulted with regarding the proposed project. As indicated above, FRWA and Reclamation have provided materials to an extensive list of interested agencies and individuals. Specific agencies consulted during the preparation of the EIR/EIS include the following:

U.S. Fish and Wildlife Service
National Oceanographic and Atmospheric Administration
State Resources Agency
California Department of Fish and Game, Region 2
State Reclamation Board
Department of Health Services
Department of Boating and Waterways
Department of Parks and Recreation
Department of Water Resources
Department of Toxic Substances Control
State Water Resources Control Board, Division of Water Rights
Central Valley Regional Water Quality Control Board
State Office of Historic Preservation
Native American Heritage Commission
State Lands Commission
California Department of Transportation, District 3

California Department of Transportation, District 10
California Department of Transportation, Division of Aeronautics
Sacramento County Department of Environmental Review and Assessment
Sacramento Regional County Sanitation District
Sacramento Regional Transit District
City of Sacramento

The following entities will receive a copy of the draft EIR/EIS. FRWA will also mail notices to an existing 3,800-person mailing list, informing these parties where the document is available locally for their review and where they may request an individual copy. The current mailing list includes property owners, Reclamation CVP contractors, and other interested parties.

Sacramento County

Agricultural Council
Board of Supervisors
County of Sacramento Water Quality Division
County of Sacramento Water Resources
Department of Environmental Management
Department of Environmental Review and Assessment
Department of Planning and Community Development
Department of Regional Parks, Recreation and Open Space
Public Works Agency
Sacramento County Flood Control Agency

Cities/Counties and Other Agencies

Alameda County Water District
Amador County Conservation District
Amador County Water Agency
American River Flood Control District
American River Parkway Advisory Committee
Arcade Water District
Arden-Cordova Water Service
Berkeley Chamber of Commerce
Cal American Water Company
Calaveras County Chamber of Commerce
Calaveras County Public Works
Calaveras Public Utility District
Carmichael Water District
Central Delta Water Agency
Central San Joaquin Water Conservation District
Central Valley Project Water Users Association
Citrus Heights Water District
City of Alameda
City of Albany

City of Berkeley
City of El Cerrito
City of Elk Grove
City of Emeryville
City of Escalon
City of Folsom
City of Galt
City of Hayward
City of Hercules
City of Ione
City of Isleton
City of Jackson
City of Lafayette
City of Lathrop
City of Lodi
City of Manteca
City of Oakland
City of Orinda
City of Piedmont
City of Pinole
City of Pleasant Hill
City of Rancho Cordova
City of Richmond
City of Ripon
City of Sacramento
City of San Ramon
City of Stockton
City of Tracy
City of Walnut Creek
City of West Sacramento
Clay Water District
Clay Irrigation District
Clements-Lockeford Chamber of Commerce
Contra Costa County Board of Supervisors
Contra Costa Water District
County of Alameda
County of Amador
County of Calaveras
County of Contra Costa
County of El Dorado
County of Placer
County of San Joaquin
County of Yolo
Del Paso Manor Water District
East Bay Municipal Utility District
East San Joaquin Parties Water Authority
El Dorado County Water Agency
El Dorado Irrigation District
Elk Grove Water Service

Fair Oaks Water District
Florin County Water District
Florin Resources Conservation District
Fruitridge Vista Water Company
Galt Chamber
Galt Irrigation District
Georgetown Divide Public Utilities District
Jackson Valley Irrigation District
Kern County Water Agency
Lockeford Community Services District
Metropolitan Water District of Southern California
Modesto-Turlock Irrigation District
Natomas Community Planning Advisory Council
Natomas Mutual Water Company
Neighborhood Association Alliance Group
North Delta Water Agency
North San Joaquin Water Conservation District
Northridge Water District
Oakdale Irrigation District
Oakland Chamber of Commerce
Omochumne-Hartnell Water District
Orangevale Water Company
Pacific Gas and Electric Company—Department of Transmissions and Distribution
Placer County Water Agency
Rancho Cordova Community Planning Advisory Council
Rancho Murieta Community Services District
Rancho Murieta Water District
Reclamation District 1000
Regional Water Authority
Rio Linda Water District
Sacramento Air Resources Board
Sacramento City-County Office of Metropolitan Planning (Water Forum)
Sacramento County Alliance of Neighbors
Sacramento Groundwater Authority
Sacramento Metropolitan Chamber of Commerce
Sacramento Municipal Utilities District
Sacramento Old City Association
San Juan Water District
San Leandro Chamber of Commerce
San Luis and Delta-Mendota Water Authority
San Ramon Chamber of Commerce
Santa Clara Valley Water District
South Delta Water Agency
South San Joaquin Irrigation District
Southeast Area Community Planning Advisory Council
Southern California Water Company
Stockton East Water District
Sutter County Board of Supervisors

Tokay Park Water Company
Town of Danville
Walnut Creek-City Council
West Sacramento Chamber of Commerce
Westlands Water District
Woodbridge Irrigation District

State of California

Air Resources Board
Environmental Protection Agency—External Affairs
Public Utilities Commission
Central Valley Regional Water Quality Control Board
Department of Conservation
Department of Environmental Toxicology
Department of Fish and Game
Department of Health Services
Department of Parks and Recreation
Department of Toxic Substances Control
Department of Transportation
Department of Water Resources
Office of Drinking Water
Office of Planning & Research
Resources Agency
State Lands Commission
State Office of Historic Preservation
State Reclamation Board
State Water Resources Control Board
Waste Management Board

Federal Agencies

Army Corps of Engineers—District Engineer
Army Corps of Engineers—Regulatory Branch
Bureau of Land Management
Bureau of Reclamation—Mid-Pacific Region
Bureau of Reclamation—North Central California Area
Bureau of Reclamation—Regional Director
Department of Agriculture Soil Conservation Services
Department of the Interior—Office of Water & Science
Environmental Protection Agency—Oceans & Estuaries
Environmental Protection Agency—Office of Water
Environmental Protection Agency—Region IX
Environmental Protection Agency—San Francisco Estuary Project
Federal Energy Regulatory Commission
Fish and Wildlife Service—District 1
Fish and Wildlife Service—Sacramento

Forest Service
Forest Service, Stanislaus National Forest
Forest Service, Eldorado National Forest
National Oceanographic and Atmospheric Administration

Representatives

California State Assembly—Dave Cox
California State Assembly—Loni Hancock
California State Assembly—Alan Nakanishi
California State Assembly—Guy Houston
California State Assembly—Barbara Matthews
California State Assembly—Tim Leslie
California State Assembly—Darrell Steinberg
California State Assembly—Wilma Chan
California State Assembly—Ellen Corbett
California State Assembly—Lois Wolk
California State Assembly—Joseph Canciamilla
California State Senate—Deborah Ortiz
California State Senate—Sam Aanestad
California State Senate—Michael Machado
California State Senate—Don Perata
California State Senate—Thomas Oller
California State Senate—Liz Figueroa
California State Senate—Tom Torlakson
State Agriculture and Water Resources Committee—Mike Machado
U.S. House of Representatives—Barbara Lee
U.S. House of Representatives—John Doolittle
U.S. House of Representatives—Doug Ose
U.S. House of Representatives—Robert Matsui
U.S. House of Representatives—George Miller
U.S. House of Representatives—Richard Pombo
U.S. House of Representatives—Ellen Tauscher
U.S. Senate—Barbara Boxer
U.S. Senate—Dianne Feinstein

Other Interested Groups

AFBCA/DB Mather
Alameda County Economic Development, Alliance for Business
Alameda Taxpayers Association
American Land Conservancy
American River Coalition
American River Recreation
American River Utilization Program
Associations of California Water Agencies
Audubon Society—Golden Gate Chapter

Audubon Society—Mount Diablo Chapter
Audubon Society—Ohlone Chapter
Audubon Society—Sacramento Chapter
Building Industry Association
Buckhorn Canyon Legal Defense Fund
Cal Trout
CALFED Bay-Delta Program
California Alliance for Jobs
California Environmental Trust
California Farm Water Coalition
California Fly Fishers Unlimited
California Groundwater Association
California League of Conservation Voters
California Marine Mammal Center
California Marine Parks and Harbors
California Native Plant Society
California Outdoors
California Sport Fishing Protection Alliance
California Trout Incorporated
California Urban Water Agencies
California Waterfowl Association
California Water Resources Association
California Wilderness Coalition
Center for Natural Lands Management
Central Valley Project Water Association
Citizens for Alameda's Last Marshland
Citizens for Albany Shoreline
Citizens for a Better Environment
Clean Water Action
Coalition for American River Water Resources
Coast-to-Crest Trail
Common Cause
Cosumnes Community Planning Advisory Council
Delta Fly Fisherman
Ducks Unlimited, Inc.
Environmental Council of Sacramento
Environmental Defense Fund
Friends of the River
Greenbelt Alliance
Greenpeace
League of Conservation Voters
League of Women Voters California
Lockeford Ranches, Inc.
Lower American River Task Force
Mokelumne River Association
Native American Heritage Commission
Natural Heritage Institute
Natural Resources Defense Council
Natomas Community Association

Office of City Attorney, San Francisco
Pacific Advocates
Pacific Coast Federation of Fisherman’s Association
Planning and Conservation League
Point Reyes Bird Observatory
Protect American River Canyons
Public Officials for Water and Environmental Reform
Romberg Tiburon Center
Rosemont Community Association
Sacramento Area Water Works Association
Sacramento County Farm Bureau
Sacramento River Preservation Trust
Sacramento Valley Open Space Conservancy
Sacramento Water Intelligently Managed
San Francisco Bay Bird Observatory
San Francisco Public Utilities Commission
San Joaquin County Farm Bureau
Save Mount Diablo
Save San Francisco Bay Association
Save the American River Association
Share the Water
Sierra Club—Mount Diablo
Sierra Club—North Alameda County
Sierra Club—Northern California
Sierra Club—Sacramento Valley Group
Sierra Club—San Francisco Bay Chapter
Sierra Club—West County
Sierra Club Water Committee
Terwilliger Nature Education Center
The Bay Institute of San Francisco
The Ecology Center
The Gem & Mineral Society
The Nature Conservancy
The Pacific Institute
The Resources Agency
Trust for Public Land
United Anglers of California
University of California Energy & Resources
Urban Creeks Council
Urban Habitat–Earth Island Inst.
W.A.T.E.R.
Waltner & Gorman
Water Advisory Commission
Water Education Foundation
WateReuse Association

Chapter 23

References

Chapter 23
References

References to the Code of Federal Regulations (CFR), the Federal Register (FR), and the U.S. Government Code (USC) are not included in this listing. FR citations in text refer to volume and page numbers (e.g., "56 FR 50075" refers to Volume 56 of the FR, page 50075); CFR and USC citations refer to title and section (e.g., "16 USC 1536" refers to Title 16 of the USC, Section 1536).

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Chapter 24

List of Preparers

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List of Preparers

Following is a list of persons who contributed to preparation of this EIR/EIS. This list is consistent with the requirements set forth in NEPA and CEQA (40 CFS 1502.17 and Section 15129 of the State CEQA Guidelines).

Name	Qualifications	Expertise	Years of Professional Experience	Participation
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Russ Yaworsky				Modeling
Freeport Regional Water Project				
Kurt Kroner	B.S., Natural Resource Management	Regulatory Compliance	15	Manager of Environmental Services, CEQA process and compliance
Robin Cort	Ph.D., Ecology B.S., Biology	NEPA and CEQA process and compliance	21	NEPA and CEQA process and compliance
East Bay Municipal Utility District				
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Name	Qualifications	Expertise	Years of Professional Experience	Participation
	Engineering			
	Professional Engineer			
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	B.S., Zoology			
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KT Shum	Ph.D., Civil and Environmental Engineering	Water Quality/Hydrology	15	Modeling
	M.S., Civil and Environmental Engineering			
	B.S., Applied Science			
	Professional Engineer			
Susan Wallenstein	M.S., Civil Engineering	Civil Environmental Engineering	20	Project Coordination
	B.A., Architecture			
	Professional Engineer			
John Skinner	B.S., Civil Engineering	Water Rights/Hydrology	26	Modeling
	Professional Engineer			
Sacramento County Department of Environmental Review and Assessment				
Robert Caikoski	M.S., Ecology	CEQA and NEPA Compliance	30	CEQA Process Technical Review
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	B.S., Mechanical Engineering			
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Forrest Williams	M.S., Civil Engineering	Facility Planning	5	Facility Planning
	B.S., Mechanical Engineering			

Name	Qualifications	Expertise	Years of Professional Experience	Participation
Jones & Stokes				
Harlan Glines	B.A., Environmental Studies	Water resource planning and impact analysis, socioeconomic studies, land use planning and impact analysis, planning policy consistency assessment, environmental documentation, and project management	19	Principal in charge
Gregg Ellis	B.A., Geography	Geography, natural resource management, water resource planning, NEPA/CEQA compliance	9	Project manager
Brooke Fraschetti	B.S., Geological and Environmental Sciences	Regulatory compliance	3	Project Coordination/ Planner
Russ Brown	Ph.D., Civil Engineering (water resources) M.S., Ocean Engineering B.S., Civil and Environmental Engineering	Hydrologic and water quality modeling to support fisheries and other water resource investigations	23	Hydrologist and water quality specialist
Anne Huber	M.S., Ecology B.S., Biology	Development and interpretation of water temperature models and water operations models	12	Water quality specialist
Jeff Lafer	M.S., Environmental Science B.S., Environmental Science	Water quality monitoring and data analysis, impact assessment, and watershed analysis of pollution sources, control, and management	13	Water quality specialist
Gregg Roy	B.S., Political Economy of Natural Resources	Socioeconomic and economic analysis, natural resources studies, agricultural land studies, and recreation impact analysis	16	Technical review and support
Warren Shaul	M.S., Fisheries B.S., Biology	Fish population dynamics and modeling, aquatic ecology, sampling design and statistical analyses, NEPA and CEQA impact assessments, ESA assessments	28	Fisheries biologist
Joy Chen	M.S., Environmental Science B.S., Environmental	Toxicology and water quality analysis	1	Fisheries biologist

Name	Qualifications	Expertise	Years of Professional Experience	Participation
	Science			
Michael McNabb	B.S., Fisheries Biology	Fish population and habitat sampling, quantitative fisheries impact assessment, and computer applications for fisheries	9	Fisheries biologist
Alan Barnard		Web Design, graphic design, cartography, and illustration	8	Graphic artist
Stephanie Theis	M.S., Applied Ecology and Conservation Biology (Fisheries) B.S., Fisheries Biology (marine option)	Fish population and habitat sampling, quantitative fisheries impact assessment, and Endangered Species Act compliance and consultation	12	Fisheries biologist
Tim Messick	M.A., Biology B.A., Botany	Graphic design, illustration, cartography, and botany	20	Graphic artist
Kevin Lee	M.S., Civil and Environmental Engineering B.S., Civil Engineering	Air quality science	4	Air quality specialist
Shannon Hatcher	B.S., Environmental Science B.S., Environmental Health & Safety	Acoustical engineering, air quality science	2	Noise specialist
Joel Butterworth	M.S., Geography B.A., Geography Certified Professional in Erosion and Sediment Control	Erosion control, soil science, watershed management	15	Earth scientist
Keturah Anderson	B.S., Recreation, Parks & Natural Resources Management	NEPA/SEPA/CEQA compliance, natural resources management, open space and recreational planning	4	Traffic specialist
Subconsultants				
Robert Tull – CH2M Hill		Environmental engineering, hydrology		Hydrologic Modeling
John McCarthy – Garcia and Associates	B.S. Forestry M.B.A.	Natural and cultural resources, , aquatic, and terrestrial ecology, and natural resources policy and planning applications	13	Task leader

Name	Qualifications	Expertise	Years of Professional Experience	Participation
Dan Clemens – Garcia and Associates	Ph.D., Biology	Biological resources	6	Wildlife
Lisa Infante – Garcia and Associates	M.S. Environmental Science	Biological resources	4	Vegetation and wildlife resources
Stacie Reutter – Garcia and Associates	M.A., Anthropology	Cultural resources	6	Cultural resources
Richard Grassetti – Uribe & Associates	M.A., Geography B.A., Geography	NEPA/CEQA compliance, cultural resources, socioeconomics and population, land use	19	Land use and agricultural
Stephanie Knott – Uribe & Associates	M.S., Geology B.S., Geology Registered Geologist	NEPA/CEQA compliance, geology, hazardous materials, environmental documentation, and project management	14	geology, public health and safety, land use, and agriculture

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