8 WSIP Variants and Impact Analysis

CHAPTER 8
WSIP Variants and Impact Analysis

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8.1 Overview

The San Francisco Public Utilities Commission (SFPUC) has requested that this Program Environmental Impact Report (PEIR) include environmental analysis of three variants to the Water System Improvement Program (WSIP or proposed program). The WSIP variants are variations of the proposed program which are designed to meet or exceed all WSIP goals and objectives but differ with respect to water supply source or drought-year level of service. The variants are not necessarily intended to be alternatives to the proposed program that would lessen or avoid environmental impacts as required by the California Environmental Quality Act (CEQA); the CEQA alternatives are described and analyzed in Chapter 9.

Subsequent to the publication of the Draft PEIR, the SFPUC requested that the PEIR address a fourth variant. Please refer to Chapter 13 (Vol. 7) of the PEIR, Section 13.4 for a description and analysis of the fourth variant, the *Phased WSIP Variant*. This chapter describes and analyzes the potential environmental effects of three WSIP variants: *WSIP Variant 1 – All Tuolumne*; *WSIP Variant 2 – Regional Desalination for Drought*; and *WSIP Variant 3 – 10% Rationing*. The variants include the same fundamental facility components and operation/maintenance plan as the proposed WSIP. The major difference between the variants and the proposed program is either in the proposed source(s) of water supply or in the drought-

year rationing level of service. To implement these differences, the variants would involve some variation in the extent of facility improvement projects needed. The descriptions and assumptions of the WSIP variants presented in this chapter are based on the report entitled *Water Supply Options* (SFPUC, 2007) and related supporting documentation. **Table 8.1** summarizes and compares the key components of the proposed program and the three variants.

The WSIP variants are designed to meet or exceed all of the goals, objectives, and levels of service of the proposed program as described in Chapter 3, Program Description, Tables 3.2 and 3.5. Thus, all variants are designed to serve the 2030 customer purchase request (regional water system demand) of 300 million gallons per day (mgd) on an average annual basis. **Table 8.2** compares the level of service performance among existing conditions, the proposed program, and the three variants. As shown on this table, while the proposed program and all the variants would meet the WSIP minimum levels of service, some would provide slightly better performance than others with respect to water supply service during drought sequences (discussed in more detail below).

The environmental impact analysis for the WSIP variants presented in this chapter is adapted from Chapter 4, WSIP Facility Projects – Settings and Impacts, Chapter 5, WSIP Water Supply and System Operations – Settings and Impacts, and Chapter 7, Growth-Inducement Potential and Indirect Effects of Growth, of this PEIR. The analysis is based on the same setting information included in those chapters and, for Variant 2, supplemented with information relevant to the regional desalination facility, and uses the same approach to the analysis. Impacts associated with facilities-related construction and operations are discussed separately from impacts associated with water supply and system operations, and the impact analysis and significance determinations are relative to the existing condition (2005) baseline. For the common elements, the variant analysis refers to the same impacts and mitigation measures described in Chapters 4, 5, and 6, supplemented where appropriate with additional impacts and mitigation measures. As described in more detail below, the variants would result in the same impacts as the proposed program for most impact areas. Therefore, to avoid redundancy, this chapter refers extensively to the analyses in Chapters 4 and 5 and focuses on the impacts that differ from those identified for the proposed program, summarizing which impacts would or would not occur under the three variants and augmenting the analysis where appropriate.

Variants 1 and 3 would include all the same or fewer facility improvement projects as the WSIP. Therefore, the basis for the facility impacts of Variants 1 and 3 rely on the detailed analysis presented in Chapter 4 for the proposed program. The basis for the discussion of impacts under Variant 2 also relies on the analysis presented in Chapter 4, however, this variant would require an additional major facility improvement project—the regional desalination project—which is still in the preliminary planning and development phase and lacks site-specific design and siting information. Therefore, the facility impact analysis for the regional desalination project under Variant 2 is also preliminary and at a much more general level of detail than the analysis in Chapter 4. For all three variants, though, the evaluation of potential impacts on water resources due to the water supply and system operations variations relies on the detailed analysis for the proposed program in Chapter 5 and compares the relative impacts of the variants to the impacts identified for the proposed program.

TABLE 8.1
SUMMARY DESCRIPTION OF THE WSIP VARIANTS

Program Element	Existing Condition	Proposed Program	Variant 1 – All Tuolumne	Variant 2 – Regional Desalination for Drought	Variant 3 – 10% Rationing
Planning Year	2005	2030	2030	2030	2030
Customer Purchase Request (annual average)	265 mgd	300 mgd	300 mgd	300 mgd	300 mgd
Water Supply Sources[a] (during nondrought and drought periods)	▪ Local watersheds (with Calaveras and Lower Crystal Springs Reservoirs operating at reduced levels based on Department of Safety of Dams restrictions) ▪ Tuolumne River	▪ Local watersheds (with Calaveras and Lower Crystal Springs Reservoirs restored) ▪ Tuolumne River, with 27 mgd increased average annual diversion ▪ Recycled water/groundwater/ additional conservation in San Francisco, 10 mgd	▪ Local watersheds (with Calaveras and Lower Crystal Springs Reservoirs restored) ▪ Tuolumne River, with 32 mgd increased average annual diversion	▪ Local watersheds (with Calaveras and Lower Crystals Springs Reservoirs restored) ▪ Tuolumne River, with 20 mgd increased average annual diversion ▪ Recycled water/groundwater/ additional conservation in San Francisco, 10 mgd	Same as proposed program[b]
Supplemental Dry-Year Water Supply Sources (for implementation during drought periods)	None	▪ Additional Tuolumne River diversions from Turlock and Modesto Irrigation District (TID and MID) transfers of 23 mgd (average over design drought) ▪ Westside Basin conjunctive use, 6 mgd (average over design drought)	Same as proposed program	▪ Potable water from regional desalination plant, 23 mgd (average over design drought) ▪ Westside Basin conjunctive use, 6 mgd (average over design drought)	▪ Additional Tuolumne River diversions from TID and MID transfers of 35 mgd (average over design drought) ▪ Westside Basin conjunctive use, 6 mgd (average over design drought)
Maximum Drought Rationing Policy	No defined limit but assumed incidental rationing of up to 25%	20%	Same as proposed program	Same as proposed program	10%
System Firm Yield	219 mgd	256 mgd	Same as proposed program	Same as proposed program	268 mgd
WSIP Facility Improvement Projects	None	All projects listed in Chapter 3, Table 3.10	Same as proposed program except two projects would not be implemented: Local Groundwater Projects (part of SF-2) and Recycled Water Projects (SF-3)	Same as proposed program	Same as proposed program
Other Facility Improvements	None	None	None	Bay Area Regional Desalination Plant(s) and associated pumping plant(s) and pipelines needed for intertie facilities	None

TABLE 8.1 (Continued)
SUMMARY DESCRIPTION OF THE WSIP VARIANTS

Program Element	Existing Conditions	Proposed Program	Variant 1 – All Tuolumne	Variant 2 – Regional Desalination for Drought	Variant 3 – 10% Rationing
Delivery, Operations, and Maintenance	(see Chapter 2, Section 2.3)	(see Chapter 3, Section 3.8)	Same as proposed program	Same as proposed program except, during drought periods, the SFPUC would receive water from the Bay Area regional desalination plant through transfer with other Bay Area water agencies	Same as proposed program except, during drought periods, the maximum rationing would be 10%
Permits and Approvals	(see Chapter 2, Sections 2.4 and 2.5)	(see Chapter 3, Section 3.12)	Same as proposed program	Same as proposed program except: ▪ Agreements with partners in Bay Area regional desalination project ▪ See Table 8.4 for list of potential permits for the Bay Area regional desalination plant ▪ Transfer agreements with TID and MID not needed	Same as proposed program except: ▪ Transfer agreements with TID and MID would be for 35 mgd instead of 23 mgd during droughts

[a] The amount of water from the various sources listed represent the average annual amount as modeled over the 82-year period of hydrologic record using the Hetch Hetchy/Local Simulation Model. In order to maximize use of available water sources under each scenario, the model uses slight variations in levels of service performance during drought years for the different scenarios, affecting the average annual amount of water diverted from the Tuolumne River. Therefore, the average annual diversions from the Tuolumne River under each scenario cannot be directly compared to each other. Thus, when comparing the average annual Tuolumne River diversions under Variant 1 with that of the proposed program, there would be an additional 5 mgd (average annual increase) diverted from the Tuolumne River coupled with a slightly reduced level of service (i.e., slightly more frequent drought rationing) instead of 10 mgd of recycled water/groundwater/conservation; however, both scenarios would still meet the WSIP level of service objectives. Refer to Table 8.2 for description of the level of service performance for the different scenarios.

[b] Under Variant 3, the water supply sources would be the same as the proposed program, but there would be slightly increased diversions from Tuolumne River during drought periods, but this slight increase is not apparent in the average annual diversion values.

SOURCE: SFPUC, 2006.

TABLE 8.2
WSIP VARIANTS – TUOLUMNE RIVER DIVERSIONS AND LEVEL OF SERVICE PERFORMANCE

System Operating Parameter	Existing Conditions	Proposed Program	WSIP Variant 1 – All Tuolumne	WSIP Variant 2 – Regional Desalination for Drought	WSIP Variant 3 – 10% Rationing
Estimated Tuolumne River Diversions over 82-Year Period of Hydrologic Record					
Average Annual Increase by the SFPUC	N/A	27 mgd	32 mgd	20 mgd	27 mgd[a]
Average Annual Diversions by the SFPUC	218 mgd	245 mgd	250 mgd	238 mgd	245 mgd[a]
Drought-Year Shortages based on 82-Year Period of Hydrologic Record					
Years of Shortages (10% Shortage)	6 out of 82 years (1 in 14 years)	6 out of 82 years (1 in 14 years)	8 out of 82 years (1 in 10 years)	Same as proposed program	8 out of 82 years (1 in 10 years)
Years of Shortages (20% Shortage)	8 out of 82 years (1 in 10 years)	2 out of 82 years (1 in 41 years)	6 out of 82 years (1 in 14 years)	Same as proposed program	None
Number of Years Drought-Year Supplies Triggered[b]	N/A	24	26	23	25
Drought-Year Shortages during 8.5-Year Design Drought					
Years of Shortages (10% Shortage)	1 year	3 years	2 years	Same as proposed program	6.5 years
Years of Shortages (20% Shortage)	5 years	3.5 years	5.5 years	Same as proposed program	None
Years of Shortages (25% Shortage)	1.5 years	None	Same as proposed program	Same as proposed program	Same as proposed program
Water Quality					
Complies with current and foreseeable future federal and state water quality requirements?	Yes for current requirements, no for foreseeable future requirements.	Yes, all supplies would meet water quality requirements.	Same as proposed program	Same as proposed program	Same as proposed program
Provides clean, unfiltered water from Hetch Hetchy Reservoir; filtered water from other watersheds?	Yes	Yes, filtration avoidance for Hetch Hetchy supply would be maintained.	Same as proposed program	Same as proposed program	Same as proposed program
Continued implementation of watershed protection measures?	Yes, ongoing implementation of Peninsula and Alameda Watershed Management Plans, and Hetch Hetchy watershed protection agreement with the U.S. National Park Service.	Yes, existing activities augmented by implementation of the Watershed and Environmental Improvement Program and PEIR mitigation measures.	Same as proposed program	Same as proposed program	Same as proposed program
Seismic Reliability					
Complies with current seismic standards?	System complies with seismic standards applicable at the time facilities were constructed, but some system components no longer comply with current seismic standards.	Yes, all WSIP projects would be designed to meet current seismic standards.	Same as proposed program	Same as proposed program	Same as proposed program
Capable of delivering basic service to all regions in the service area 24 hours following a major earthquake?[c]	No	Yes, seismic upgrades implemented as part of WSIP would allow system to accommodate 229 mgd demand within 24 hours.	Same as proposed program	Same as proposed program	Same as proposed program
Facilities restored to meet average-day demand within 30 days of a major earthquake?	No	Yes, seismic upgrades implemented as part of WSIP would allow system to accommodate 300 mgd demand within 30 days.	Same as proposed program	Same as proposed program	Same as proposed program
Delivery Reliability					
Provides operational flexibility to allow for planned maintenance without service interruptions?	Limited to parts of the system	Yes, program would include complete planned maintenance program.	Same as proposed program	Same as proposed program	Same as proposed program
Provides operational flexibility and system capacity to replenish local reservoirs, as needed?	Limited ability	Yes, program would provide operational flexibility and system capacity to replenish local reservoirs.	Same as proposed program	Same as proposed program	Same as proposed program
Capable of minimizing risk of service interruption due to unplanned facility upsets or outages?	Limited ability	Yes, maintenance program would incorporate provisions for unplanned facility upsets or outages.	Same as proposed program	Same as proposed program	Same as proposed program
Capable of serving average 2030 demand of 300 mgd with one planned shutdown of a major facility and one unplanned facility outage?	No	Yes	Same as proposed program	Same as proposed program	Same as proposed program

TABLE 8.2 (Continued)
WSIP VARIANTS – TUOLUMNE RIVER DIVERSIONS AND LEVEL OF SERVICE PERFORMANCE

	Existing Conditions	Proposed Program	WSIP Variant 1 – All Tuolumne	WSIP Variant 2 – Regional Desalination for Drought	WSIP Variant 3 – 10% Rationing
Water Supply					
Capable of reliably serving average 2030 demand of 300 mgd during nondrought years?	No, although the system could occasionally serve 300 mgd during nondrought years, it could not reliably deliver this amount.	Yes, system would be capable of reliably serving average annual purchase requests of 300 mgd during nondrought years.	Same as proposed program	Same as proposed program	Same as proposed program
Meets drought-year delivery needs through 2030 while limiting rationing to 20% during 8.5-year design drought?	No	Yes, rationing would not exceed 20% during an 8.5-year design drought.	Same as proposed program	Same as proposed program	Yes, rationing would not exceed 10% during the 8.5-year design drought.
Meets system firm yield of 256 mgd?	No	Yes, system firm yield objective would be achieved.	Same as proposed program	Same as proposed program	Yes, system firm yield objective would be 268 mgd, surpassing WSIP objective
Diversifies water supply options during nondrought and drought periods and improves use of new water sources, including groundwater, recycled water, additional conservation, and water transfers?	No	Yes, the proposed program includes 10 mgd of recycling, groundwater, and additional conservation in all years and relies on groundwater from conjunctive-use program and water transfers during drought years.	Not during normal (nondrought) years except for the use of surface supplies to offset groundwater use to support the conjunctive-use program. Yes during drought years, since groundwater from conjunctive-use program and water transfers would be utilized.	Yes, includes 10 mgd of recycling, groundwater and additional conservation in all years and relies on desalination, and conjunctive use during drought years.	Same as proposed program

[a] Because of the reduced level of rationing, Variant 3 – 10% Rationing would result in slightly increased average annual Tuolumne River diversions over the 82-year hydrologic record compared to the proposed program, but due to rounding, the levels of diversion appear to be the same.
[b] The number of times over the 82-year hydrologic record that drought-year supplies would be used to augment supplies. See Table 8.1 for the source of drought-year supplies under existing conditions, the proposed program, and the variants.
[c] Basic service is defined as average winter-month usage with a regional performance objective of 229 mgd. The performance objective is to provide delivery to at least 70 percent of the turnouts in each region (104 mgd for East/South Bay; 44 mgd for Peninsula; and 81 mgd for San Francisco).

This chapter is organized as follows. Each of the three variants and its associated facilities-related impacts are described in detail in Sections 8.2, 8.3, and 8.4, respectively; these sections provide the facilities impact analysis for the variants, similar to Chapter 4. Section 8.5 evaluates the impacts resulting from water supply and system operations for all variants, similar to Chapter 5. As with the proposed program, the Hetch Hetchy/Local Simulation Model (HH/LSM) water supply planning model (described in Chapter 3, Section 3.4 and detailed in Appendix H) was used to evaluate the performance of the three variants relative to the goals and objectives of the WSIP, based on historical hydrologic data for the 82-year period from 1920 to 2002, as well as to predict the impacts of water supply and system operations on the affected water resources. The last section, Section 8.6, presents a comparison of the major impacts of the proposed program and the three variants.

8.2 WSIP Variant 1 – All Tuolumne

8.2.1 Description

Water Supply

The water supply for *WSIP Variant 1 – All Tuolumne* would be identical to that proposed for the WSIP, except that to accommodate the estimated 35-mgd average annual increase in purchase request (from 265 to 300 mgd) by the year 2030, customers would be served entirely with additional water from the Tuolumne River watershed. The water supply would not include the 10 mgd from implementation of the Recycled Water Projects (SF-3), Local Groundwater Projects[1] (a component of SF-2, Groundwater Projects), and additional conservation programs in San Francisco in the WSIP proposed water supply option. In all other respects, *WSIP Variant 1 – All Tuolumne* would include the same water supply sources as the proposed program. During all hydrologic year types, this variant would continue to maximize use of local water supplies from the Alameda and Peninsula watersheds and would accommodate the remaining purchase requests from Tuolumne River diversions. During extended dry-year sequences, supplemental water would be obtained from Tuolumne River diversions through transfers from the Turlock Irrigation District (TID) and Modesto Irrigation District (MID) as well as through implementation of a conjunctive-use program in the Westside Groundwater Basin, identical to the WSIP. Using the HH/LSM, the SFPUC determined that the average annual Tuolumne River diversion could increase by 32 mgd under this variant compared to existing (2005) conditions and by 5 mgd[2] compared to the proposed program.

[1] The Local Groundwater Projects involve the development of 4 mgd of new potable water groundwater sources in San Francisco. About 2 mgd of local groundwater would be developed from four new groundwater wells; 2 mgd would be obtained by converting groundwater currently used for irrigation to a potable supply and meeting the irrigation demands previously met by groundwater with recycled water.

[2] When comparing the Tuolumne River diversions under Variant 1 with the proposed program, there would be an additional 5 mgd (average annual) diverted from the Tuolumne River coupled with a slightly reduced level of service (i.e., slightly more frequent drought rationing) instead of 10 mgd of recycled water/groundwater/additional conservation. Refer to Table 8.2 for description of the level of service performance for the different scenarios.

Regional Water System Operations

Under *WSIP Variant 1 – All Tuolumne*, the operation, maintenance, and delivery strategy of the SFPUC regional water system would be essentially identical to that proposed under the WSIP (see Chapter 3, Section 3.8, Proposed System Operations Strategy). Specific operating procedures, however, would vary slightly due to the absence of local recycled and groundwater supplies in San Francisco and the increased use of Tuolumne River water supplies to accommodate the 2030 customer demands. The differences in operating procedures between this variant and the proposed program and the effects of this variant on water resources are discussed in more detail in Section 8.5, below.

Level of Service Performance

WSIP Variant 1 – All Tuolumne would achieve all of the proposed WSIP level of service performance goals through 2030, as shown in Table 8.2. However, as shown in the table, even though it would achieve the performance goals, this variant would have different implications in terms of its performance during the design drought when compared to the WSIP. These differences are due to minor variations in the assumptions used to model the operating strategy required to provide customer water deliveries during the design drought, and actual operations during a drought sequence would likely be similar for Variant 1 and the proposed program.

As shown in Table 8.2, modeling results indicate that the proposed program would perform slightly better than Variant 1 with respect to drought response. While both the proposed program and Variant 1 would limit rationing to 20 percent during drought sequences, *WSIP Variant 1 – All Tuolumne* would result in an estimated slight increase in the number of drought-year shortages compared to the WSIP. When modeled over the 82-year period of hydrologic record (1920–2002), Variant 1 would trigger the drought response program 26 times in the 82-year period, with rationing required in 14 of those years; this compares to 24 times that the drought response program would be triggered under the proposed program, with rationing in 8 of the years. Another way of indicating the difference in level of service performance is to consider that, when modeled over the 8.5-year design drought, Variant 1 would require 2 years of rationing at 10 percent and 5.5 years at 20 percent (7.5 out of 8.5 years subject to rationing), while the proposed program would require 3 years of rationing at 10 percent and 3.5 years at 20 percent (6.5 out of 8.5 years subject to rationing). The slight increase in severity of rationing is due to absence of the 10 mgd from implementation of the Recycled Water Projects (SF-3), Local Groundwater Projects (a component of SF-2, Groundwater Projects), and additional conservation programs in San Francisco. Instead of serving a net 290 mgd demand with system resources (300 mgd purchase request less 10 mgd of recycling, groundwater and additional conservation projects in San Francisco), the regional system would serve a 300 mgd demand, requiring a greater level of rationing to deliver the same amount of water.

Facility Requirements

WSIP Variant 1 – All Tuolumne would require the construction of nearly all of the same facility improvement projects as the proposed program. Under this variant, the Recycled Water Projects (SF-3) and Local Groundwater Projects in San Francisco (a component of SF-2, Groundwater Projects) would not be constructed. All other WSIP projects would be constructed and implemented as described in Chapter 3, Section 3.9, Proposed Facility Improvement Projects.

Institutional Requirements

WSIP Variant 1 – All Tuolumne would involve the same institutional requirements as the proposed program, as described in Chapter 3, Section 3.12, Required Actions and Approvals, except that the SFPUC would not need permits for the recycled water or groundwater projects in San Francisco.

8.2.2 Setting

The regional setting for facility improvement projects for *WSIP Variant 1 – All Tuolumne* is the same as the regional setting for the WSIP study area described in Chapter 4, extending from Oakdale Portal in Tuolumne County west along the regional water system to its terminus in San Francisco. Similarly, the regional setting for potentially affected watersheds and drainages, including the Tuolumne River, Alameda Creek, and Peninsula watersheds, is the same as that described for the proposed program in Chapter 5.

8.2.3 Impact Analysis – Facilities Construction and Operation

Under *WSIP Variant 1 – All Tuolumne*, potential impacts related to the construction and operation of WSIP facilities would be the same in all respects as those described for the proposed program in Chapter 4, except for impacts associated with the Recycled Water Projects (SF-3) and Local Groundwater Projects in San Francisco (a component of SF-2, Groundwater Projects). The Recycled Water Projects includes two recycled water projects scheduled to occur from 2010 to 2012: a series of recycled water treatment/storage/transmission facilities along the westside of San Francisco and the Harding Park/Lake Merced project. Since these projects would not be constructed under *WSIP Variant 1 – All Tuolumne*, no impacts associated with the Recycled Water Projects would occur, and the associated mitigation measures would not be required.

The Groundwater Projects (SF-2) includes three groundwater projects scheduled for construction from 2009 to 2014: the Lake Merced, other Local Groundwater, and Westside Groundwater Basin conjunctive-use projects. Under the variant, only the Lake Merced and Westside Groundwater Basin conjunctive-use components would be constructed; therefore, impacts associated with the other Local Groundwater component would not occur.

This variant would have slightly fewer environmental impacts than those associated with WSIP facilities construction and operation, particularly in the west side of San Francisco; as a result, there would be fewer impacts contributing to cumulative facilities impacts in the San Francisco Region of the regional water system. However, in all other respects, this variant would result in

the same facilities-related cumulative impacts as those identified and described in Chapter 4 for the proposed program. **Table 8.3** identifies the impacts that would occur under *WSIP Variant 1 – All Tuolumne* related to facilities construction and operation.

Impacts associated with water supply and systemwide operations for all of the variants are discussed below in Section 8.5. The growth-inducement potential of Variant 1 as well as the indirect environmental effects associated with growth would be identical to those described for the proposed program in Chapter 7.

8.2.4 Mitigation Measures – Variant 1

Nearly all mitigation measures for facilities-related impacts identified for the proposed program and described in Chapter 6 would apply to Variant 1. Table 8.3 summarizes the facilities-related impacts of Variant 1; where applicable, the corresponding mitigation measures are presented in Chapter 6. Variant 1 would require slightly fewer mitigation measures compared to the proposed program, since the Recycled Water Projects (SF-3) and other Local Groundwater Projects in San Francisco (a component of SF-2, Groundwater Projects) would not be constructed. Mitigation measures related to water resources impacts applicable to Variant 1 would be identical to those for the proposed program, as described in Chapters 5 and 6 and discussed below in Section 8.5.

8.3 WSIP Variant 2 – Regional Desalination for Drought

8.3.1 Description

Water Supply

The water supply for *WSIP Variant 2 – Regional Desalination for Drought* would be identical to that proposed for the WSIP, except that during drought years the SFPUC would receive water from a proposed regional desalination plant instead of water transfers from TID and MID. Under this variant, the SFPUC, through its participation in the Bay Area Regional Desalination Project (BARDP) (a description of the BARDP is provided below under Facility Requirements), would receive additional water supply of up to 26 mgd during drought periods (an average annual yield of 23 mgd over the 8.5-year design drought), either directly or indirectly, from one or two regional desalination plants to meet the WSIP water supply and firm yield objectives. As described below under Facility Requirements, the BARDP would include facilities and institutional arrangements for a regional desalination plant(s) as well as those required for water transfers and conveyance to the participating agencies. The SFPUC would not need to develop water transfers agreements with TID and MID for supplemental water during drought periods under this variant, thereby reducing the overall increase in average annual diversion from the Tuolumne River by the SFPUC.

TABLE 8.3
SUMMARY OF FACILITY CONSTRUCTION AND OPERATION IMPACTS FOR WSIP VARIANTS

Impact	Variants 1, 2, and 3																				Variant 1 only	Variants 2 and 3 only		Variant 2 only[a]
	Advanced Disinfection	Lawrence Livermore Supply Improvements	San Joaquin Pipeline System	Rehabilitation of Existing San Joaquin Pipelines	Tesla Portal Disinfection Station	Alameda Creek Fishery Enhancement	Calaveras Dam Replacement	Additional 40-mgd Treated Water Supply	New Irvington Tunnel	SVWTP – Treated Water Reservoirs	San Antonio Backup Pipeline	Bay Division Pipeline Reliability Upgrade	BDPL Nos. 3 and 4 Crossovers	Seismic Upgrade of BDPL Nos. 3 and 4 at Hayward Fault	Baden and San Pedro Valve Lots Improvements	Crystal Springs/San Andreas Transmission Upgrade	HTWTP Long-Term Improvements	Lower Crystal Springs Dam Improvements	Pulgas Balancing Reservoir Rehabilitation	San Andreas Pipeline No. 3 Installation	Groundwater Projects – Lake Merced and Regional Components Only	Groundwater Projects	Recycled Water Projects	Regional Desalination for Drought
	SJ-1	SJ-2	SJ-3	SJ-4	SJ-5	SV-1	SV-2	SV-3	SV-4	SV-5	SV-6	BD-1	BD-2	BD-3	PN-1	PN-2	PN-3	PN-4	PN-5	SF-1	SF-2	SF-2	SF-3	VA-2
Land Use and Visual Quality																								
Impact 4.3-1: Temporary disruption or displacement of existing land uses during construction.	LS	LS	PSM	PSM	LS	LS	LS	LS	PSU	LS	LS	PSM	PSM	LS	LS	LS	LS	LS	LS	PSM	PSM	PSM	PSM	PSM
Impact 4.3-2: Permanent displacement or long-term disruption of existing land uses.	LS	N/A	PSU	N/A	LS	N/A	N/A	PSU	LS	N/A	PSU	PSU	LS	N/A	N/A	PSU	N/A	N/A	N/A	N/A	PSM	PSU	PSU	PSM
Impact 4.3-3: Temporary construction impacts on scenic vistas or visual character.	LS	LS	LS	LS	LS	LS	LS	LS	LS	LS	LS	LS	LS	LS	LS	LS	LS	LS	LS	LS	LS	LS	LS	PSM
Impact 4.3-4: Permanent adverse impacts on scenic vistas or visual character.	PSM	LS	LS	N/A	PSM	PSM	PSU	LS	PSM	LS	PSM	PSM	PSM	N/A	LS	PSM	PSM	PSM	PSM	PSM	PSM	PSM	PSM	PSM
Impact 4.3-5: New permanent sources of light glare.	PSM	PSM	PSM	PSM	PSM	PSM	PSM	PSM	PSM	PSM	PSM	PSM	PSM	PSM	PSM	PSM	PSM	PSM	PSM	PSM	PSM	PSM	PSM	PSM
Geology, Soils, and Seismicity																								
Impact 4.4-1: Slope instability during construction.	LS	PSM	N/A	N/A	LS	PSM	PSM	PSM	PSM	PSM	PSM	LS	N/A	N/A	LS	LS	PSM	LS	PSM	LS	PSM	PSM	PSM	PSM
Impact 4.4-2: Erosion during construction.	LS	LS	LS	LS	LS	LS	LS	LS	LS	LS	LS	LS	LS	LS	LS	LS	LS	LS	LS	LS	LS	LS	LS	PSM
Impact 4.4-3: Substantial alteration of topography.	LS	LS	LS	LS	LS	LS	LS	LS	LS	LS	LS	LS	LS	LS	LS	LS	LS	LS	LS	LS	LS	LS	LS	PSM
Impact 4.4-4: Squeezing ground and subsidence during tunneling.	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	PSM	N/A	N/A	PSM	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	PSM
Impact 4.4-5: Surface fault rupture.	LS	LS	LS	LS	LS	LS	LS	LS	LS	LS	LS	LS	LS	LS	LS	LS	LS	LS	LS	LS	PSM	LS	LS	PSM
Impact 4.4-6: Seismically induced groundshaking.	LS	LS	LS	LS	LS	LS	LS	LS	LS	LS	LS	LS	LS	LS	LS	LS	LS	LS	LS	LS	LS	LS	LS	PSM
Impact 4.4-7: Seismically induced ground failure, including liquefaction and settlement.	LS	LS	LS	LS	LS	LS	LS	LS	LS	LS	LS	LS	LS	LS	LS	LS	LS	LS	LS	LS	PSM	LS	LS	PSM
Impact 4.4-8: Seismically induced landslides or other slope failures.	LS	LS	N/A	N/A	LS	LS	LS	LS	LS	LS	LS	LS	N/A	N/A	LS	LS	LS	LS	LS	LS	PSM	LS	LS	PSM
Impact 4.4-9: Expansive or corrosive soils.	PSM	PSM	PSM	PSM	PSM	PSM	PSM	PSM	PSM	PSM	PSM	PSM	PSM	PSM	PSM	PSM	PSM	PSM	PSM	PSM	PSM	PSM	PSM	PSM
Hydrology and Water Quality																								
Impact 4.5-1: Degradation of water bodies as a result of erosion and sedimentation or a hazardous materials release during construction.	LS	LS	LS	LS	LS	LS	LS	LS	LS	LS	LS	LS	LS	LS	LS	LS	LS	LS	LS	LS	LS	LS	LS	PSM
Impact 4.5-2: Depletion of groundwater resources.	LS	N/A	LS	LS	LS	LS	LS	N/A	PSM	N/A	LS	LS	LS	LS	LS	LS	LS	LS	LS	LS	N/A	N/A	LS	PSM
Impact 4.5-3a: Degradation of water quality due to construction dewatering discharges.	LS	N/A	LS	LS	LS	LS	LS	N/A	LS	N/A	LS	LS	LS	LS	LS	LS	LS	LS	LS	LS	N/A	N/A	LS	PSM
Impact 4.5-3b: Degradation of water quality due to construction-related discharges of treated water.	LS	LS	LS	LS	LS	N/A	N/A	LS	LS	LS	LS	LS	LS	LS	N/A	N/A	LS	N/A	LS	LS	N/A	N/A	N/A	PSM
Impact 4.5-4: Flooding and water quality impacts associated with impeding or redirecting flood flows.	N/A	N/A	PSM	PSM	N/A	PSM	N/A	N/A	PSM	N/A	PSM	PSM	PSM	N/A	N/A	N/A	N/A	N/A	N/A	N/A	PSM	PSM	N/A	PSM
Impact 4.5-5: Degradation of water quality and increased flows due to discharges to surface water during operation.	N/A	N/A	LS	N/A	N/A	N/A	N/A	LS	N/A	LS	LS	LS	LS	N/A	N/A	LS	LS	N/A	LS	N/A	N/A	PSM	LS	N/A

TABLE 8.3 (Continued)
SUMMARY OF FACILITY CONSTRUCTION AND OPERATION IMPACTS FOR WSIP VARIANTS

Impact	Variants 1, 2, and 3																			Variant 1 only	Variants 2 and 3 only		Variant 2 only[a]
	Advanced Disinfection	Lawrence Livermore Supply Improvements	San Joaquin Pipeline System	Rehabilitation of Existing San Joaquin Pipelines	Tesla Portal Disinfection Station	Alameda Creek Fishery Enhancement	Calaveras Dam Replacement	Additional 40-mgd Treated Water Supply	New Irvington Tunnel	SVWTP – Treated Water Reservoirs	San Antonio Backup Pipeline	Bay Division Pipeline Reliability Upgrade	BDPL Nos. 3 and 4 Crossovers	Seismic Upgrade of BDPL Nos. 3 and 4 at Hayward Fault	Baden and San Pedro Valve Lots Improvements	Crystal Springs/San Andreas Transmission Upgrade	HTWTP Long-Term Improvements	Lower Crystal Springs Dam Improvements	Pulgas Balancing Reservoir Rehabilitation	San Andreas Pipeline No. 3 Installation	Groundwater Projects – Lake Merced and Regional Components Only	Groundwater Projects	Recycled Water Projects	Regional Desalination for Drought
	SJ-1	SJ-2	SJ-3	SJ-4	SJ-5	SV-1	SV-2	SV-3	SV-4	SV-5	SV-6	BD-1	BD-2	BD-3	PN-1	PN-2	PN-3	PN-4	PN-5	SF-1	SF-2	SF-2	SF-3	VA-2
Impact 4.5-6: Degradation of water quality as a result of alteration of drainage patterns or an increase in impervious surfaces.	LS	PSM	LS	LS	LS	LS	LS	LS	LS	LS	LS	LS	LS	LS	LS	LS	LS	LS	LS	LS	LS	LS	PSM
Impact V-1: Discharge of brine concentrate	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	PSU
Biological Resources																							
Impact 4.6-1: Impacts on wetlands and aquatic resources.	PSM	PSM	PSM	PSM	PSM	PSM	PSM	PSM	PSM	PSM	PSM	PSM	PSM	PSM	LS	PSM	LS	PSM	PSM	PSM	PSM	PSM	PSM	PSM
Impact 4.6-2: Impacts on sensitive habitats, common habitats, and heritage trees.	PSM	PSM	PSM	PSM	PSM	PSM	PSM	PSM	PSM	PSM	PSM	PSM	PSM	PSM	PSM	PSM	LS	PSM	PSM	PSM	PSM	PSM	PSM	PSM
Impact 4.6-3: Impacts on key special-status species – direct mortality and/or habitat effects.	PSM	PSM	PSM	PSM	PSM	PSM	PSM	PSM	PSM	PSM	PSM	PSM	PSM	PSM	PSM	PSM	LS	PSM	PSM	LS	PSM	LS	LS	PSU
Impact 4.6-4: Water discharge effects on riparian and/or aquatic resources.	LS	LS	PSM	PSM	LS	LS	LS	LS	PSM	LS	LS	PSM	PSM	LS	LS	LS	LS	LS	LS	N/A	N/A	N/A	N/A	PSU
Impact 4.6-5: Conflicts with adopted conservation plans or other approved biological resources plans	N/A	N/A	PSM	PSM	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	PSM
Cultural Resources																								
Impact 4.7-1: Impacts on paleontological resources.	PSM	LS	PSM	PSM	PSM	PSM	PSM	PSM	PSM	PSM	PSM	LS	LS	PSM	PSM	LS	PSM	LS	PSM	PSM	PSM	PSM	PSM	PSM
Impact 4.7-2: Impacts on archaeological resources.	PSM	PSM	PSM	PSM	PSM	PSM	PSM	PSM	PSM	PSM	PSM	PSM	PSM	PSM	PSM	PSM	PSM	PSM	PSM	PSM	PSM	PSM	PSM	PSM
Impact 4.7-3: Impacts on historical significance of a historic district or a contributor to a historic district.	PSM	N/A	PSM	PSM	N/A	N/A	PSU	N/A	PSM	N/A	PSM	PSM	PSM	PSM	N/A	PSU	N/A	PSM	N/A	PSM	N/A	N/A	N/A	N/A
Impact 4.7-4: Impacts on the historical significance of individual facilities resulting from demolition or alteration.	PSM	N/A	PSM	PSM	N/A	N/A	PSU	N/A	PSU	N/A	PSM	PSM	PSM	PSM	N/A	PSU	N/A	PSU	N/A	PSM	N/A	N/A	LS	PSM
Impact 4.7-5: Impacts on adjacent historic architectural resources.	LS	LS	PSM	PSM	PSM	LS	PSM	LS	PSM	LS	PSM	PSM	PSM	PSM	LS	PSM	LS	PSM	PSM	PSM	LS	LS	PSM	N/A
Traffic, Transportation, and Circulation																								
Impact 4.8-1: Temporary reduction in roadway capacity and increased traffic delays.	LS	LS	PSM	PSM	LS	LS	PSM	LS	LS	LS	PSM	PSM	LS	PSM	LS	PSM	LS	PSM	PSM	PSM	LS	PSM	PSM	PSM
Impact 4.8-2: Short-term traffic increases on roadways.	PSM	PSM	PSM	PSM	PSM	PSM	PSM	PSM	PSM	PSM	PSM	PSM	PSM	PSM	LS	PSM	PSM	PSM	PSM	PSM	LS	LS	PSM	PSM
Impact 4.8-3: Impaired access to adjacent roadways and land uses.	LS	LS	PSM	PSM	LS	LS	PSM	LS	LS	LS	LS	PSM	PSM	PSM	LS	LS	LS	PSM	LS	PSM	LS	PSM	PSM	PSM
Impact 4.8-4: Temporary displacement of on-street parking.	LS	LS	LS	PSM	LS	LS	LS	LS	LS	LS	LS	PSM	LS	PSM	LS	LS	LS	PSM	PSM	PSM	LS	PSM	PSM	PSM
Impact 4.8-5: Increased traffic safety hazards during construction.	PSM	PSM	PSM	PSM	PSM	PSM	PSM	PSM	PSM	PSM	PSM	PSM	PSM	PSM	PSM	PSM	PSM	PSM	PSM	PSM	PSM	PSM	PSM	PSM
Impact 4.8-6: Long-term traffic increases during facility operation.	LS	LS	LS	LS	LS	N/A	N/A	LS	N/A	LS	N/A	LS	LS	LS	LS	LS	LS	LS	LS	N/A	LS	LS	LS	PSM
Air Quality																								
Impact 4.9-1: Construction emissions of criteria pollutants.	PSM	PSM	PSM	PSM	PSM	PSM	PSM	PSM	PSM	PSM	PSM	PSM	PSM	PSM	LS	LS	LS	LS	LS	LS	PSM	LS	LS	PSM
Impact 4.9-2: Exposure to diesel particulate matter during construction.	LS	N/A	LS	LS	LS	LS	PSM	LS	LS	PSM	LS	PSM	LS	LS	LS	LS	LS	LS	LS	LS	LS	LS	LS	PSM
Impact 4.9-3: Exposure to emissions (possibly including asbestos) from tunneling.	N/A	N/A	PSM	PSM	N/A	LS	N/A	LS	PSM	N/A	LS	PSM	N/A	PSM	N/A	PSM	N/A	N/A	N/A	PSM	PSM	PSM	PSM	PSM
Impact 4.9-4: Air pollutant emissions during project operation.	LS	LS	LS	LS	LS	LS	LS	LS	LS	LS	N/A	LS	LS	N/A	LS	LS	LS	LS	LS	LS	LS	LS	LS	PSM

TABLE 8.3 (Continued)
SUMMARY OF FACILITY CONSTRUCTION AND OPERATION IMPACTS FOR WSIP VARIANTS

Impact	Variants 1, 2, and 3																				Variant 1 only	Variants 2 and 3 only		Variant 2 only[a]
	Advanced Disinfection	Lawrence Livermore Supply Improvements	San Joaquin Pipeline System	Rehabilitation of Existing San Joaquin Pipelines	Tesla Portal Disinfection Station	Alameda Creek Fishery Enhancement	Calaveras Dam Replacement	Additional 40-mgd Treated Water Supply	New Irvington Tunnel	SVWTP – Treated Water Reservoirs	San Antonio Backup Pipeline	Bay Division Pipeline Reliability Upgrade	BDPL Nos. 3 and 4 Crossovers	Seismic Upgrade of BDPL Nos. 3 and 4 at Hayward Fault	Baden and San Pedro Valve Lots Improvements	Crystal Springs/San Andreas Transmission Upgrade	HTWTP Long-Term Improvements	Lower Crystal Springs Dam Improvements	Pulgas Balancing Reservoir Rehabilitation	San Andreas Pipeline No. 3 Installation	Groundwater Projects – Lake Merced and Regional Components Only	Groundwater Projects	Recycled Water Projects	Regional Desalination for Drought
	SJ-1	SJ-2	SJ-3	SJ-4	SJ-5	SV-1	SV-2	SV-3	SV-4	SV-5	SV-6	BD-1	BD-2	BD-3	PN-1	PN-2	PN-3	PN-4	PN-5	SF-1	SF-2	SF-2	SF-3	VA-2
Impact 4.9-5: Odors generated during project operation.	LS	LS	N/A	N/A	LS	N/A	N/A	LS	N/A	LS	N/A	N/A	N/A	N/A	N/A	N/A	LS	N/A	N/A	LS	LS	LS	LS	PSM
Impact 4.9-6: Secondary emissions at power plants.	LS	LS	LS	LS	LS	LS	LS	LS	LS	LS	LS	LS	LS	LS	LS	LS	LS	LS	LS	LS	LS	LS	LS	PSM
Impact 4.9-7: Conflict with implementation of applicable regional air quality plans addressing criteria air pollutants and state goals for reducing emissions.	LS	LS	LS	LS	LS	LS	LS	LS	LS	LS	LS	LS	LS	LS	LS	LS	LS	LS	LS	LS	LS	LS	LS	PSM
Noise and Vibration																								
Impact 4.10-1: Disturbance from temporary construction-related noise increases.	PSU	PSU	PSU	PSU	PSU	PSU	PSU	PSU	PSU	PSU	PSU	PSU	PSU	PSU	PSU	PSU	PSU	PSU	PSU	PSU	PSU	PSU	PSU	PSM
Impact 4.10-2: Temporary noise disturbance along construction haul routes.	PSU	N/A	PSU	PSU	PSU	LS	LS	LS	PSM	LS	LS	PSU	PSU	PSU	PSU	LS	PSU	LS	LS	PSU	PSM	PSU	PSU	PSM
Impact 4.10-3: Disturbance due to construction-related vibration.	LS	LS	PSU	PSU	LS	LS	LS	PSU	PSM	LS	LS	PSU	PSU	PSU	PSU	LS	LS	LS	LS	PSU	PSM	PSU	PSU	PSM
Impact 4.10-4: Disturbance due to long-term noise increases.	LS	LS	LS	N/A	LS	LS	N/A	LS	LS	LS	N/A	LS	N/A	N/A	LS	LS	LS	N/A	LS	N/A	LS	LS	LS	PSM
Public Services and Utilities																								
Impact 4.11-1: Potential temporary damage to or disruption of existing regional or local public utilities.	LS	LS	PSM	LS	LS	PSM	PSM	PSM	PSM	LS	PSM	PSM	PSM	PSM	LS	PSM	LS	PSM	LS	PSM	PSM	PSM	PSM	PSM
Impact 4.11-2: Temporary adverse effects on solid waste landfill capacity.	PSM	PSM	PSM	PSM	PSM	PSM	PSM	PSM	PSM	PSM	PSM	PSM	PSM	PSM	PSM	PSM	PSM	PSM	PSM	PSM	PSM	PSM	PSM	PSM
Impact 4.11-3: Impacts related to compliance with statutes and regulations related to solid waste.	PSM	PSM	PSM	PSM	PSM	PSM	PSM	PSM	PSM	PSM	PSM	PSM	PSM	PSM	PSM	PSM	PSM	PSM	PSM	PSM	PSM	PSM	PSM	PSM
Impact 4.11-4: Impacts related to the relocation of utilities.	PSM	PSM	PSM	PSM	PSM	PSM	PSM	PSM	PSM	PSM	PSM	PSM	PSM	PSM	PSM	PSM	PSM	PSM	PSM	PSM	PSM	PSM	PSM	PSM
Recreational Resources																								
Impact 4.12-1: Temporary conflicts with established recreational uses during construction.	N/A	N/A	PSM	PSM	N/A	LS	LS	N/A	PSM	N/A	N/A	PSM	PSM	N/A	N/A	PSM	N/A	LS	LS	PSM	PSM	PSM	PSM	PSM
Impact 4.12-2: Conflicts with established recreational uses due to facility siting and project operation.	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	PSM	PSM	PSM	PSM	PSM
Agricultural Resources																								
Impact 4.13-1: Temporary conflicts with established agricultural resources.	N/A	N/A	PSM	PSM	N/A	PSM	PSM	PSM	PSM	N/A	PSM	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Impact 4.13-2: Conversion of farmlands to nonagricultural uses.	N/A	N/A	PSM	N/A	N/A	N/A	LS	PSM	N/A	PSM	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Hazards																								
Impact 4.14-1: Potential to encounter hazardous materials in soil or and groundwater.	LS	LS	LS	PSM	LS	LS	LS	LS	LS	LS	LS	PSM	PSM	PSM	PSM	LS	LS	LS	LS	PSM	PSM	PSM	PSM	PSM
Impact 4.14-2: Exposure to naturally occurring asbestos.	N/A	N/A	N/A	N/A	N/A	N/A	LS	N/A	N/A	N/A	N/A	PSM	N/A	N/A	N/A	LS	N/A	LS	N/A	LS	LS	LS	LS	PSM
Impact 4.14-3: Risk of fires during construction.	LS	LS	LS	LS	LS	LS	LS	LS	LS	LS	LS	LS	N/A	N/A	LS	LS	N/A	LS	LS	N/A	LS	LS	LS	PSM
Impact 4.14-4: Gassy conditions in tunnels.	N/A	N/A	LS	LS	N/A	LS	N/A	LS	LS	N/A	LS	LS	N/A	LS	N/A	LS	N/A	N/A	N/A	LS	LS	LS	LS	PSM
Impact 4.14-5: Exposure to hazardous building materials.	N/A	N/A	PSM	PSM	PSM	N/A	PSM	N/A	PSM	N/A	N/A	PSM	N/A	N/A	PSM	PSM	PSM	PSM	PSM	PSM	PSM	PSM	PSM	PSM

TABLE 8.3 (Continued)
SUMMARY OF FACILITY CONSTRUCTION AND OPERATION IMPACTS FOR WSIP VARIANTS

Impact	Variants 1, 2, and 3																				Variant 1 only	Variants 2 and 3 only		Variant 2 only[a]
	Advanced Disinfection	Lawrence Livermore Supply Improvements	San Joaquin Pipeline System	Rehabilitation of Existing San Joaquin Pipelines	Tesla Portal Disinfection Station	Alameda Creek Fishery Enhancement	Calaveras Dam Replacement	Additional 40-mgd Treated Water Supply	New Irvington Tunnel	SVWTP – Treated Water Reservoirs	San Antonio Backup Pipeline	Bay Division Pipeline Reliability Upgrade	BDPL Nos. 3 and 4 Crossovers	Seismic Upgrade of BDPL Nos. 3 and 4 at Hayward Fault	Baden and San Pedro Valve Lots Improvements	Crystal Springs/San Andreas Transmission Upgrade	HTWTP Long-Term Improvements	Lower Crystal Springs Dam Improvements	Pulgas Balancing Reservoir Rehabilitation	San Andreas Pipeline No. 3 Installation	Groundwater Projects – Lake Merced and Regional Components Only	Groundwater Projects	Recycled Water Projects	Regional Desalination for Drought
	SJ-1	SJ-2	SJ-3	SJ-4	SJ-5	SV-1	SV-2	SV-3	SV-4	SV-5	SV-6	BD-1	BD-2	BD-3	PN-1	PN-2	PN-3	PN-4	PN-5	SF-1	SF-2	SF-2	SF-3	VA-2
Impact 4.14-6: Accidental hazardous materials release from construction equipment.	LS	LS	LS	LS	LS	LS	LS	LS	LS	LS	LS	LS	LS	LS	LS	LS	LS	LS	LS	LS	LS	LS	LS	PSM
Impact 4.14-7: Increased use of hazardous materials during operation.	LS	LS	LS	N/A	LS	N/A	N/A	LS	N/A	LS	N/A	LS	LS	N/A	LS	N/A	LS	LS	N/A	N/A	LS	LS	LS	PSM
Impact 4.14-8: Emission or use of hazardous materials within 1/4 mile of a school.	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	LS	LS	N/A	LS	N/A	LS	N/A	N/A	N/A	LS	LS	LS	PSM
Energy Resources																								
Impact 4.15-1: Construction-related energy use.	PSM	PSM	PSM	PSM	PSM	PSM	PSM	PSM	PSM	PSM	PSM	PSM	PSM	PSM	PSM	PSM	PSM	PSM	PSM	PSM	PSM	PSM	PSM	PSM
Impact 4.15-2: Long-term energy use during operation.	PSM	PSM	PSM	LS	PSM	PSM	N/A	PSM	N/A	PSM	N/A	PSM	PSM	PSM	N/A	PSM	PSM	N/A	N/A	PSM	PSM	PSM	PSM	PSU
Collective Facilities Impacts																								
Impact 4.16-1a: Collective temporary and permanent impacts on existing land uses in the vicinity of proposed facility sites.	N/A		N/A		PSU		LSM		N/A		N/A													
Impact 4.16-1b: Collective temporary and permanent impacts on the visual character of the surrounding area.	LSM		LS		LSM		LSM		LSM		N/A													
Impact 4.16-2: Collective exposure of people or structures to geologic and seismic hazards.	N/A		N/A		N/A		N/A		N/A		N/A													
Impact 4.16-3: Collective WSIP impacts related to the degradation of surface waters and flooding hazards.	LSM		LSM		LSM		LSM		LSM		LSM													
Impact 4.16-4: Collective loss of sensitive biological resources.	PSM		PSU		PSM		PSU		PSM		N/A													
Impact 4.16-5: Collective increase in impacts related to archaeological, paleontological, and historical resources.	LSM		PSU		LSM		PSU		LSM		N/A													
Impact 4.16-6: Collective traffic increases on local and regional roads.	PSM		PSM		PSM		PSM		PSM		PSM													
Impact 4.16-7: Collective increases in construction and/or operational emissions in the region.	PSM		PSM		LSM		LS		LS		PSU													
Impact 4.16-8: Collective increases in construction-related and operational noise.	PSU		PSM		PSU		PSU		PSU		N/A													
Impact 4.16-9: Collective impacts on utilities and landfill capacity.	N/A		N/A		N/A		N/A		N/A		LSM													
Impact 4.16-10: Collective effects on recreational resources during construction.	LSM		LSM		LSM		LSM		LSM		LSM													
Impact 4.16-11: Collective conversion of farmland to nonagricultural uses.	N/A		N/A		N/A		N/A		N/A		LSM													
Impact 4.16-12: Collective effects related to hazardous conditions and exposure to or release of hazardous materials.	LSM		LSM		LSM		LSM		LSM		LSM													
Impact 4.16-13: Collective increases in the use of nonrenewable energy resources.	LSM		LSM		LSM		LSM		LSM		LSM													

TABLE 8.3 (Continued)
SUMMARY OF FACILITY CONSTRUCTION AND OPERATION IMPACTS FOR WSIP VARIANTS

Impact	Variants 1, 2, and 3																				Variant 1 only	Variants 2 and 3 only		Variant 2 only[a]
	Advanced Disinfection	Lawrence Livermore Supply Improvements	San Joaquin Pipeline System	Rehabilitation of Existing San Joaquin Pipelines	Tesla Portal Disinfection Station	Alameda Creek Fishery Enhancement	Calaveras Dam Replacement	Additional 40-mgd Treated Water Supply	New Irvington Tunnel	SVWTP – Treated Water Reservoirs	San Antonio Backup Pipeline	Bay Division Pipeline Reliability Upgrade	BDPL Nos. 3 and 4 Crossovers	Seismic Upgrade of BDPL Nos. 3 and 4 at Hayward Fault	Baden and San Pedro Valve Lots Improvements	Crystal Springs/San Andreas Transmission Upgrade	HTWTP Long-Term Improvements	Lower Crystal Springs Dam Improvements	Pulgas Balancing Reservoir Rehabilitation	San Andreas Pipeline No. 3 Installation	Groundwater Projects – Lake Merced and Regional Components Only	Groundwater Projects	Recycled Water Projects	Regional Desalination for Drought
	SJ-1	SJ-2	SJ-3	SJ-4	SJ-5	SV-1	SV-2	SV-3	SV-4	SV-5	SV-6	BD-1	BD-2	BD-3	PN-1	PN-2	PN-3	PN-4	PN-5	SF-1	SF-2	SF-2	SF-3	VA-2
Cumulative Facilities Impacts																								
Impact 4.17-1: Cumulative disruption of established communities, changes in existing land use patterns, and impacts on the existing visual character.	LS																							PS
Impact 4.17-2: Cumulative exposure of people or structures to geologic and seismic hazards.	B/LS																							PS
Impact 4.17-3: Cumulative impacts related to the degradation of water quality, alteration of drainage patterns, increased surface runoff, and flooding hazards.	LS																							PS
Impact 4.17-4: Cumulative loss of sensitive biological resources.	LS																							PS
Impact 4.17-5: Cumulative increase in impacts on archaeological, paleontological, and historical resources.	PSU																							PS
Impact 4.17-6: Cumulative traffic increases on local and regional roads.	PSU																							PS
Impact 4.17-7: Cumulative increases in construction and/or operational emissions in the region.	PSU																							PS
Impact 4.17-8: Cumulative increases in construction-related and operational noise.	PSU																							PS
Impact 4.17-9: Cumulative impacts related to disruption of utility service or relocation of utilities.	LS																							PS
Impact 4.17-10: Cumulative effects on recreational resources during construction.	LS																							PS
Impact 4.17-11: Cumulative conversion of farmland to nonagricultural uses.	LS																							PS
Impact 4.17-12: Cumulative effects related to hazardous conditions and exposure to or release of hazardous materials.	LS																							PS
Impact 4.17-13: Cumulative increases in the use of nonrenewable energy resources.	LS																							PS

NOTE: Shaded boxes indicate where potential impacts and/or significance levels for the variant differ from those of the proposed program.

[a] The regional desalination plant and associated facilities under Variant 2 could result in additional impacts that are not shown in the table but would be determined during project-level environmental review when more detailed siting, design, construction and operation information is available. As discussed further in the text, additional potentially significant impacts could include: water quality and aquatic resources impacts due to disposal of brine concentrate; water quality and aquatic resources impacts due construction and operation of intake and outfall structures; potential for impacts associated with seiche, tsunami or mudflow; and potential cumulative impacts associated with increased salinity in the Delta due to increased diversion of freshwater inflow from the Tuolumne River coupled with discharge of brine concentrate.

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During nondrought years, similar to the proposed program, the SFPUC would accommodate the projected increase of 35 mgd in purchase requests through 2030 by implementing additional conservation programs, Recycled Water Projects (SF-3), and Local Groundwater Projects in San Francisco (a component of SF-2, Groundwater Projects) and by diverting additional surface water from the Tuolumne River. On an average annual basis over the 82-year period of hydrologic record, Variant 2 would result in a 20-mgd increase in diversions from the Tuolumne River over the existing condition, 7 mgd less than the proposed program. During drought years, the increase in system firm yield through 2030 would be met through potable water produced by the BARDP combined with the Westside Groundwater Basin conjunctive-use project (a component of SF-2, Groundwater Projects) along with the yield associated with the restoration of storage capacity in Calaveras and Crystal Springs Reservoirs as part of the WSIP facility improvement projects. During the 8.5-year design drought, the average annual yield from the BARDP would be 23 mgd; average annual yield from the Westside Groundwater Basin conjunctive-use project would be 6 mgd, which is the same as under the proposed program.

Regional Water System Operations

Under *WSIP Variant 2 – Regional Desalination for Drought*, the operation, maintenance, and delivery strategy of the SFPUC regional water system would be essentially the same as that proposed under the WSIP during nondrought periods (see Chapter 3, Section 3.8, Proposed System Operations Strategy). However, during drought periods under this variant, the BARDP would supplement the water supply sources in addition to the Westside Basin conjunctive-use project. During drought periods, the SFPUC would receive water from a regional desalination plant or plants through water transfers from other Bay Area water supply agencies; water transfer facilities and operations would be developed as needed as part of the BARDP. The differences in regional system operating procedures between this variant and the proposed program are discussed in more detail in Section 8.5, below.

Level of Service Performance

As indicated in Table 8.2, *WSIP Variant 2 – Regional Desalination for Drought* would achieve all of the proposed level of service performance goals through 2030. However, as shown in the table, even though it would achieve the performance goals, this variant would have slightly different implications in terms of its performance during drought years when compared to the proposed program. These differences are due to minor variations in the assumptions used to model the operating strategy required to provide customer water deliveries during the design drought, and actual operations during a drought sequence would likely be similar for Variant 2 and the proposed program.

Modeling results indicate that Variant 2 would perform slightly better than the proposed program with respect to drought response. When modeled over the 82-year period of hydrologic record (1920–2002), under Variant 2 the drought response program would be triggered 23 times in the 82-year period, with rationing required in 8 of those years; this compares to 24 times under the WSIP that the drought response program would be needed, also with rationing in 8 of the years. Both Variant 2 and the proposed program would perform similarly during the design drought

sequence. As stated above, these minor differences are due to the modeling assumptions, and there would likely be no noticeable differences between Variant 2 and the proposed program during actual operations.

This level of service analysis for Variant 2 assumes full implementation of the BARDP and does not incorporate any evaluation of feasibility or reliability associated with the BARDP. Feasibility and reliability studies associated with the BARDP are being conducted as part of that planning effort (see below under "Development of BARDP") and are not available at this time.

Facility Requirements

Under *WSIP Variant 2 – Regional Desalination for Drought*, all of the same facility improvement projects would be implemented as those proposed under the WSIP, as described in Chapter 3, Section 3.9, Proposed Facility Improvement Projects. In addition, Variant 2 would require construction of one or two Bay Area regional desalination plants and associated conveyance and delivery facilities, as described below.

Bay Area Regional Desalination Project

The BARDP involves a partnership among regional water agencies, including the SFPUC, Contra Costa Water District (CCWD), East Bay Municipal Utility District (EBMUD), and Santa Clara Valley Water District (SCVWD), for the purpose of developing desalination as a regional water supply to improve supply reliability for over 5 million people served by the four agencies. The proposed BARDP would develop and implement one or two desalination plants and associated facilities capable of producing about 65 to 71 mgd of potable water from ocean water, seawater, or brackish water. The BARDP would benefit participating agencies by allowing them to either directly receive desalination product water into their water systems or to receive transfers from other agencies that directly receive desalination product water. However, the institutional commitments and arrangements to implement a full-scale desalination plant as well as the necessary technical and feasibility studies have not been completed.

Development of the BARDP

A pre-feasibility study has been completed for the BARDP facility (URS, 2003). In 2005, the agencies received a grant from the California Department of Water Resources to complete a feasibility study to evaluate the institutional feasibility for the BARDP, and in 2006 the participating agencies received a second grant from the California Department of Water Resources to construct a desalination pilot plant (EBMUD, 2006). The pre-feasibility study included a review of the participating agencies and their water needs, a summary of recent desalination projects, preliminary identification of permitting requirements, an overview of the desalination process and product water quality issues, and a preliminary siting study identifying three possible locations for a regional desalination plant. The pilot plant would test technologies and methods for intake of source water, pretreatment, brine disposal, and other processes required for a full-scale plant. The pilot plant and related studies are scheduled to be implemented from 2007 to 2009.

The participating agencies are currently preparing a feasibility study for the project. Elements of the feasibility study include an analysis of the institutional issues for implementation of the full-scale BARDP, assessment of site and infrastructure options for the three short-listed sites, preparation of preliminary site layouts for a single large facility and a smaller facility, preparation of a detailed scope of environmental analysis for the development of a full-scale BARDP, public outreach, and preparation of the feasibility study report. If the feasibility study and pilot testing demonstrate the viability of the project, it is expected that environmental review would occur in 2009, design in 2010, and construction of the full-scale BARDP in 2012. The pilot plant has not been designed, and the CEQA and permitting processes have not begun.

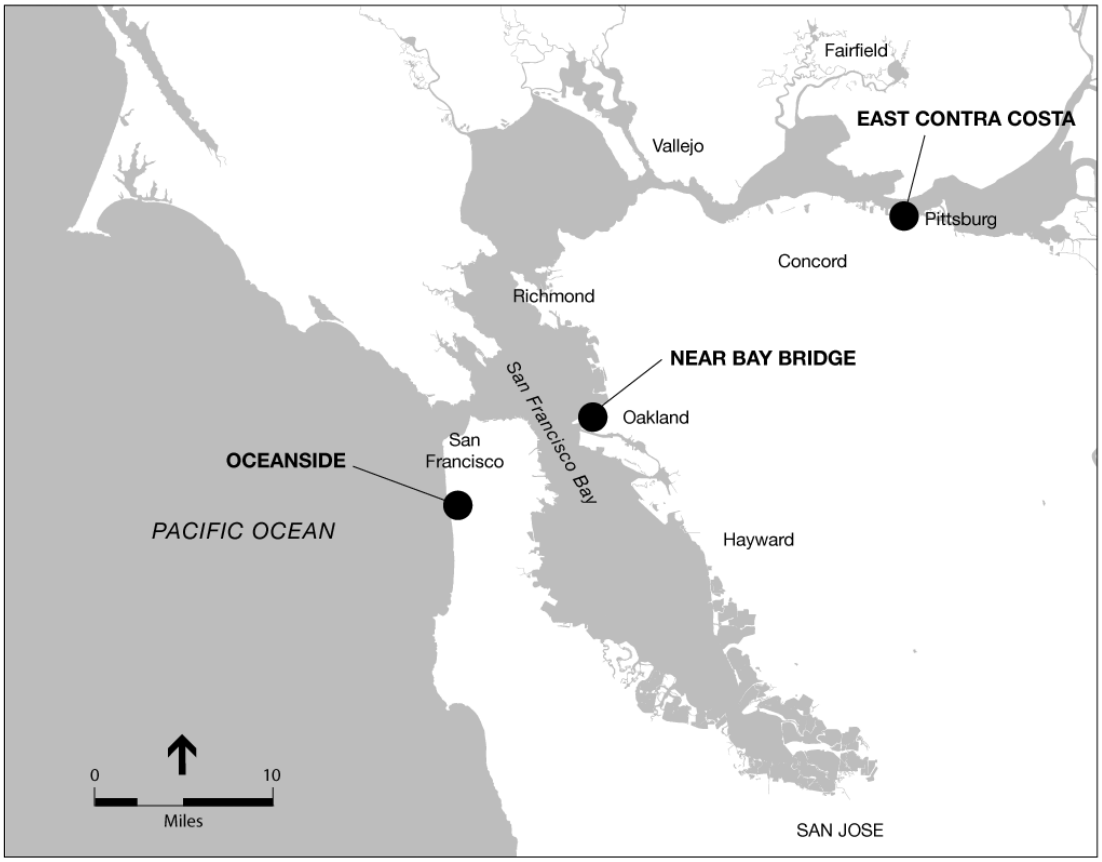
For the purposes of the programmatic review of WSIP Variant 2 in this PEIR, the conclusions developed in the *Bay Area Regional Desalination Project Pre-Feasibility Final Report* (URS, 2003) and *Bay Area Regional Desalination Project, Grant Proposal for Proposition 50 Chapter 6(a) Funding* (EBMUD, 2006) are summarized below and used to make broad assumptions regarding the facility requirements of the desalination plant needed in Variant 2. However, extensive technical studies are still necessary to identify the appropriate site(s) and to develop the conceptual engineering for a desalination project in the Bay Area. The preliminary assumptions are subject to change pending further investigations, design and siting of the plant, pilot plant test results, as well as clarification of institutional uncertainties. If the BARDP is to be implemented, site-specific environmental review will be required prior to project approval.

Preliminary Description of BARDP

The studies cited above and completed to date have identified three possible locations for a regional desalination plant: the Oceanside site in San Francisco, Bay Bridge site in Oakland, and East Contra Costa site near Pittsburg in eastern Contra Costa County. The preferred project would consist of a 65 to 71 mgd desalination plant(s) located at one or two of these three sites, as shown in **Figure 8.1**. Currently, the pilot plant and top-ranked site for the regional plant is the East Contra Costa site, which is generally located along the industrial shoreline area of eastern Contra Costa County, as shown in **Figure 8.2**.

The desalination plant would use brackish or saline water as source water and produce potable drinking water that meets all drinking water standards; the potable water or "product water" produced from the plant would be of similar quality to the water that is currently being provided to customers by the participating municipal utilities that would receive the product water in their distribution systems. The conceptual processes for the desalination plant include filtration to remove suspended solids, a dual-stage reverse-osmosis[3] system to remove salts, and post-treatment to stabilize and disinfect the water to make it suitable for mixing in drinking water systems. Depending on the site(s) selected for the development of the full-scale BARDP, the desalination project may require multiple components, including raw water supply/intake facilities, process and treatment facilities, and concentrate disposal facilities/outfall structures. To

[3] Reverse osmosis is a process to remove salt from water whereby pressure is applied to water with higher salt concentration in order to force it to flow across a membrane towards water with lower salt concentration. The majority of total dissolved solids remain on the side of the membrane with the higher salt concentration.



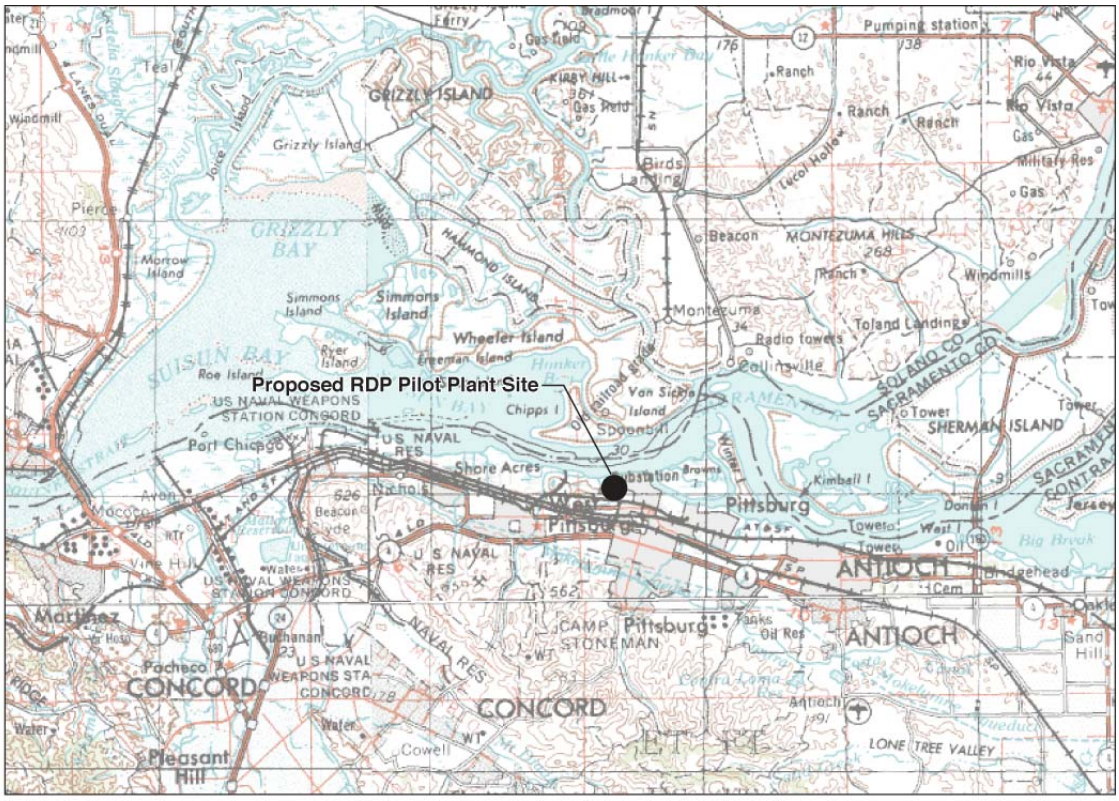
SFPUC Water System Improvement Program . 203287

SOURCE: URS, June 2005, Bay Area Regional Desalination Project, Conveyance Options Evaluation.

Figure 8.1
Potential Sites for Regional Desalination Plant

convey the product water from the desalination plant to the water supply agencies, transmission pipelines and pump station(s) would also be required. It is assumed that the BARDP would use or modify existing distribution and transmission facilities to the extent possible.

For the East Contra Costa site, it is estimated that a booster pump station and about two miles of pipeline would be needed to connect to the existing transmission facilities of the CCWD, EBMUD, or both. Energy consumption for a desalination plant at the East Contra Costa site is estimated at 7,500 kilowatt-hours per million gallons of product water, depending on the site and the size of the plant. Energy consumption at the Bay Bridge site in Oakland is estimated at 19,000 kilowatt-hours per million gallons of product water, and at the Oceanside site in San Francisco is estimated at 22,000 kilowatt-hours per million gallons of product water. At both the Oakland and San Francisco sites, further studies are needed to determine the extent and nature of additional water conveyance, transfer, or delivery facilities. Depending on the final site selected, it might be possible to modify some facilities that are already present at the site (such as intake structures, outfall structures, or energy facilities), in which case new facilities would not be needed as part of either the desalination plant or the associated conveyance or delivery facilities.



SFPUC Water System Improvement Program . 203287

SOURCE: East Bay Municipal Utility District, 2006, Bay Area Regional Desalination Project, Grant Proposal for Proposition 50 Chapter 6(a) Funding

Figure 8.2
Location of Regional Desalination Project Pilot Plant

Proposed operation of the regional desalination plant(s) would be developed as part of the technical studies and would depend on numerous factors, including the site(s) selected, final design of the plant, and institutional agreements among participating agencies.

Under this variant, the SFPUC would receive transfer water from other Bay Area water agencies in all cases, except if the facility were located in San Francisco. As a possible operating scenario, during drought years the SFPUC could receive an equivalent share of its BARDP water in the form of a surface water transfer from EBMUD. Potable water received from EBMUD could be conveyed to the SFPUC/EBMUD intertie located in the city of Hayward. The water received through the intertie, up to 26 mgd, would then be conveyed into the SFPUC regional system through the Bay Division Pipelines.[4] Alternatively, in the event that a facility is located in San Francisco, the SFPUC could receive water directly from the desalination plant.

[4] Use of the SFPUC/EBMUD intertie for drought supply would require further environmental review, since the intertie project description only included use for emergencies and critical maintenance.

Institutional Requirements

Implementation of the *WSIP Variant 2 – Regional Desalination Project* would have all of the same institutional requirements as the proposed program, except that it would not require the transfer agreements with TID and MID for the supplemental dry-year supply, and it would require additional institutional agreements for the BARDP. In addition to the institutional agreement among the participating agencies, the BARDP would require various agreements, permits, and approvals for construction and operation. The BARDP would require interagency cooperation to cover environmental/construction costs and transfer agreements among participating agencies involved in water transfers. A preliminary list of operating permits and approvals from federal, state, and local regulatory agencies that may apply to the BARDP is presented in **Table 8.4**, below. A subset of these permits and regulatory approvals may be applicable, depending on the site(s) selected for the development of the BARDP. Although not shown in the table, the BARDP would also be subject to requirements of CEQA, and possibly the National Environmental Policy Act (NEPA) if federal agencies become involved; however, the lead agency or agencies for the CEQA and NEPA processes would not be identified until institutional agreements among the participating agencies are developed.

8.3.2 Setting

The regional setting for *WSIP Variant 2 – Regional Desalination for Drought* is the same as the regional setting for the WSIP study area described in Chapters 4 and 5, except for the BARDP component described below. The BARDP setting includes the facilities setting extending from Oakdale Portal in Tuolumne County west along the regional system to its terminus in San Francisco, as well as the water resources setting encompassing the Tuolumne River, Alameda Creek, and Peninsula watersheds.

The regional setting for the BARDP desalination plant and associated facilities described below is based on the East Contra Costa site since it is the site selected for pilot testing. However, the final site for the regional desalination plant has not been selected and is pending the completion of ongoing studies, including the feasibility study and pilot plant project. For the purposes of providing a general review in this PEIR for review of WSIP Variant 2, it is assumed that the BARDP site would be located in eastern Contra Costa County.

The East Contra Costa site is located in an unincorporated area of Contra Costa County between Pittsburg and Antioch. The Suisun Bay and New York Slough are located to the north and northeast of the county's shoreline. The potential sites for the desalination plant are located in generally industrial areas that include such facilities as the PG&E Pittsburg Substation, the Delta Diablo Sanitation District facilities, and Mirant Pittsburg Power Plant. One possible site would be co-located with an existing power plant, sharing its intake and outfall structures.

Potentially affected waters in the vicinity of the proposed BARDP include Suisun Bay and New York Slough, both tributaries to San Pablo Bay. Suisun Bay receives flow from the Sacramento and San Joaquin Rivers. Due to freshwater inflow from rivers, the salinity of water in Suisun Bay is generally lower than in downstream waters such as San Pablo Bay (Contra Costa

TABLE 8.4
PRELIMINARY PERMITS AND APPROVALS FOR THE BAY AREA REGIONAL DESALINATION PROJECT

Agency/Requirement(s)	Activities Subject to Requirement	Relevance to the BARDP
FEDERAL		
U.S. Army Corps of Engineers: Clean Water Act, Section 404 Permit, Rivers and Harbors Act of 1899, Section 10	Filling of wetlands or surface waters	Intake and outfall structures, pipelines (creek crossings)
U.S. Fish and Wildlife Service: Federal Endangered Species Act, Section 7 Consultation	Effects on federally listed species and habitat	Desalination plant and associated facilities, concentrated salt discharge from reverse-osmosis process
National Marine Fisheries Service: Federal Endangered Species Act, Section 7	Effects on federally listed fish species	Desalination plant and associated facilities, concentrated salt discharge from reverse-osmosis process
STATE		
California Coastal Commission: California Coastal Act, Coastal Development Permit	Development in coastal zone, including tidelands, submerged lands, and public trust lands	Desalination plant and associated facilities, pipelines
California Department of Fish and Game: Streambed Alteration Agreement	Changes in natural condition of streams, lakes, and rivers	Pipelines (creek crossings) Facility construction and operations
California Endangered Species Act, Section 2081 Agreement	Effects on state-listed species and habitats	
California Department of Health Services: Drinking Water Permit Source Water Assessment and Protection Plan	Drinking water permit	Desalination plant and facilities for new water supply source
California State Lands Commission	Offshore components on any ungranted tidelands	Intake and outfall structures
California State Water Resources Control Board	Water-rights permit	Desalination plant for new water supply source
California Regional Water Quality Control Board, San Francisco Bay Region: Clean Water Act, Section 401 Water Quality Certification	Activities affecting surface water quality	Pipelines (creek crossings) All proposed facilities
National Pollutant Discharge Elimination System Permit or Waste Discharge Requirements for discharge of brine	Operation of plant for discharge of brine	
National Pollutant Discharge and Elimination System Permit for Stormwater	Construction and operation activities	
State Historic Preservation Office	Any activities affecting potentially historic resources	Use of existing, potentially historic structures or facilities
REGIONAL		
San Francisco Bay Conservation and Development Commission	Activities affecting the San Francisco Bay shoreline	Intake and outfall structures

NOTE: Federal and state environmental review requirements under NEPA and CEQA not shown on this table since federal involvement and NEPA requirements are currently unknown and state lead agency under CEQA is also unknown.

County and City of Pittsburg, 2001). Extensive marsh and wetland areas along Suisun Bay provide habitat for a variety of plant and wildlife species.

8.3.3 Impact Analysis – Facilities Construction and Operation

Under *WSIP Variant 2 – Regional Desalination for Drought*, facilities construction and operation impacts would consist of WSIP facilities impacts, BARDP impacts, and the cumulative and growth impacts of both.

WSIP Facilities Impacts

Potential impacts related to the construction and operation of WSIP facilities would be the same in all respects for Variant 2 as those described for the proposed program in Chapter 4. These impacts are summarized in Table 8.3.

Bay Area Regional Desalination Project Impacts

The impact analysis for the BARDP in the context of Variant 2 is based on the general project description provided above, including descriptions from the pre-feasibility study (URS, 2003) and the pilot plant grant application (EBMUD, 2006). However, since the BARDP is still in the conceptual planning phase, detailed project information has not yet been developed for its design, construction, or operation, and CEQA environmental documentation has not been completed (or even started). Therefore, for the purpose of this PEIR, a conceptual-level, generalized impact analysis of the BARDP is presented based on the BARDP assumptions described above. The formal CEQA environmental review of the BARDP will be conducted at a time deemed appropriate by the participating agencies and under the purview of the designated CEQA lead agency. The impact discussion presented below is intended solely to provide a basis for comparing potential environmental impacts at a programmatic level among the proposed program and three variants; the impacts and their significance determinations are based on limited, preliminary information and the actual project-specific impact assessment will be conducted during formal CEQA environmental review of the BARDP.

Chapter 4 includes programmatic impact analyses and mitigation measures for the construction and operation of generic facility types, including pipelines, pump stations, and treatment facilities. Much of this information is applicable to the regional desalination plant and associated facilities, and the reader is referred to Chapter 4 for those discussions. In general, due to the preliminary nature of the project design, uncertainty regarding site locations, and lack of site- and project-specific information, most of the potential impacts associated with construction and operation of a desalination plant and related facilities are considered potentially significant at this conceptual level of analysis. However, in most cases, it is presumed that potential impacts could be avoided or reduced to a less-than-significant level through careful site selection and site layout, appropriate project design, and environmentally-sensitive construction and operation techniques or through implementation of mitigation measures, as described below.

Plans and Policies

The pre-feasibility study identified three options for BARDP institutional arrangements: (1) contracting among the participating agencies, with one being the lead agency, (2) creating a joint powers authority among the participating agencies, or (3) each participating agency contracting with a third party such as the California Department of Water Resources or the U.S. Bureau of Reclamation. The specific plans and policies applicable to the BARDP would depend on the institutional arrangements for its construction and operation as well as on the final project location.

Based on the identification of a preliminary site along the eastern Contra Costa County shoreline, the Bay Conservation and Development Commission's (BCDC) *San Francisco Bay Plan* was reviewed for relevant goals and policies applicable to the construction and operation of a desalination plant (BCDC, 2005).

The *San Francisco Bay Plan* guides conservation of San Francisco Bay waters and development of its shoreline. The Bay Plan includes specific policies applicable to geographic segments of the bay shoreline, although none are identified in the vicinity of the East Contra Costa site. The Bay Plan includes the following policies relevant to desalination:

> *Policy 10*: Desalination projects should be located, designed, and operated in a manner that: (a) avoids or minimizes to the greatest practicable extent adverse impacts on fish, other aquatic organisms, and wildlife and their habitats; (b) ensures that the discharge of brine into the bay is properly diluted and rapidly disperses into the bay waters to minimize impacts; and (c) is consistent with the discharge requirements of the Regional Water Quality Control Board.
>
> *Policy 11*: Because desalination plants do not need to be located in the bay or directly on the shoreline: (a) no bay fill should be approved for desalination plants except for a minor amount of fill needed for pipelines, fish screening devices, and other directly related facilities that provide bay water to a plant and discharge diluted brine from the plant back into the bay; and (b) maximum feasible public access consistent with the project should be included as part of any desalination project that uses bay waters.

It is presumed that the final design of the BARDP would be consistent with the *San Francisco Bay Plan*. Similarly, it is assumed that project planning, site selection, and design of the BARDP would be consistent with other applicable land use plan policies, if any, although in the absence of site-specific information there remains the potential for conflicts with adopted plans.

Land Use and Visual Quality

In the process of selecting the preliminary site along the eastern Contra Costa County shoreline, potential sites considered for the desalination plant were generally limited to those with compatible land uses (e.g., sites with existing industrial or utility uses such as refineries, wastewater treatment plants, power plants, or airports). Some open space/marsh sites adjacent to existing industrial uses were also considered. However, pending final site selection for the plant and associated facilities, potential land use and visual impacts are considered to be similar to

those described in Chapter 4, Section 4.3 (Impacts 4.3-1 to 4.3-5). These impacts include the potential for temporary conflicts with established uses during construction, permanent displacement of existing land uses, temporary or permanent degradation of visual resources/scenic views, and new sources of light and glare. In the absence of a specific site location and project design, these impacts are considered potentially significant. It is presumed that implementation of appropriate site selection, design measures, construction techniques, and mitigation measures could avoid land use and visual impacts or reduce them to a less-than-significant level.

Geology, Soils, and Seismicity

At any of the identified BARDP sites, there would be a potential for seismic and/or geologic hazards. The final site selection for the desalination plant and associated facilities would include geotechnical investigations. These studies would be performed to determine the engineering suitability and feasibility of the site as well as appropriate design measures to minimize geologic hazards. Thus, as standard practice, the design and construction of the desalination plant and associated facilities would incorporate and implement recommendations from the geotechnical investigations. In addition, the facilities would be designed and constructed consistent with current building and seismic codes as well as applicable regulations (see Chapter 4, Section 4.4).

However, until the final sites are selected for the plant and associated facilities and preliminary engineering design completed, potential geology, soils, and seismicity impacts (Impacts 4.4-1 to 4.4-9) would be considered potentially significant. Similar to potential geologic and seismic impacts described in Chapter 4, impacts of the BARDP could be avoided or reduced to a less-than-significant level by implementing recommendations from the geotechnical investigations, complying with applicable building codes and regulations, and implementing appropriate site selection, design measures, and construction techniques.

Water Quality and Hydrology

Construction impacts associated with the desalination facilities would be similar to those described in Chapter 4, Section 4.5 (Impacts 4.5-1, 4.5-2, and 4.5-3); these impacts are related to the potential for water quality degradation from erosion and sedimentation, short-term depletion of groundwater resources from construction dewatering, and construction discharges to surface waters and would be considered potentially significant. Depending on the site selected for the BARDP, there could be impacts associated with flooding similar to those for WSIP facilities (Impact 4.5-4), but either site selection or incorporation of flood protection measures could reduce these impacts to less than significant. Similarly, implementation of the associated mitigations requiring preparation of erosion control plans and compliance with National Pollutant Discharge Elimination System (NPDES) construction permits could reduce these impacts to a less-than-significant level. Construction activities associated with the installation of intake structures, outfalls, or other facilities in the ocean or bay could result in potentially significant water quality impacts not discussed in Chapter 4; these include temporary disturbance of bottom sediments and potential degradation of water quality from chemicals in sediments or construction materials. It is presumed that implementation of appropriate site selection, design measures, construction

techniques, and site-specific mitigation measures as well as compliance with applicable water quality regulations could avoid these impacts or reduce them to a less-than-significant level.

The operational impact associated with increased impervious surfaces would be similar to that described in Chapter 4, Section 4.5 (Impact 4.5-6); this impact and would be considered potentially significant but could be mitigated with site-specific management practices and control measures similar to those described in Chapter 6. In the absence of siting and design information, the BARDP is considered to have potentially significant long-term impacts associated with flooding, seiche, tsunami, and mudflow hazards (unlike the WSIP projects), although it is presumed that implementation of appropriate site selection, design measures, construction techniques, and mitigation measures could avoid these impacts or reduce them to a less-than-significant level. Impact 4.5-5 regarding discharges of treated water for some of the WSIP facilities would not apply to the BARDP.

One water quality impact that is unique to the operation of a desalination plant and not discussed in Chapter 4 involves the disposal of brine concentrate, a waste product from the desalination process that contains the chemicals and minerals removed from seawater or brackish water to produce potable water. The brine concentrate or "reject water" from the desalination process is likely to have a salt content approximately twice that of bay or ocean waters and therefore would be denser and less buoyant than the receiving waters. The concentrate could also have higher concentrations of metals and other potentially toxic constituents than are present in the bay or ocean. Disposal of the brine concentrate through either an existing outfall or a new outfall built for the plant could result in significant localized water quality impacts (as well as associated biological resource impacts, as discussed separately below). Detailed studies will be required to determine if disposal of the brine concentrate would be consistent with applicable water quality objectives and criteria, including criteria for toxic pollutants.

The design and operation of the outfall structure would require regulatory permitting through the NPDES program and approval by the California Regional Water Quality Control Board; furthermore, siting a desalination plant on the eastern Contra Costa County shoreline would require disposal to the Delta, which has more stringent discharge standards than those for the bay or ocean. To avoid significant water quality impacts, site-specific studies to determine the hydraulics and dilution of brine concentrate would be needed to ensure appropriate mixing in the outfall structure during a range of diurnal, tidal, and seasonal conditions and to protect aquatic resources that could be affected by the discharge. In order for the BARDP to be feasible, it would have to incorporate design and operation measures that ensure regulatory compliance with discharge requirements for long-term protection of water quality. Although it is possible that appropriate design and operation of the BARDP along with compliance with water quality regulations and implementation of mitigation measures could reduce potentially significant water quality impacts, due to the limited information available and unknown status of project details, water quality impacts are considered potentially significant and unavoidable in order to be conservative in this preliminary evaluation. The CEQA environmental review of the BARDP will provide a detailed impact analysis based on project-specific information and determine if there are feasible mitigation measures to reduce impacts to a less-than-significant level. The diversion

of brackish water from this zone and discharge of higher-salinity concentrate could result in a cumulative effect on the Delta and upstream users. The daily tidal exchange of water through this area is so great that the discharge of concentrate from the BARDP alone would not present a regional salinity issue, but its contribution to salinity changes in the context of past, present, and proposed water diversion projects in the Delta and upstream rivers tributary to the Delta needs further evaluation. This potential cumulative effect is considered to be potentially significant but mitigable through design and operation measures or other compensatory actions to offset potential salinity effects.

Biological Resources

Construction and operation of the desalination plant and associated facilities could result in potentially significant impacts on biological resources, depending on the final sites selected, the design of the proposed facilities, and other project characteristics to be determined. Although the preliminary site location for the desalination plant along the eastern Contra Costa County shoreline includes previously disturbed areas in predominantly industrial use, some of the area may include marshes, wetlands, or other sensitive habitat. Potential impacts of the desalination facilities on wetlands, sensitive habitats, special-status species, and other aquatic resources would be similar to those described in Chapter 4, Section 4.6 (Impacts 4.6-1 to 4.6-4), although the types of habitat and affected species would be different. Similarly, depending on the final site selection and the ultimate project design, the BARDP could result in conflicts with adopted conservation plans or other approved biological resources plans (Impact 4.6-5). In the absence of more detailed project information, these impacts would all be considered potentially significant. However, in most cases, it is presumed that implementation of appropriate site selection, design measures, construction techniques, and mitigation measures involving compliance with permit requirements of the appropriate resource agencies could avoid these impacts or reduce them to a less-than-significant level.

In addition to the biological resources impacts discussed in Chapter 4, the BARDP would result in significant impacts on marine or other aquatic resources associated with construction and operation of both the intake and outfall structures. Construction of these facilities would result in disturbance and displacement of these resources. Operation of the intake facility could result in the incidental entrapment or entrainment of fish and other aquatic organisms, potentially including special-status species. Discharge of brine concentrate through the outfall would affect bottom-dwelling aquatic organisms sensitive to extreme salinity or temperature changes and could also affect many filter-feeding animals.[5] As discussed above under Hydrology and Water Quality, in order to be feasible the BARDP would have to incorporate design and operation measures that ensure regulatory compliance with intake and discharge requirements. In addition to ensuring protection of water quality for aquatic habitats, the BARDP will be required to comply with any other permit conditions for potentially affected special-status species or sensitive habitats. Although potential aquatic resources (including special-status species) and associated water quality impacts for the BARDP could possibly be mitigated through design/operation and mitigation measures and regulatory compliance, this impact is considered

[5] Filter feeders are animals that feed by straining suspended matter and food particles from water.

potentially significant and unavoidable in order to be conservative in this preliminary evaluation. The CEQA environmental review of the BARDP will provide a detailed impact analysis based on project-specific information and determine if there are feasible mitigation measures to reduce impacts to a less-than-significant level.

Cultural Resources

Unlike other facilities proposed under the WSIP, the desalination plant would not be a component of the SFPUC regional water system and therefore would not be associated with its historic properties. However, due to uncertainty regarding the location of the BARDP as well as whether or not the plant would utilize existing structures or facilities, it is premature to conclude that the project would not affect historic, archaeological, or paleontological resources. In the absence of more detailed project information, impacts on cultural resources (similar to Impacts 4.7-1, 4.7-2, 4.7-4 and 4.7-6 described in Chapter 4) would be considered potentially significant. However, it is presumed that implementation of appropriate site selection, design measures, construction techniques, and mitigation measures involving the appropriate resource agencies could avoid impacts or reduce them to a less-than-significant level.

Traffic, Transportation, and Circulation

Chapter 4, Section 4.8 presents a general description of the types of construction and operation impacts on traffic, transportation, and circulation for treatment plants, pipelines, and pump stations. These include construction-related effects on roadway capacity, traffic delays, impaired access to adjacent land uses, displacement of parking, and increased traffic safety hazards as well as long-term traffic increases during facility operation. Similar types of impacts (Impacts 4.8-1 to 4.8-6) would be expected during construction and operation of the BARDP and associated facilities. In the absence of more detailed project information, impacts on traffic, transportation, and circulation would be considered potentially significant. However, implementation of appropriate site selection, design measures, construction techniques, and mitigation measures could avoid impacts or reduce them to a less-than-significant level.

Air Quality

The preliminary site for the BARDP is located in the San Francisco Bay Area Air Basin, as described in Chapter 4, Section 4.9, and would be subject to the same air quality conditions and regulations. Air quality impacts similar to those described in Chapter 4 for pipelines, treatment facilities, and pump stations (Impacts 4.9-1 to 4.9-7) related to construction and operational air quality emissions and odors could also occur with the BARDP. In addition, increased energy demand for long-term operation of a desalination plant could indirectly result in increased use of fossil fuels and emissions of greenhouse gases. In the absence of more detailed project information, air quality impacts would be considered potentially significant. However, it is presumed that implementation of appropriate site selection, design measures, construction techniques, and mitigation measures as well as compliance with applicable air quality regulations could avoid these impacts or reduce them to a less-than-significant level.

Noise and Vibration

Construction and operation of the BARDP could result in similar types of noise and vibration impacts as those described in Chapter 4, Section 4.10 (Impacts 4.10-1 to 4.10-4), although operation of the desalination plant could have different noise characteristics than those associated with a water treatment plant. Based on preliminary siting of the facility within or near existing industrial and utility uses, it is likely that the desalination plant site would not be located in proximity to sensitive receptors. However, in the absence of more detailed project information, impacts related to temporary and/or long-term increases in noise and vibration would be considered potentially significant. It is presumed that implementation of appropriate site selection, design measures, construction techniques, and mitigation measures (including measures to assure compliance with local noise ordinances) could avoid these impacts or reduce them to a less-than-significant level.

Public Services and Utilities

Implementation of the BARDP would not increase the demand for municipal water supply, wastewater capacity, or governmental services such as schools or parks. The BARDP design would include onsite storm drainage facilities, which would be required to comply with the local storm drainage district as well as any applicable NPDES permit requirements; however, depending on the site, it is not expected that expansion of existing storm drainage facilities would be required. The long-term solid waste disposal needs would depend on the final design and operational characteristics of the BARDP facilities and would include the ongoing disposal of pretreatment sludge generated by the desalination process. The design of BARDP facilities would likely include fire protection and security features, so the demand for fire protection or police protection services is not expected to increase. However, in the absence of more detailed project information, impacts on public services and utilities would be considered potentially significant. It is presumed that implementation of design measures, construction techniques, and mitigation measures (including compliance with regulations related to solid waste) could avoid these impacts or reduce them to a less-than-significant level.

Recreational Resources

Implementation of the BARDP would not increase demand for recreational facilities, include new recreational facilities, or require expansion of existing recreational facilities. Based on the assumption that the BARDP facilities would be sited on or near compatible land uses, such as sites with existing industrial or utility uses, this project is not likely to be located in the immediate vicinity of existing recreational resources. However, there are established recreational uses along the eastern Contra Costa County shoreline, including marinas and boat ramps, as well as water-based recreational uses in the Delta that could be affected by the BARDP and any associated intake and/or outfall structures. Recreational resources would be identified following specific site selection. In the absence of more detailed project information, impacts on recreational resources would be considered potentially significant. It is presumed that implementation of design measures, construction techniques, and mitigation measures could avoid these impacts or reduce them to a less-than-significant level.

Agricultural Resources

Based on a preliminary site on the eastern Contra Costa County shoreline near Pittsburg, the BARDP would not affect any farmlands, as no agricultural activity occurs in the vicinity. However, the California Department of Conservation maps indicate important farmland is present in some parts of eastern Contra Costa County (California Department of Conservation, 2004). Therefore, until the BARDP site is identified, agricultural resources impacts would be considered potentially significant but mitigable with appropriate site selection.

Hazards

The BARDP would be subject to the same hazardous materials regulatory framework as that described in Chapter 4, Section 4.14. Similar to the WSIP facilities, construction and operation of the BARDP could result in hazardous materials impacts. Due to the industrial nature of the site vicinity in eastern Contra Costa County, there is a potential to encounter hazardous materials in soil and groundwater during construction. If the BARDP were co-located with an existing facility or required the demolition of existing structures, hazardous building materials could be encountered. Operation of the desalination plant would likely require the handling and storage of hazardous materials, which could expose the public or the environment to hazardous materials. Therefore, construction and operation of the BARDP could result in similar types of hazardous materials impacts as those described in Impacts 4.14-1 to 4.14-3 and 4.14-5 to 4.14-8 (Impacts 4.14-3 and 4.14-4 do not apply, since the site is not located within a wildland fire area and no tunnel construction is proposed). In the absence of more detailed project information, these hazardous materials impacts would be considered potentially significant; however, it is presumed that implementation of appropriate site selection, design measures, construction techniques, and mitigation measures as well as compliance with all applicable federal, state, and local hazardous materials regulations could avoid these potential impacts or reduce them to a less-than-significant level.

Energy Resources

Implementation of the BARDP would result in the substantial use of nonrenewable energy resources during both construction and operation. In the pre-feasibility study, energy consumption for operation of the desalination plant was estimated to range from 7,500 to 22,000 kilowatt-hours per million gallons of product water, depending on the site selected for the BARDP. Even though these estimates are subject to change pending more detailed project design, the desalination plant would require extensive power consumption for long-term operations. Energy-intensive processes include pumping raw water to the filtration system, filtration, reverse-osmosis, and product water pumping. The project would result in the long-term use of large amounts of energy, and more detailed studies would be needed as part of project feasibility and design to determine the extent of available power, energy conservation measures to be incorporated into project design, and the impact of plant operation in the context of regional energy availability. The use of conventional energy sources has a limited range of available mitigation options. However, the development of the BARDP includes the exploration and investigation of energy-saving technologies and the use of alternative energy sources for BARDP operation. If conventional energy sources were used, the energy impacts would likely be

potentially significant and unavoidable, although some of the impacts could potentially be mitigated through project design. Due to the unknown effectiveness of energy-saving technologies as applied to the BARDP, and in the absence of more detailed information, energy impacts would be considered potentially significant and unavoidable in order to be conservative in this preliminary evaluation. The CEQA environmental review of the BARDP will provide a detailed impact analysis based on project-specific information and determine if there are feasible mitigation measures to reduce impacts to a less-than-significant level.

Cumulative and Growth Impacts

This variant would generally result in the same facilities-related cumulative impacts as those identified and described in Chapter 4, Section 4.17, for the WSIP facilities, independent of the BARDP. When the BARDP is included as part of the WSIP under Variant 2, the combined impacts of the BARDP described above together with the WSIP facilities impacts described in Chapter 4 would constitute the collective impact. The BARDP would not contribute to any overlapping impacts due to the distance between the SFPUC facilities from the East Contra Costa site, but it would contribute to multi-regional impacts, exacerbating the collective impacts described in Chapter 4, Section 16. When considered in terms of cumulative impacts, Variant 2 would result in the same cumulative impacts as those identified for the proposed program augmented by the additional cumulative impacts of the BARDP due to its contribution to other past, present and reasonably foreseeable future projects in the vicinity of the East Contra Costa site. Implementation of the BARDP in combination with the WSIP would contribute additional cumulative facilities-related impacts in the eastern Contra Costa County region (or wherever the final site(s) is located); the extent of that contribution would be determined based on more specific project design, siting, and scheduling information in the project EIR for the BARDP. In addition, Variant 2 would contribute to cumulative long-term energy impacts in Northern California when considered in combination with the increased energy demands associated with the BARDP plus the WSIP facilities, as described in Section 4.15. The extent of the additional contribution to cumulative energy impacts of Variant 2 compared to the proposed program would be due to the BARDP's contribution to long-term energy demands, and the associated implications with respect to regional energy resources (including the potential to increase emissions of greenhouse gases); this additional contribution would be evaluated based on more detailed project design and siting in the project-specific EIR for the BARDP.

Impacts associated with the SFPUC water supply and systemwide operations for all of the variants are discussed below in Section 8.5. Although the BARDP in itself could have implications with respect to growth inducement, within the context of WSIP Variant 2, the BARDP would serve only as a supplemental dry-year and emergency water supply. Therefore, the growth-inducement potential of Variant 2 as well as the indirect environmental effects associated with growth would be identical to those described for the proposed program in Chapter 7. The growth-inducement potential of the BARDP as a whole and the project's indirect environmental effects would be evaluated as part of the formal CEQA review of the BARDP.

8.3.4 Mitigation Measures – Variant 2

All mitigation measures for WSIP facilities-related impacts identified for the proposed program and described in Chapter 6 would apply to Variant 2, in addition to the mitigation measures associated with the BARDP to be developed when the project-specific CEQA review is conducted. Table 8.3 identifies the facilities-related impacts of Variant 2; where applicable, the corresponding mitigation measures are presented in Chapter 6. In some instances, the same programmatic mitigation measures for the WSIP facilities could apply to the BARDP, although more comprehensive mitigation requirements would be developed as part of the project-level CEQA review of the BARDP, which will identify site-specific measures to reduce the identified impacts.

Mitigation measures related to water resources impacts on the Tuolumne River, Alameda, and Peninsula watersheds and the Westside Groundwater Basin applicable to Variant 2 would be identical to those for the proposed program, as described in Chapters 5 and 6 and discussed below in Section 8.5.

8.4 WSIP Variant 3 – 10% Rationing

8.4.1 Description

Water Supply

The water supply for *WSIP Variant 3 – 10% Rationing* would be identical to that under the proposed program, except that additional supplies from TID and MID transfers would be needed during drought years. This variant would reduce the maximum rationing during drought years from 20 to 10 percent, effectively modifying the WSIP system performance objective for dry-year delivery and increasing the system firm yield to 268 mgd (compared to 256 mgd for the proposed program). During nondrought and drought years, this variant would accommodate the projected increase in purchase requests through 2030 (35 mgd) in the same manner as the proposed program: surface water from the Tuolumne River, Alameda, and Peninsula watersheds; and implementation of additional conservation programs, Recycled Water Projects (SF-3), and Local Groundwater Projects in San Francisco (part of SF-2, Groundwater Projects). Under Variant 3, drought-year demand would additionally be served through the Westside Groundwater Basin conjunctive-use project (a component of SF-2, Groundwater Projects) and through TID and MID transfers, similar to the proposed program (except with an increase in TID and MID transfers). *WSIP Variant 3 – 10% Rationing* would require additional annual average TID and MID transfers of up to 12 mgd during the 8.5-year design drought (35 mgd compared to 23 mgd under the proposed program). Using the HH/LSM, the SFPUC determined that the average annual Tuolumne River diversion would be slightly greater under Variant 3 when compared to the proposed program due to the additional transfers during drought sequences; however, when presented in terms of the number of million gallons per day, both Variant 3 and the proposed program would result in an average annual diversion from the Tuolumne River of about 27 mgd over the 82-year period of hydrologic record.

Regional Water System Operations

Under *WSIP Variant 3 – 10% Rationing*, the operation, maintenance, and delivery strategy of the SFPUC regional water system would be identical to that proposed under the WSIP at all times, except during drought years. During an extended dry period, the SFPUC would implement the same drought response program as that described for the WSIP in Chapter 3, Section 3.8.1, except that the maximum rationing would be 10 percent. During extended drought sequences following implementation of the supplemental dry-year supplies (TID and MID transfers and Westside Basin conjunctive-use program), the SFPUC would limit rationing to 10 percent on a systemwide basis. In order to implement this variant, the SFPUC would need to establish a transfer agreement with TID and MID for 35 mgd (compared to 23 mgd for the proposed program).

Level of Service Performance

WSIP Variant 3 – 10% Rationing would achieve all of the proposed level of service performance goals through 2030, as indicated in Table 8.2, and would exceed the WSIP level of service for drought-year rationing. However, as shown in the table, even though it would achieve the performance goals, this variant would have different implications in terms of its performance during the design drought when compared to the WSIP.

Modeling results indicate that under Variant 3, rationing would occur slightly more frequently than under the proposed program. However, Variant 3 would reduce the degree of rationing during the design drought. When modeled over the 82-year period of hydrologic record (1920–2002), Variant 3 would trigger the drought response 25 times in the 82-year period, with rationing required in 8 of those years; this compares to 24 times that the drought response program would be triggered under the proposed program, with rationing in 8 of the years. The minor difference is due to the modeling assumptions, and there would likely be no noticeable difference between Variant 3 and the proposed program during actual operations in terms of the frequency of drought response actions. When modeled over the 8.5-year design drought, Variant 3 would require 6.5 years of rationing at 10 percent (6.5 out of 8.5 years subject to rationing), while the proposed program would require 3 years of rationing at 10 percent and 3.5 years at 20 percent (6.5 out of 8.5 years subject to rationing).

Facility Requirements

The facility requirements under *WSIP Variant 3 – 10% Rationing* would be identical to those of the proposed program, as described in Section 3.9, Proposed Facility Improvement Projects. All facilities proposed under the WSIP would be required, and no additional facilities would be needed.

Institutional Requirements

WSIP Variant 3 – 10% Rationing would require the same type of agreements with TID and MID to secure water transfers as those needed under the proposed program. The only difference is in the quantity of water subject to the transfer agreement for Variant 3, which would be an annual average of 35 mgd over the design drought compared to 23 mgd for the proposed program. No other institutional requirements are expected.

8.4.2 Setting

The regional setting for facility improvement projects for *WSIP Variant 3 – 10% Rationing* is the same as the regional setting for the WSIP study area described in Chapter 4, extending from Oakdale Portal in Tuolumne County west along the regional water system to its terminus in San Francisco. Similarly, the regional setting for potentially affected watersheds and drainages, including the Tuolumne River, Alameda Creek, and Peninsula watersheds, is the same as that described for the proposed program in Chapter 5.

8.4.3 Impact Analysis – Facility Construction and Operations

Table 8.3 identifies the impacts that would occur under *WSIP Variant 3 – 10% Rationing* related to facilities construction and operations. All facilities-related impacts would be the same in all respects as those identified for the proposed program and described in Chapter 4, including the cumulative impacts. All of the same mitigation measures presented in Chapter 6 would be required. No additional impacts would result.

Impacts associated with water supply and systemwide operations for Variant 3 are discussed below in Section 8.5. The growth-inducement potential of Variant 3 as well as the indirect environmental effects associated with growth would be similar to those described for the proposed program in Chapter 7. The overall availability and reliability of water supply is the most relevant factor influencing future growth and development, as discussed in Chapter 7, with the difference in rationing policy during drought sequences between the proposed project and Variant 3 not likely a significant factor affecting growth.

8.4.4 Mitigation Measures – Variant 3

All mitigation measures for facilities-related impacts identified for the proposed program and described in Chapter 6 would apply to Variant 3. Table 8.3 summarizes the facilities-related impacts of Variant 3; where applicable, the corresponding mitigation measures are presented in Chapter 6. No additional facilities-related mitigation measures would be required.
Mitigation measures related to water resources impacts applicable to Variant 3 would be identical to those for the proposed program, as described in Chapters 5 and 6 and discussed below in Section 8.5.

8.5 All Variants – Impacts of Water Supply and System Operations

This section presents the impacts resulting from water supply and system operations for all variants, similar to the analysis presented in Chapter 5 for the proposed program. The WSIP variants would meet the need for additional water in 2030 through different combinations of water from the Tuolumne River, additional conservation, recycling, groundwater and desalination. Under all variants, the SFPUC would continue to use water supplies from the Bay Area watersheds to the maximum extent practical, but the contribution from the Bay Area watersheds would be almost the same for the WSIP and the three variants. As described previously in Sections 8.2, 8.3, and 8.4, the regional water system would be operated somewhat differently under each of the three variants to accommodate the various mixes of water sources and different shortage criteria.

The variants would alter the way the regional water system would be operated, which would, in turn, affect water levels in reservoirs on the Tuolumne River and its tributaries and in the Alameda and Peninsula watersheds. Altered operation of the regional water system would also affect flow in streams in the Tuolumne River, Alameda, and Peninsula watersheds. As described in Chapter 5 for the WSIP, the other environmental impacts of the variants would result from variant-induced changes in water levels in reservoirs and flow in streams. The variants would have minor differences in effects on the Westside Groundwater Basin compared to the WSIP.

As discussed in Sections 8.2, 8.3, and 8.4 and presented in Table 8.2, all three variants would achieve the WSIP levels of service, but they would vary slightly from each other and from the proposed program with respect to their predicted performance during drought periods. Water rationing would occur about the same frequency but would be slightly more severe with Variant 1 than with the WSIP. Rationing would occur with about the same frequency and severity under Variant 2, and with about the same frequency but with less severity under Variant 3. Consequently, it should be noted that the environmental impacts of the variants are not associated with a common and equal level of water supply service.

Similar to the analysis for the proposed program in Chapter 5, the SFPUC applied the HH/LSM to the variants, and model results were used to predict potential impacts of the variants on water resources in the Tuolumne River, Alameda, and Peninsula watersheds. The model output was used to provide quantitative estimates of changes that would occur with implementation of the variants compared to the existing condition. The model was employed to estimate flow in streams and rivers and water levels in reservoirs with each of the three variants in place. Technical specialists then assessed the effects of variant-induced changes in stream flows and reservoir levels on geomorphology, water quality, groundwater, fisheries, terrestrial wildlife and vegetation, and recreation in the three affected watersheds. Impacts on the Westside Groundwater Basin due to the variants were evaluated based on a qualitative comparison with impacts identified for the proposed program.

The environmental impacts of water supply and system operations under the variants on resources in the Tuolumne River, Alameda, and Peninsula watersheds compared to the existing condition are summarized in **Tables 8.5**, **8.6**, and **8.7**, respectively. For comparative purposes, the tables also present the water resources impacts of the WSIP compared to the existing condition (summarizing the analysis in Chapter 5 of this PEIR). Significance determinations were made for the impacts of the variants and are shown in the tables following the narrative descriptions. Impacts on reservoir water levels and stream flow in each watershed, which were used as the basis for analysis of all other environmental impacts of water system operations under the variants, are discussed in detail below for each variant. The impacts are assessed before mitigation measures have been applied.

Similarly, the environmental impacts of water supply and system operations under the variants on the Westside Groundwater Basin compared to the existing condition are summarized in **Table 8.8**, and the cumulative impacts under the variants are summarized in **Table 8.9**.

Tables 8-5, 8-6, 8-7, 8-8, and 8-9 use several standard phrases to indicate how the impacts of a variant compare to the impacts of the proposed program. In these tables, the phrase "same as the proposed program" is used when an impact of a variant is identical or almost identical to that of the proposed program. The phrase "similar to the proposed program" is used when an impact of a variant is similar in character to that of the proposed program and the magnitude of the impact is close to but not identical to the impact of the proposed program. The phrases "similar to but greater than the proposed program" and "similar to but less than the proposed program" are used when an impact of a variant is similar in character to that of the proposed program but the magnitude of the impact is discernibly greater than or less than the impact of the proposed program, although as explained below, the degree of variance is generally small.

In general, the impacts of the variants compared to the existing condition are quite similar to those of the WSIP compared to the existing condition. Although some of the impacts of the variants differ somewhat from those of the WSIP (sometimes greater and sometimes less severe), the magnitude of the differences is generally small. With the exception of impacts on the North Westside Groundwater Basin under Variant 1 (Impacts 5.6-1, 5.6-2, and 5.6-3), the significance determinations made for the variants are the same as those for the WSIP. Under Variant 1, Local Groundwater Projects would not be implemented, and there would be no wells developed in the North Westside Groundwater Basin. Therefore, the PSM impacts on the North Westside Groundwater Basin under the proposed program would be not applicable under Variant 1. In all other cases, impacts determined to be less than significant for the WSIP are also less than significant for the variants and impacts determined to be potentially significant for the WSIP are also potentially significant for the variants. Similarly, with the exception of measures associated with the North Westside Groundwater Basin, all mitigation measures identified for the proposed program in Chapter 5 and described in Chapter 6 would be similar for all variants.

TABLE 8.5
SUMMARY OF WATER SUPPLY AND SYSTEM OPERATIONS IMPACTS FOR THE WSIP VARIANTS COMPARED TO EXISTING CONDITION – TUOLUMNE WATERSHED

Impact	Proposed Program	Variant 1 – All Tuolumne	Variant 2 – Regional Desalination for Drought	Variant 3 – 10% Rationing
Section 5.3.1, Stream Flow and Reservoir Water Levels				
Impact 5.3.1-1: Effects on flow along the Tuolumne River below O'Shaughnessy Dam	Would reduce average monthly storage in Hetch Hetchy Reservoir year-round and would lower monthly average water levels by up to 10 feet with the greatest reduction just prior to snowmelt runoff. Would have little or no effect on average monthly flow in this reach of the Tuolumne River in most summer, fall and winter months of all hydrologic year types. Would reduce average monthly flow in some spring months with the greatest reductions (up to 30%) occurring in dry years. Would reduce average spring monthly flow by up to 90% very infrequently. Flow reductions would manifest themselves as delays in spring releases from Hetch Hetchy Reservoir above minimum required for up to 8 days. Could affect peak flows. (LS)	Would reduce average monthly storage in Hetch Hetchy Reservoir year-round and would lower monthly average water levels by up to 12 feet with the greatest reduction just prior to snowmelt runoff. Would have little or no effect on average monthly flow of this reach of the Tuolumne River in most summer, fall and winter months of all hydrologic year types. Would reduce average monthly flow in some spring months with the greatest reductions (up to 33%) occurring in dry years. Would reduce average monthly flow by up to 90% very infrequently. Flow reductions would manifest themselves as delays in spring releases from Hetch Hetchy Reservoir above minimum required by up to 9 days. Could affect peak flows. (LS)	Would reduce average monthly storage in Hetch Hetchy Reservoir year-round and would lower monthly average water levels by up to 7 feet with the greatest reduction just prior to snowmelt runoff. Would have little or no effect on average monthly flow of this reach of the Tuolumne River in most summer, fall and winter months of all hydrologic year types. Would reduce average monthly flow up to in some spring months with the greatest reductions (up to 30%) occurring in dry years. Would reduce average monthly flow by up to 90% very infrequently. Flow reductions would manifest themselves as delays in spring releases from Hetch Hetchy Reservoir above minimum required by up to 7 days. Could affect peak flows. (LS)	Would reduce average monthly storage in Hetch Hetchy Reservoir year-round and would lower monthly average water levels by up to 10 feet with the greatest reduction just prior to snowmelt runoff. Would have little or no effect on average monthly flow of this reach of the Tuolumne River in most summer, fall and winter months of all hydrologic year types. Would reduce average monthly flow up to 30% in some spring months. Would reduce average monthly flow by up to 90% very infrequently. Flow reductions would manifest themselves as delays in spring releases from Hetch Hetchy Reservoir above minimum required by up to 10 days. Could affect peak flows. (LS)
Impact 5.3.1-2: Effects on flow along Cherry Creek below Cherry Dam	Water levels in Lake Lloyd would not be altered such that they would be substantially outside the range experienced under the existing condition. Would reduce year-round average monthly storage in Lake Lloyd by about 1,000 AF and average monthly water levels by about 1 foot. Would have little or no effect on magnitude and timing of releases to Cherry Creek. (LS)	Would reduce average monthly storage in Lake Lloyd by about 1,000 AF and average monthly water levels by about 1 foot. Would not alter releases to Cherry Creek. (LS)	Would alter average water levels by about 1 foot. Would not alter releases to Cherry Creek. (LS)	Would not alter water levels or alter releases to Cherry Creek. (LS)

TABLE 8.5 (Continued)
SUMMARY OF WATER SUPPLY AND SYSTEM OPERATIONS IMPACTS FOR THE WSIP VARIANTS COMPARED TO EXISTING CONDITION — TUOLUMNE WATERSHED

Impact	Proposed Program	Variant 1 – All Tuolumne	Variant 2 – Regional Desalination for Drought	Variant 3 – 10% Rationing
Section 5.3.1, Stream Flow and Reservoir Water Levels (cont.)				
Impact 5.3.1-3: Effects on flow along Eleanor Creek below Eleanor Dam	Would have little effect on water levels in Lake Eleanor. Change in storage would be limited to infrequent transfers to Lake Lloyd and periods of severe drought. Would have little or no effect on magnitude and timing of releases to Eleanor Creek. (LS)	Would not alter water levels or releases. (LS)	Would not alter water levels or releases. (LS)	Would not alter water levels or release. (LS)
Impact 5.3.1-4: Effects on flow along the Tuolumne River below La Grange Dam	Would reduce average monthly storage in Don Pedro Reservoir in most months and would lower average monthly water levels by up to 10 feet and by as much as 27 feet in severe droughts. Would have little or no effect on average monthly flow in most summer months of all hydrologic year types. Would reduce average monthly flow below La Grange Dam in some months between November and June by up to 25%. Maximum percentage reduction in average monthly flow would be 92%, occurring very infrequently (one month in the 82-year hydrologic simulation). Flow reductions would manifest themselves as delays in spring releases from Don Pedro Reservoir above minimum required. In years when several spring pulse releases above the minimum required are made, the WSIP may eliminate one or more of the pulse releases and would delay others by several days or weeks. Could affect peak flows. (LS)	Would reduce average monthly storage in Don Pedro Reservoir almost year-round and would lower average monthly water levels by up to 12 feet. Would lower water levels by as much as 37 feet in severe droughts. Would have little or no effect on average monthly flow in most summer months of all hydrologic year types. Would reduce average monthly flow below La Grange Dam in some months between November and June by up to 32%. Would reduce average monthly flow by up to 95% very infrequently. Flow reductions would manifest themselves as delays in spring releases from Don Pedro Reservoir above minimum required. Would delay spring releases above minimum required by up to several weeks. Delays would be similar to but slightly greater than with WSIP. (LS)	Would reduce average monthly storage in Don Pedro Reservoir almost year-round and would lower average monthly water levels by up to 6 feet. Would lower water levels by as much as 16 feet in severe droughts. Would have little or no effect on average monthly flow in most summer months of all hydrologic year types. Would reduce average monthly flow below La Grange Dam up to 21% in some months between November and June. Would reduce monthly flow by up to 80% very infrequently. Flow reductions would manifest themselves as delays in spring releases from Don Pedro Reservoir above minimum required. Would delay spring releases above minimum required by up to several days. Delays would be less than with WSIP. (LS)	Would reduce average monthly storage in Don Pedro Reservoir year-round and would lower average monthly water levels by up to 11 feet. Would lower water levels by as much as 38 feet in severe droughts. Would have little or no effect on average monthly flow in most summer months of all hydrologic year types. Would reduce average monthly flow below La Grange Dam in some months between November and June by up to 25%. Would reduce average monthly flow by up to 95% very infrequently. Flow reductions would manifest themselves as delays in spring releases from Don Pedro Reservoir above minimum required. Would delay spring releases above minimum required by up to several weeks. Delays would be similar to WSIP. (LS)

TABLE 8.5 (Continued)
SUMMARY OF WATER SUPPLY AND SYSTEM OPERATIONS IMPACTS FOR THE WSIP VARIANTS COMPARED TO EXISTING CONDITION — TUOLUMNE WATERSHED

Impact	Proposed Program	Variant 1 – All Tuolumne	Variant 2 – Regional Desalination for Drought	Variant 3 – 10% Rationing
Section 5.3.1, Stream Flow and Reservoir Water Levels (cont.)				
Impact 5.3.1-5: Effects on flow along the San Joaquin River and the Sacramento-San Joaquin Delta.	Most WSIP-induced flows in the Tuolumne River between La Grange Dam and its confluence with the San Joaquin River would occur from January through June in wet or above-normal years. The greatest reductions would occur in years following extended droughts when storage in Don Pedro Reservoir is being replenished and could result in a average monthly flow reduction of up to 25 to 50% along the San Joaquin River between the Tuolumne and Stanislaus River confluences. Flow reductions of these magnitudes would be rare events occurring four to five times in the 82-year period of hydrologic record. Overall, the WSIP would not cause an alteration of flows along the San Joaquin River or in the Sacramento-San Joaquin Delta such that it would be substantially outside the range experienced under existing condition. (LS)	Similar to but slightly greater than proposed program (LS)	Similar to proposed but less than proposed program (LS)	Similar to proposed program (LS)
Section 5.3.2, Geomorphology				
Impact 5.3.2-1: Effects on sediment transport and channel characteristics between O'Shaughnessy Dam and Don Pedro Reservoir	Would have little effect on the very large and infrequent floods between O'Shaughnessy Dam and Don Pedro Reservoir that are capable of moving boulders and altering the characteristics of bedrock channels. Infrequent reductions in duration and magnitude of peak flows could affect sediment deposition and erosion in side channels and meadows and groundwater levels in riparian zones. (LS)	Similar to proposed program. (LS)	Similar to proposed program. (LS)	Similar to proposed program. (LS)
Impact 5.3.2-2: Effects on sediment transport and channel characteristics below La Grange Dam	Would have little effect on very large and infrequent floods below La Grange Dam, but would result in infrequent reduction in duration and magnitude of peak flows could affect sediment deposition and erosion in main channel and groundwater levels in riparian zones. (LS)	Similar to proposed program. (LS)	Similar to proposed program. (LS)	Similar to proposed program. (LS)

TABLE 8.5 (Continued)
SUMMARY OF WATER SUPPLY AND SYSTEM OPERATIONS IMPACTS FOR THE WSIP VARIANTS COMPARED TO EXISTING CONDITION — TUOLUMNE WATERSHED

Impact	Proposed Program	Variant 1 – All Tuolumne	Variant 2 – Regional Desalination for Drought	Variant 3 – 10% Rationing
Section 5.3.3, Surface Water Quality				
Impact 5.3.3-1: Effects on water quality in Hetch Hetchy Reservoir and along the Tuolumne River below O'Shaughnessy Dam	Changes in reservoir levels would have little effect on temperature in Hetch Hetchy Reservoir in all year types. Would have little effect on temperature or dissolved oxygen along the Tuolumne River below O'Shaughnessy Dam in most year types. During extreme droughts (once in 82-year hydrologic record), warmer water released to the river would result in prolonged violations of the water quality objectives for temperature. However, water temperatures would still remain within an acceptable range for coldwater fish and would not substantially affect the river's ability to support COLD beneficial use designation. (LS)	Similar to proposed program. (LS)	Similar to proposed program. (LS)	Similar to proposed program. (LS)
Impact 5.3.3-2: Effects on water quality in Don Pedro Reservoir and along the Tuolumne River below La Grange Dam	Changes in reservoir levels would have little effect on temperature in Don Pedro Reservoir in all year types. Releases from the reservoir would still be from the cool water pool below the thermocline. Thus, no increase in water released to the Tuolumne River below La Grange Dam would occur. Would have little effect on temperature in the river below the reservoir most of the time, but on infrequent occasions would cause mean daily temperature increases of 1 or 2 °C and, on very rare occasions, increases of 10 °C at confluence with San Joaquin River. Although these very rare occasions would result in violations of water quality objectives for water temperatures, they would not impair the river's ability to support the designated beneficial uses, including coldwater fisheries. (LS)	Similar to proposed program. (LS)	Similar to proposed program. (LS)	Similar to proposed program. (LS)
Impact 5.3.3-3: Effects on water quality along the San Joaquin River and the Sacramento-San Joaquin Delta	Very infrequently following protracted droughts, flow reductions could cause salinity, expressed in terms of electroconductivity, to rise above established water quality objectives for the San Joaquin River at Vernalis. Under these circumstances the USBR, the agency responsible for compliance with these objectives, would increase releases from New Melones Reservoir to compensate for the reduction in flow and related impacts on water quality.	Similar to proposed program (LS)	Similar to proposed program (LS)	Similar to proposed program (LS)

TABLE 8.5 (Continued)
SUMMARY OF WATER SUPPLY AND SYSTEM OPERATIONS IMPACTS FOR THE WSIP VARIANTS COMPARED TO EXISTING CONDITION — TUOLUMNE WATERSHED

Impact	Proposed Program	Variant 1 – All Tuolumne	Variant 2 – Regional Desalination for Drought	Variant 3 – 10% Rationing
Section 5.3.3, Surface Water Quality (cont.)				
Impact 5.3.3-3 (cont.)	WSIP-related changes in Delta inflow would occur when flow through the Delta is at its seasonal maximum and would be too small to adversely affect water quality. (LS)			
Section 5.3.4, Surface Water Supplies				
Impact 5.3.4-1: Effects on Tuolumne River, San Joaquin River, and Stanislaus River water users	Under the WSIP, SFPUC's water supply facilities would continue to be operated in compliance with the provisions of the Raker Act, which requires that the SFPUC operate its water facilities so as to not infringe on the established water rights of TID and MID. Thus, the WSIP would have no adverse effect on the availability of Tuolumne River water to TID and MID or on the quality of water available to them. During most year types the WSIP would have no effect on the availability of Stanislaus River water to the USBR and other water supply agencies that receive water from New Melones Reservoir. On rare occasions following protracted droughts, WSIP-induced flow reductions along the San Joaquin River could cause flows to fall below established flow and water quality objectives at Vernalis, and the USBR would be required to increase releases from New Melones Reservoir or other San Joaquin Valley CVP facilities to compensate for these reduction in flows. Availability and quality of water at water agencies' and irrigators' diversion points along the San Joaquin, and Stanislaus Rivers would not be changed appreciably. (LS)	Similar to proposed program. (LS)	Similar to but less than proposed program. (LS)	Similar to proposed program. (LS)
Impact 5.3.4-2: Effects on Delta water users	Under rare circumstances, small reductions in Delta inflow between June and September of wet and above normal years would reduce water availability at the SWP and CVP diversion points. (LS)	Similar to proposed program. (LS)	Similar to but less than proposed program. (LS)	Similar to proposed program. (LS)

TABLE 8.5 (Continued)
SUMMARY OF WATER SUPPLY AND SYSTEM OPERATIONS IMPACTS FOR THE WSIP VARIANTS COMPARED TO EXISTING CONDITION — TUOLUMNE WATERSHED

Impact	Proposed Program	Variant 1 – All Tuolumne	Variant 2 – Regional Desalination for Drought	Variant 3 – 10% Rationing
Section 5.3.5, Groundwater				
Impact 5.3.5-1: Alteration of stream flows along the Tuolumne River, which could affect local groundwater recharge and groundwater levels	Would result in slight increases in groundwater discharge to the Tuolumne River along some reaches below La Grange Dam and reductions in stream flow to the groundwater basin along other reaches. Overall, the WSIP would have little or no effect on groundwater levels and groundwater recharge. The production rate of existing wells would not be affected. (LS)	Same as proposed program. (LS)	Same as proposed program. (LS)	Same as proposed program. (LS)
Impact 5.3.5-2: Alteration of stream flows along the Tuolumne River, which could affect local groundwater quality	Effects on groundwater quality would be slight and limited to a shallow, unconfined aquifer located along the Tuolumne River in the vicinity of Modesto that is only used for sub-potable uses. No adverse effects on identified beneficial uses of groundwater basin would result. (LS)	Same as proposed program. (LS)	Same as proposed program. (LS)	Same as proposed program. (LS)
Section 5.3.6, Fisheries				
Impact 5.3.6-1: Effects on fishery resources in Hetch Hetchy Reservoir	WSIP-related reductions in seasonal storage within Hetch Hetchy Reservoir would fall within the existing range of natural variation in seasonal storage volumes. No adverse impacts on resident fish habitat within the reservoir would occur. (LS)	Similar to proposed program. (LS)	Similar to proposed program. (LS)	Similar to proposed program. (LS)
Impact 5.3.6-2: Effects on fishery resources along the Tuolumne River between Hetch Hetchy Reservoir and Don Pedro Reservoir	Little or no change on fisheries in most summer, fall and winter months. In spring months, average monthly flows would be reduced by 4 to 30 percent and the start of large spring releases from Hetch Hetchy Reservoir could be delayed by several days. These reductions and delays in spring flows would be within the natural interannual variation that has occurred in the past and would not adversely affect fishery resources along this stretch of the Tuolumne River. (LS)	Similar to proposed program. (LS)	Similar to proposed program. (LS)	Similar to proposed program. (LS)
Impact 5.3.6-3: Effects on fishery resources in Don Pedro Reservoir	WSIP-related reductions in seasonal storage within Don Pedro Reservoir would fall within the existing range of natural variation in seasonal storage volumes. No adverse impacts on resident fish habitat within the reservoir would occur. (LS)	Similar to proposed program. (LS)	Similar to proposed program. (LS)	Similar to proposed program. (LS)

TABLE 8.5 (Continued)
SUMMARY OF WATER SUPPLY AND SYSTEM OPERATIONS IMPACTS FOR THE WSIP VARIANTS COMPARED TO EXISTING CONDITION — TUOLUMNE WATERSHED

Impact	Proposed Program	Variant 1 – All Tuolumne	Variant 2 – Regional Desalination for Drought	Variant 3 – 10% Rationing
Section 5.3.6, Fisheries (cont.)				
Impact 5.3.6-4: Effects on fishery resources along the Tuolumne River below La Grange Dam	In wet or above-normal years when Don Pedro Reservoir is being filled, changes in the timing and duration of releases from the reservoir would decrease average monthly flows along the lower Tuolumne River beneath La Grange Dam. The greatest average flow reductions would occur during June and could potentially result in elevated water temperatures. Changes to stream flow and water temperature would result in a reduction in the linear extent of suitable habitat for rearing Chinook salmon and oversummering steelhead/rainbow trout, potentially adversely affecting these fish populations in the lower Tuolumne River. (PSM)	Similar to than proposed program. (PSM)	Similar to but less than proposed program. (PSM)	Similar to proposed program. (PSM)
Impact 5.3.6-5: Effects on fishery resources along the San Joaquin River	During certain drought conditions, WSIP operations would reduce inflow to Don Pedro Reservoir and, as a result, increase the seasonal (summer) temperatures of water released from the reservoir, which would also affect water temperature along the lower San Joaquin River. However, the greatest flow reductions would occur after most out-migrating juvenile Chinook salmon have left the San Joaquin River. Other fish species inhabiting the river are tolerant of elevated water temperatures and would not likely be affected. (LS)	Similar to proposed program. (LS)	Similar to but less than proposed program. (LS)	Similar to proposed program. (LS)
Section 5.3.7, Terrestrial Biological Resources				
Impact 5.3.7-1: Impacts on riparian habitat and related biological resources in Hetch Hetchy Reservoir and along the bedrock channel portions of the Tuolumne River below O'Shaughnessy Dam to Don Pedro Reservoir				
• Sensitive Habitats	Riparian and meadow habitat in Hetch Hetchy Reservoir is already limited and would not be significantly affected by predicted annual fluctuations in reservoir storage. Along the upper Tuolumne River, the dynamic hydrology regime, steep banks, and rocky substrate limits riparian tree structure and minimizes the encroachment of riparian vegetation into the channel. (LS)	Similar to proposed program. (LS)	Similar to proposed program. (LS)	Similar to proposed program. (LS)

TABLE 8.5 (Continued)
SUMMARY OF WATER SUPPLY AND SYSTEM OPERATIONS IMPACTS FOR THE WSIP VARIANTS COMPARED TO EXISTING CONDITION — TUOLUMNE WATERSHED

Impact	Proposed Program	Variant 1 – All Tuolumne	Variant 2 – Regional Desalination for Drought	Variant 3 – 10% Rationing
Section 5.3.7, Terrestrial Biological Resources (cont.)				
Impact 5.3.7-1 (cont.)				
• Key Special Status Species	Changes to habitat in the reservoir and along the upper Tuolumne River would be minimal and would not significantly alter the composition, extent, and structure of special-status species. (LS)	Similar to proposed program. (LS)	Similar to proposed program. (LS)	Similar to proposed program. (LS)
• Other Species of Concern	Changes to habitat in the reservoir and along the upper Tuolumne River would be minimal and would not significantly alter the composition, extent, and structure of other species of concern. (LS)	Similar to proposed program. (LS)	Similar to proposed program. (LS)	Similar to proposed program. (LS)
• Common Habitats and Species	Effects on common habitats and species in the reservoir and along the upper Tuolumne River would be minimal. (LS)	Similar to proposed program. (LS)	Similar to proposed program. (LS)	Similar to proposed program. (LS)
Impact 5.3.7-2: Impacts on alluvial features that support meadow and riparian habitat along the Tuolumne River from O'Shaughnessy Dam to Don Pedro Reservoir				
• Sensitive Habitats	Delayed snowmelt releases, reductions in flow, and the resulting reduction in groundwater recharge would result in a reduction in the extent and diversity of wetland and riparian habitats, including sensitive wetland and riparian habitats in the Poopenaut Valley. (PSM)	Similar to proposed program. (PSM)	Similar to proposed program. (PSM)	Similar to proposed program. (PSM)
• Key Special Status Species	A reduction in wetland and riparian habitat would reduce suitable breeding habitat for key-special status species potentially occurring along this reach (e.g. foothill yellow-legged frog, California red-legged frog, and the willow flycatcher), the populations of which are already critically reduced in the Sierra Nevada. (PSM)	Similar to proposed program. (PSM)	Similar to proposed program. (PSM)	Similar to proposed program. (PSM)
• Other Species of Concern	A reduction in the extent and diversity of wetland and riparian habitats would reduce habitat quality and extent for animal and plant species of concern. (PSM)	Similar to proposed program. (PSM)	Similar to proposed program. (PSM)	Similar to proposed program. (PSM)

TABLE 8.5 (Continued)
SUMMARY OF WATER SUPPLY AND SYSTEM OPERATIONS IMPACTS FOR THE WSIP VARIANTS COMPARED TO EXISTING CONDITION — TUOLUMNE WATERSHED

Impact	Proposed Program	Variant 1 – All Tuolumne	Variant 2 – Regional Desalination for Drought	Variant 3 – 10% Rationing
Section 5.3.7, Terrestrial Biological Resources (cont.)				
Impact 5.3.7-2 (cont.)				
• Common Habitats and Species	All habitats affected by the WSIP are considered sensitive. A large number of common animal species depend on sensitive meadows and larger riparian areas potentially affected by the WSIP for food and cover. (PSM)	Similar to proposed program. (PSM)	Similar to proposed program. (PSM)	Similar to proposed program. (PSM)
Impact 5.3.7-3: Impacts on biological resources in Lake Eleanor and along Eleanor Creek				
• Sensitive Habitats	Increased transfers to Lake Lloyd during extended droughts could slightly reduce the extent and quality of wetland habitat in Lake Eleanor. Quantity and timing of releases to Eleanor Creek would be similar to existing conditions and would not affect sensitive riparian habitats. (LS)	Same as proposed program. (LS)	Same as proposed program. (LS)	Same as proposed program. (LS)
• Key Special Status Species	Effects on habitat in Lake Eleanor and along Eleanor Creek would be minimal and would not significantly affect key special status species, including foothill yellow-legged frog. (LS)	Same as proposed program. (LS)	Same as proposed program. (LS)	Same as proposed program. (LS)
• Other Species of Concern	Minimal effects on riparian habitats in Lake Eleanor and along Eleanor Creek resulting from the WSIP would not adversely affect other species of concern. (LS)	Same as proposed program. (LS)	Same as proposed program. (LS)	Same as proposed program. (LS)
• Common Habitats and Species	Effects on common habitats and species in Lake Eleanor and along Eleanor Creek would be incremental and small. (LS)	Same as proposed program. (LS)	Same as proposed program. (LS)	Same as proposed program. (LS)
Impact 5.3.7-4: Impacts to biological resources in Lake Lloyd and along Cherry Creek				
• Sensitive Habitats	Change in monthly water levels would be minimal and would not significantly affect surrounding vegetation and wetland habitats. During dry years, small increases in releases to Cherry Creek would benefit riparian habitats. (LS)	Same as proposed program. (LS)	Same as proposed program. (LS)	Same as proposed program. (LS)

TABLE 8.5 (Continued)
SUMMARY OF WATER SUPPLY AND SYSTEM OPERATIONS IMPACTS FOR THE WSIP VARIANTS COMPARED TO EXISTING CONDITION — TUOLUMNE WATERSHED

Impact	Proposed Program	Variant 1 – All Tuolumne	Variant 2 – Regional Desalination for Drought	Variant 3 – 10% Rationing
Section 5.3.7, Terrestrial Biological Resources (cont.)				
Impact 5.3.7-4 (cont.)				
• Key Special Status Species	Effects on habitat in Lake Lloyd and Cherry Creek would be minimal and would not significantly affect key special status species, including foothill yellow-legged frog. (LS)	Same as proposed program. (LS)	Same as proposed program. (LS)	Same as proposed program. (LS)
• Other Species of Concern	Changes riparian habitats associated with Lake Lloyd and Cherry Creek would be minimal. No adverse effects on other species of concern occur. (LS)	Same as proposed program. (LS)	Same as proposed program. (LS)	Same as proposed program. (LS)
• Common Habitats and Species	Effects on common habitats and species would be minimal. (LS)	Same as proposed program. (LS)	Same as proposed program. (LS)	Same as proposed program. (LS)
Impact 5.3.7-5: Impacts on biological resources in Don Pedro Reservoir				
• Sensitive Habitats	Large fluctuations in reservoir storage levels under existing conditions have precluded the development of riparian and wetland habitats in Don Pedro Reservoir. Thus, WSIP-induced changes in reservoir levels would have a minimal effect on sensitive habitats. (LS)	Similar to proposed program. (LS)	Similar to proposed program. (LS)	Similar to proposed program. (LS)
• Key Special Status Species	Due to very limited potential habitat for California red-legged frog in Don Pedro Reservoir, impacts on this key special-status species would be minimal. (LS)	Similar to proposed program. (LS)	Similar to proposed program. (LS)	Similar to proposed program. (LS)
• Other Species of Concern	Would result in an incremental reduction in the quality and extent of habitat for other species of concern, including western pond turtle, several bat and bird species, and bald eagle. (LS)	Similar to proposed program. (LS)	Similar to proposed program. (LS)	Similar to proposed program. (LS)
• Common Habitats and Species	Increased drawdown of Don Pedro Reservoir would not affect common habitats. Thus, impacts to common species would be minimal. (LS)	Similar to proposed program. (LS)	Similar to proposed program. (LS)	Similar to proposed program. (LS)

TABLE 8.5 (Continued)
SUMMARY OF WATER SUPPLY AND SYSTEM OPERATIONS IMPACTS FOR THE WSIP VARIANTS COMPARED TO EXISTING CONDITION — TUOLUMNE WATERSHED

Impact	Proposed Program	Variant 1 – All Tuolumne	Variant 2 – Regional Desalination for Drought	Variant 3 – 10% Rationing
Section 5.3.7, Terrestrial Biological Resources (cont.)				
Impact 5.3.7-6: Impacts on biological resources along the Tuolumne River below La Grange Dam				
• Sensitive Habitats	Delayed spring releases and reductions in average and total flow (particularly during and following an extended drought) below La Grange Dam would reduce or eliminate suitable conditions for recruitment of some riparian species along the river. (PSM)	Similar to proposed program. (PSM)	Similar to but less than proposed program. (PSM)	Similar to proposed program. (PSM)
• Key Special Status Species	Because of the known presence of key special-status species and the very limited amount of remaining suitable habitat along this reach of the Tuolumne River, this incremental impact would be potentially significant. (PSM)	Similar to proposed program. (PSM)	Similar to but less than proposed program. (PSM)	Similar to proposed program. (PSM)
• Other Species of Concern	Species of concern that would be adversely affected by changes in the extent and quality of suitable riparian habitat include western pond turtle, several bat species, and a wide variety of riparian- and marsh-associated bird species. (PSM)	Similar to proposed program. (PSM)	Similar to but less than proposed program. (PSM)	Similar to proposed program. (PSM)
• Common Habitats and Species	The populations of common species that depend on riparian habitat could be adversely affected by the alteration of habitat. (PSM)	Similar to proposed program. (PSM)	Similar to but less than proposed program. (PSM)	Similar to proposed program. (PSM)
Impact 5.3.7-7: Conflicts with the provisions of adopted conservation plans or other approved biological resources plans for the Tuolumne Wild and Scenic River	The Tuolumne River Wild and Scenic Plan does not apply to the exercise of CCSF's water rights under the Raker Act. Implementation of the WSIP would not conflict with any adopted conservation plan or biological resources plan. (LS).	Same as proposed program (LS)	Same as proposed program (LS)	Same as proposed program (LS)

TABLE 8.5 (Continued)
SUMMARY OF WATER SUPPLY AND SYSTEM OPERATIONS IMPACTS FOR THE WSIP VARIANTS COMPARED TO EXISTING CONDITION — TUOLUMNE WATERSHED

Impact	Proposed Program	Variant 1 – All Tuolumne	Variant 2 – Regional Desalination for Drought	Variant 3 – 10% Rationing
Section 5.3.8, Recreation and Visual Resources				
Impact 5.3.8-1: Effects on reservoir recreation due to changes in water system operations	During the primary recreation season (between Memorial Day and Labor Day), average monthly water levels in Hetch Hetchy Reservoir would be lowered by less than 5 feet compared to the existing condition except in critically dry years, when up to a 10-foot drop in reservoir levels would be expected. This drop in reservoir levels would not likely be perceptible to most hikers. Only during the off-season when visitation to the reservoir is low (between January and March) would the increased drawdown be noticeable. There would be no WSIP-induced changes in water levels in Lake Eleanor and minimal changes in water levels in Lake Lloyd. There would be no effect on recreation. During prolonged drought periods, drawdown of water levels at Don Pedro Reservoir would exceed the 450-foot threshold level for recreational uses, potentially impairing the use of boat ramp facilities. When compared to the existing condition, the frequency of these incidences would increase from 13 to 24 summer months over the 82-year hydrologic record. These infrequent events would not significantly affect boating facilities. Non-native fish populations in Don Pedro Reservoir can tolerate the changes in reservoir levels and, thus, no effects on fishing activities would result. Visual impacts associated with reservoir drawdown would not be noticeable to most recreational users. (LS)	Similar to proposed program. (LS)	Similar to proposed program. (LS)	Similar to proposed program. (LS)
Impact 5.3.8-2: Effects on river recreation due to changes in water system operations	With the WSIP, the onset of large releases from Hetch Hetchy Reservoir in the early spring would be delayed by up to 8 days and the total volume of releases reduced. However, during the rest of the year, the WSIP would have very little effect on the number of days flow in the river is suitable for whitewater rafting and would have very little effect on the need for scheduled releases from Holm Powerhouse.	Similar to proposed program. (LS)	Similar to proposed program. (LS)	Similar to proposed program. (LS)

TABLE 8.5 (Continued)
SUMMARY OF WATER SUPPLY AND SYSTEM OPERATIONS IMPACTS FOR THE WSIP VARIANTS COMPARED TO EXISTING CONDITION — TUOLUMNE WATERSHED

Impact	Proposed Program	Variant 1 – All Tuolumne	Variant 2 – Regional Desalination for Drought	Variant 3 – 10% Rationing
Section 5.3.8, Recreation and Visual Resources (cont.)				
Impact 5.3.8-2 (cont.)	Relatively minor changes in upper Tuolumne River flow associated in May and June would be imperceptible to visitors. No change in flow releases during the peak recreational period (July through August) would occur. With the WSIP, the onset of releases from La Grange Dam above the minimum flow requirements would be delayed, and the total volume of releases would be reduced. Releases during the rest of the year would be similar to those under the existing condition. Minimum flow conditions would be maintained under all circumstances during summer. (LS)			
Impact 5.3.8-3: Effects on aesthetic values of the Tuolumne Wild and Scenic River	During below-normal and dry years, WSIP-induced reductions in flow would result in a reduction of flows of up to 30 percent in May. However, because flow in the upper river would remain within the range experienced under the existing condition, WSIP-related flow reductions would likely be imperceptible to or unobserved by visitors. (LS)	Same as proposed program (LS)	Same as proposed program (LS)	Same as proposed program (LS)
Section 5.3.9, Energy Resources				
Impact 5.3.9-1: Effects on hydropower generation at facilities along the Tuolumne River	Increased diversions from Hetch Hetchy Reservoir would increase the SFPUC's average annual hydropower generation by about 1.4 percent (23,000 MWh). The resultant reduction in inflow to Don Pedro Reservoir would decrease MID/TID's average annual hydropower generation by approximately 2.4 percent (14,000 MWh). Overall, hydropower generation on the Tuolumne River would be increased by about 0.4 percent (9,000 MWh). (B)	Similar to proposed program. (B)	Similar to proposed program. (B)	Similar to proposed program. (B)

LS = Less than Significant, no mitigation required.
SM or PSM = Significant or Potentially Significant, can be Mitigated to less than significant.
SU or PSU = Significant Unavoidable or Potentially Significant Unavoidable, cannot be mitigated to less than significant.
B = Beneficial

TABLE 8.6
SUMMARY OF WATER SUPPLY AND SYSTEM OPERATIONS IMPACTS FOR THE WSIP VARIANTS COMPARED TO EXISTING CONDITIONS – ALAMEDA WATERSHED

Impact	Proposed Program	Variant 1 – All Tuolumne	Variant 2 – Regional Desal for Drought	Variant 3 – 10% Rationing
Section 5.4.1, Stream Flow and Reservoir Water Levels				
Impact 5.4.1-1: Effects along Calaveras Creek below Calaveras Reservoir	Under the WSIP, the restored capacity of Calaveras Reservoir would change the nature of releases from the reservoir to Calaveras Creek. Changes in reservoir operation would result in substantial flow reductions along Calaveras Creek below Calaveras Dam in winter and early spring of wet and above-normal precipitation years. Reduced winter flows would remain in the range of existing flows. Instream fishery releases to Calaveras Creek in summer months would be beneficial. (LS)	Similar to proposed program. (LS)	Similar to proposed program. (LS)	Similar to proposed program. (LS)
Impact 5.4.1-2: Effects on flow along Alameda Creek below the diversion dam	In all year types, system operations under the WSIP would increase diversions from Alameda Creek to Calaveras Reservoir between the months of December and May, nearly eliminating low and moderate (1 to 650 cfs) flows in Alameda Creek downstream of the diversion dam and substantially reducing many higher (greater than 650 cfs) flows that have occurred since 2002. The resultant reduction in stream flows and alteration of the stream hydrograph is considered an adverse effect. (SU)	Same as proposed program (SU)	Same as proposed program (SU)	Same as proposed program (SU)
Impact 5.4.1-3: Effects in San Antonio Reservoir and along San Antonio Creek	Typically, San Antonio Reservoir would remain slightly higher than under existing conditions. Every fifth year, during planned maintenance for the Mountain Tunnel, the reservoir would be drawn to replace flows not provided by the Hetch Hetchy system, resulting in lower water levels and increased reservoir storage for one to two years after the maintenance period. With the exception of occasional operational changes due to maintenance, the proposed program would result in minor increases and decreases in winter and spring flows along San Antonio Creek in some wet and above-normal years but flows would remain within range of existing conditions. (LS)	Similar to proposed program (LS)	Similar to proposed program. (LS)	Similar to proposed program. (LS)
Impact 5.4.1-4: Effects on flow along Alameda Creek below the confluence of San Antonio Creek	Would result in a substantial reduction (8 to 52 percent) in flow volumes during January, February, and March of normal or wetter years and a moderate increase (about 14 percent) in flow volumes in April of normal years. These changes in flow would be dampened by inflows from other tributaries in the Sunol Valley and would not result in adverse hydrologic effects. (LS)	Similar to proposed program (LS)	Similar to proposed program (LS)	Similar to proposed program (LS)

TABLE 8.6 (Continued)
SUMMARY OF WATER SUPPLY AND SYSTEM OPERATIONS IMPACTS FOR THE WSIP VARIANTS COMPARED TO EXISTING CONDITIONS – ALAMEDA WATERSHED

Impact	Proposed Program	Variant 1 – All Tuolumne	Variant 2 – Regional Desal for Drought	Variant 3 – 10% Rationing
Section 5.4.2, Geomorphology				
Impact 5.4.2-1: Effects on channel formation and sediment transport along Calaveras Creek	Would increase erosion, sediment transport, and deposition along Calaveras Creek during heavy rainfall (compared to existing condition). However, this sediment transport would be similar to the long-term conditions that formed the current channel. (LS)	Same as proposed program. (LS)	Same as proposed program. (LS)	Same as proposed program. (LS)
Impact 5.4.2-2: Effects on channel formation and sediment transport along Alameda Creek downstream of the diversion dam	Would reduce peak flows in Alameda Creek downstream of the diversion dam through increased use of the diversion tunnel. High flows (up to 650 cfs) and annual sluicing would still transport substantial quantities of sediment downstream. (LS)	Same as proposed program. (LS)	Same as proposed program. (LS)	Similar to proposed program. (LS)
Impact 5.4.2-3: Effects on channel formation and sediment transport along San Antonio Creek downstream of San Antonio Reservoir	Flows and associated geomorphic changes would be within the range of historical flows and changes. (LS)	Same as proposed program. (LS)	Same as proposed program. (LS)	Same as proposed program. (LS)
Section 5.4.3, Surface Water Quality				
Impact 5.4.3-1: Effects on water quality in Calaveras Reservoir	Increased reservoir storage would result in minimal changes in temperature. The existing oxygenation system, sized to be operated in a larger reservoir, would maintain or improve DO concentrations, nutrient levels, and algal biomass when compared to existing conditions. Turbidity would be lowered due to the larger storage capacity. (LS)	Similar to proposed program. (LS)	Similar to proposed program. (LS)	Similar to proposed program. (LS)
Impact 5.4.3-2: Effects on water quality in San Antonio Reservoir	Proposed program would maintain higher overall storage, leading to similar or larger cold/cool water volumes and minimal changes in temperature. Overall DO conditions, nutrient, and algae levels are expected to be similar to existing conditions. (LS)	Similar to proposed program. (LS)	Similar to proposed program. (LS)	Similar to proposed program. (LS)
Impact 5.4.3-3: Effects on water quality along Calaveras, San Antonio, and Alameda Creeks	Under future operations, water temperatures and DO conditions along Calaveras Creek would be similar to existing conditions. The trapping of nutrients in the reservoir would reduce nutrients in downstream waters and the oxidation of ammonia would reduce the potential for excess ammonia releases from the reservoir.	Similar to proposed program. (LS)	Similar to proposed program. (LS)	Similar to proposed program. (LS)

TABLE 8.6 (Continued)
SUMMARY OF WATER SUPPLY AND SYSTEM OPERATIONS IMPACTS FOR THE WSIP VARIANTS COMPARED TO EXISTING CONDITIONS – ALAMEDA WATERSHED

Impact	Proposed Program	Variant 1 – All Tuolumne	Variant 2 – Regional Desal for Drought	Variant 3 – 10% Rationing
Section 5.4.3, Surface Water Quality (cont.)				
Impact 5.4.3-3 (cont.)	Release mechanisms from San Antonio Reservoir would remain unchanged. Thus, the temperature, DO conditions, and levels of nutrients of associated constituents in downstream waters would be similar to existing conditions. Would lower water temperatures in Alameda Creek from the vicinity of the diversion tunnel to several miles downstream of the confluence with Calaveras Creek. DO conditions and nutrient levels would be similar to the existing condition. (LS)			
Section 5.4.4, Groundwater				
Impact 5.4.4-1: Changes in groundwater levels, flows, quality, and supplies	Changes in stream flows would result in minimal changes in the groundwater levels of Sunol Valley groundwater resources. Groundwater quality would not be affected. (LS)	Same as proposed program. (LS)	Same as proposed program. (LS)	Same as proposed program. (LS)
Section 5.4.5, Fisheries				
Impact 5.4.5-1: Effects on fishery resources in Calaveras Reservoir	The increase in reservoir storage would result in increased coldwater pool volume, which would increase the volume of habitat available for coldwater and warmwater resident fish species. Elevated reservoir water levels could improve connectivity and migration of fish between the reservoir and upstream tributaries. (B)	Similar to proposed program. (B)	Similar to proposed program. (B)	Similar to proposed program. (B)
Impact 5.4.5-2: Effects on fishery resources along Calaveras Creek below Calaveras Dam and along Alameda Creek below confluence with Calaveras Creek	Year-round fishery releases from Calaveras Reservoir to Calaveras Creek, including summer base flows that do not occur under the existing condition, would improve habitat quality and availability for resident rainbow trout and other fish inhabiting Calaveras and Alameda creeks. (B)	Similar to proposed program. (B)	Similar to proposed program. (B)	Similar to proposed program. (B)
Impact 5.4.5-3: Effects on fishery resources along Alameda Creek downstream of the Alameda Creek Diversion Dam	Following implementation of the Calaveras Dam Replacement Project (SV-2), operation of Calaveras Reservoir and the Alameda Creek Diversion Dam would be restored to pre-2002 conditions. A substantial increase in diversions from Alameda Creek to Calaveras Reservoir would reduce flows in this stretch	Similar to proposed program. (PSM)	Similar to proposed program. (PSM)	Similar to proposed program. (PSM)

TABLE 8.6 (Continued)
SUMMARY OF WATER SUPPLY AND SYSTEM OPERATIONS IMPACTS FOR THE WSIP VARIANTS COMPARED TO EXISTING CONDITIONS – ALAMEDA WATERSHED

Impact	Proposed Program	Variant 1 – All Tuolumne	Variant 2 – Regional Desal for Drought	Variant 3 – 10% Rationing
Section 5.4.5, Fisheries (cont.)				
Impact 5.4.5-3 (cont.)	of the creek. Diversion of most or all flows during late winter and spring months would reduce the ability of resident rainbow trout to spawn and for eggs to incubate. In addition, the increased diversion of flows to the reservoir would divert fish from Alameda Creek to the reservoir, prevent fish passage to downstream reaches of Alameda Creek, and increase the potential for fish entrainment since there are currently no screens on the diversion. (PSM)			
Impact 5.4.5-4: Effects on fishery resources in San Antonio Reservoir	Slight increases in storage and water levels in San Antonio Reservoir would increase the coldwater pool volume in the reservoir and increase coldwater and warmwater habitat in the reservoir, provide greater opportunities for connectivity and migration of fish between the reservoir and upstream habitat, and benefit coldwater fish species downstream. (B)	Similar to proposed program. (B)	Similar to proposed program. (B)	Similar to proposed program. (B)
Impact 5.4.5-5: Effects on fishery resources along San Antonio Creek below San Antonio Reservoir	Releases to San Antonio Creek from San Antonio Reservoir would be similar to existing conditions but with slightly greater total releases in winter and spring. (LS)	Similar to proposed program. (LS)	Similar to proposed program. (LS)	Similar to proposed program. (LS)
Impact 5.4.5-6: Effects on fishery resources along Alameda Creek below confluence with San Antonio Creek	Minor changes in flows along San Antonio Creek would result in minimal effects on the contribution of San Antonio Creek flows to downstream fishery habitat along Alameda Creek. (LS)	Similar to proposed program. (LS)	Similar to proposed program. (LS)	Similar to proposed program. (LS)
Section 5.4.6, Terrestrial Biological Resources				
Impact 5.4.6-1: Effects on riparian habitat and related biological resources in Calaveras Reservoir				
• Sensitive Habitats	Increased reservoir storage elevations would result in the inundation and permanent loss of seasonal wetlands, seeps, perennial freshwater marsh, and riparian habitat that have established since 2002. (PSM)	Same as proposed program. (PSM)	Same as proposed program. (PSM)	Same as proposed program. (PSM)

TABLE 8.6 (Continued)
SUMMARY OF WATER SUPPLY AND SYSTEM OPERATIONS IMPACTS FOR THE WSIP VARIANTS COMPARED TO EXISTING CONDITIONS – ALAMEDA WATERSHED

Impact	Proposed Program	Variant 1 – All Tuolumne	Variant 2 – Regional Desal for Drought	Variant 3 – 10% Rationing
Section 5.4.6, Terrestrial Biological Resources (cont.)				
Impact 5.4.6-1 (cont.)				
• Key Special Status Species	Since 2002, yellow-legged frogs have occupied approximately 10,000 linear feet of stream channel along Arroyo Hondo between the maximum reservoir elevation mandated by the DSOD and the spillway elevation. Higher maintained reservoir levels would reduce the length of this high-quality habitat along the creek and adversely affect existing populations of foothill yellow-legged frog, (PSM)	Same as proposed program. (PSM)	Same as proposed program. (PSM)	Same as proposed program. (PSM)
• Other Species of Concern	No plant species would be inundated under future conditions. Potential changes to grassland, riparian, and marsh habitats associated with wildlife species of concern in and near Calaveras Reservoir would be minor. (LS)	Same as proposed program. (LS)	Same as proposed program. (LS)	Same as proposed program. (LS)
• Common Habitats and Species	Raised reservoir elevations would inundate low-diversity, weedy, upland vegetation within the "bathtub ring" that provides little habitat value. (LS)	Same as proposed program. (LS)	Same as proposed program. (LS)	Same as proposed program. (LS)
Impact 5.4.6-2: Effects on riparian habitat and related biological resources along Alameda Creek, from below the diversion dam to the confluence with Calaveras Creek				
• Sensitive Habitats	Composition and structure of sensitive riparian habitats along this reach of Alameda Creek is the result of prevailing conditions prior to 2002. A return to the pre-2002 diversions from Alameda Creek would return flow conditions to those under which these habitats formed. No significant alteration of structure, composition, or diversity of riparian habitats would occur. (LS)	Similar to proposed program. (LS)	Similar to proposed program. (LS)	Similar to proposed program. (LS)
• Key Special Status Species	A reduction in the frequency, duration, and magnitude of flows below the diversion dam would reduce the total available aquatic breeding habitat and food sources for California red-legged frog and foothill yellow-legged frog populations that currently occupy this reach of Alameda Creek. (PSM)	Similar to proposed program. (PSM)	Similar to proposed program. (PSM)	Similar to proposed program. (PSM)

TABLE 8.6 (Continued)
SUMMARY OF WATER SUPPLY AND SYSTEM OPERATIONS IMPACTS FOR THE WSIP VARIANTS COMPARED TO EXISTING CONDITIONS – ALAMEDA WATERSHED

Impact	Proposed Program	Variant 1 – All Tuolumne	Variant 2 – Regional Desal for Drought	Variant 3 – 10% Rationing
Section 5.4.6, Terrestrial Biological Resources (cont.)				
Impact 5.4.6-2 (cont.)				
• Other Species of Concern	Because the prevailing riparian habitats along this reach are the result of pre-2002 flows, adverse impacts to raptor, songbird, and mammal species of concern would be minimal. (LS)	Similar to proposed program. (LS)	Similar to proposed program. (LS)	Similar to proposed program. (LS)
• Common Habitats and Species	Implementation of the WSIP would not affect common upland habitats and species in this area. (N/A)	Similar to proposed program. (N/A)	Similar to proposed program. (N/A)	Similar to proposed program. (N/A)
Impact 5.4.6-3: Effects on riparian habitat and related biological resources along Calaveras Creek, from Calaveras Reservoir to the confluence with Alameda Creek				
• Sensitive Habitats	Following completion of the Calaveras Dam Replacement Project (SV-2), there would be no cone valve releases into Calaveras Creek below the dam during the two- to five-year period when the reservoir is being refilled. However, minimum instream flow releases below Calaveras Dam would ensure that existing riparian vegetation along this reach is sustained even during protracted dry periods. (LS)	Similar to proposed program. (LS)	Similar to proposed program. (LS)	Similar to proposed program. (LS)
• Key Special Status Species	Future outlet works at Calaveras Dam would have the capacity to make higher volume releases than under existing conditions. Depending on the timing and volume of operational releases, they could adversely affect the reproductive success of special status amphibian species along this reach (e.g. California red-legged frog and foothill yellow-legged frog). (PSM)	Similar to proposed program. (PSM)	Similar to proposed program. (PSM)	Similar to proposed program. (PSM)
• Other Species of Concern	Potential changes in the structure and species composition of breeding habitat for riparian-nesting birds such as raptors, egrets, and songbird species of concern in the vicinity of Calaveras Creek below the reservoir would be minimal. (LS)	Similar to proposed program. (LS)	Similar to proposed program. (LS)	Similar to proposed program. (LS)
• Common Habitats and Species	Little change in extent and condition of common habitats and species. (LS)	Similar to proposed program. (LS)	Similar to proposed program. (LS)	Similar to proposed program. (LS)

TABLE 8.6 (Continued)
SUMMARY OF WATER SUPPLY AND SYSTEM OPERATIONS IMPACTS FOR THE WSIP VARIANTS COMPARED TO EXISTING CONDITIONS – ALAMEDA WATERSHED

Impact	Proposed Program	Variant 1 – All Tuolumne	Variant 2 – Regional Desal for Drought	Variant 3 – 10% Rationing
Section 5.4.6, Terrestrial Biological Resources (cont.)				
Impact 5.4.6-4: Effects on riparian habitat and related biological resources along Alameda Creek, from Calaveras Creek to San Antonio Creek				
• Sensitive Habitats	Changes in winter and summer flows along Alameda Creek would affect existing riparian communities along this reach, but the extent of this potential impact would be small. (LS)	Similar to proposed program. (LS)	Similar to proposed program. (LS)	Similar to proposed program. (LS)
• Key Special Status Species	Depending on annual rainfall and localized site conditions along this creek segment, changes in winter and summer flows along this reach could result in both beneficial and adverse impacts on habitat for California red-legged frogs and foothill yellow-legged frog populations. (PSM)	Similar to proposed program. (PSM)	Similar to proposed program. (PSM)	Similar to proposed program. (PSM)
• Other Species of Concern	Minor changes in the structure and diversity of riparian habitat in this section of the creek would not substantially alter the extent or quality of breeding habitat for songbirds, raptors, and mammals. (LS)	Similar to proposed program. (LS)	Similar to proposed program. (LS)	Similar to proposed program. (LS)
• Common Habitats and Species	Common upland habitats would be unaffected. The overall extent of riparian habitat would be similar to the existing condition. (LS)	Similar to proposed program. (LS)	Similar to proposed program. (LS)	Similar to proposed program. (LS)
Impact 5.4.6-5: Effects on riparian habitat and related biological resources in San Antonio Reservoir				
• Sensitive Habitats	The average range of reservoir elevations under the WSIP would be slightly less than existing and any loss of existing perennial freshwater marsh or riparian scrub would be balanced by development of similar habitat at higher elevations. (LS)	Similar to proposed program. (LS)	Similar to proposed program. (LS)	Similar to proposed program. (LS)
• Key Special Status Species	Negligible changes in the extent of riparian scrub and freshwater marsh habitat resulting from future reservoir operations would not significantly affect habitat conditions for California red-legged frog and California tiger salamander at San Antonio Reservoir. (LS)	Similar to proposed program. (LS)	Similar to proposed program. (LS)	Similar to proposed program. (LS)

TABLE 8.6 (Continued)
SUMMARY OF WATER SUPPLY AND SYSTEM OPERATIONS IMPACTS FOR THE WSIP VARIANTS COMPARED TO EXISTING CONDITIONS – ALAMEDA WATERSHED

Impact	Proposed Program	Variant 1 – All Tuolumne	Variant 2 – Regional Desal for Drought	Variant 3 – 10% Rationing
Section 5.4.6, Terrestrial Biological Resources (cont.)				
Impact 5.4.6-5 (cont.)				
• Other Species of Concern	Apart from maintenance drawdown every five years, only minimal changes in reservoir levels would result. During drawdown periods, waterfowl and other littoral species could be temporarily displaced from preferred habitat. This would be a negligible effect. (LS)	Similar to proposed program. (LS)	Similar to proposed program. (LS)	Similar to proposed program. (LS)
• Common Habitats and Species	Minor changes in reservoir levels would result in negligible impacts on common habitats and species. (LS)	Similar to proposed program. (LS)	Similar to proposed program. (LS)	Similar to proposed program. (LS)
Impact 5.4.6-6: Effects on riparian habitat and related biological resources along San Antonio Creek between Turner Dam and the confluence with Alameda Creek				
• Sensitive Habitats	Releases to San Antonio Creek would be rare and similar to existing conditions. No notable change in conditions for riparian and wetland habitats are anticipated. (LS)	Similar to proposed program. (LS)	Similar to proposed program. (LS)	Similar to proposed program. (LS)
• Key Special Status Species	Impacts on California red-legged frog habitat would be minimal. (LS)	Similar to proposed program. (LS)	Similar to proposed program. (LS)	Similar to proposed program. (LS)
• Other Species of Concern	Future conditions along this section of San Antonio Creek would be similar to existing conditions and would have no effect on habitat of other species of concern. (LS)	Similar to proposed program. (LS)	Similar to proposed program. (LS)	Similar to proposed program. (LS)
• Common Habitats and Species	Common habitats and species would be unaffected. (N/A)	Same as proposed program. (LS)	Same as proposed program. (LS)	Same as proposed program. (LS)
Impact 5.4.6-7: Effects on riparian habitat and related biological resources along Alameda Creek below the confluence with San Antonio Creek				
• Sensitive Habitats	WSIP-induced reductions in flow along Alameda Creek below the confluence with San Antonio Creek would be buffered by other stream inputs downstream. Minimal impacts on habitat would result. (LS)	Same as proposed program. (LS)	Same as proposed program. (LS)	Same as proposed program. (LS)

TABLE 8.6 (Continued)
SUMMARY OF WATER SUPPLY AND SYSTEM OPERATIONS IMPACTS FOR THE WSIP VARIANTS COMPARED TO EXISTING CONDITIONS – ALAMEDA WATERSHED

Impact	Proposed Program	Variant 1 – All Tuolumne	Variant 2 – Regional Desal for Drought	Variant 3 – 10% Rationing
Section 5.4.6, Terrestrial Biological Resources (cont.)				
Impact 5.4.6-7 (cont.)				
• Key Special Status Species	Little habitat for key special-status species exists along this reach of Alameda Creek. (LS)	Same as proposed program. (LS)	Same as proposed program. (LS)	Same as proposed program. (LS)
• Other Species of Concern	Minimal impacts on other species of concern. (LS)	Same as proposed program. (LS)	Same as proposed program. (LS)	Same as proposed program. (LS)
• Common Habitats and Species	Would result in minimal flow changes during normal to wet years and limited impacts on terrestrial ecological resources. (N/A)	Same as proposed program. (N/A)	Same as proposed program. (N/A)	Same as proposed program. (N/A)
Impact 5.4.6-8: Conflicts with the provisions of adopted conservation plans or other approved biological resources plans	Proposed program as a whole was found to be consistent with the provisions of the Alameda WMP. (LS)	Same as proposed program. (LS)	Same as proposed program. (LS)	Same as proposed program. (LS)
Section 5.4.7 Recreation and Visual Resources				
Impact 5.4.7-1: Effects on recreation facilities and/or activities	Under both existing and future conditions, water recreation is prohibited in SFPUC reservoirs. Thus, changes in reservoir water levels would not adversely affect recreation. Operations under the WSIP would substantially reduced flows along Alameda Creek in the Sunol Regional Wilderness during winter and early spring months and adversely affect the recreational experience of hikers; however, with the changes in project description for the Calaveras Dam Replacement (SV-2) project, bypass flows would be reduced from the diversion dam when flows are present. (LS)	Same as proposed program (LS)	Same as proposed program (LS)	Same as proposed program (LS)
Impact 5.4.7-2: Visual effects on scenic resources or visual character of water bodies	Apart from raised water levels in Calaveras Reservoir and substantial reductions in flows along Alameda Creek in the Sunol Regional Wilderness area during winter and spring months, changes in stream flow and reservoir elevations in the Alameda watershed would not be apparent to most recreational users. WSIP-induced reductions in stream flows along Alameda Creek would substantially change quality of visual resources in the Sunol Regional Wilderness area; however, with the changes in project description for the Calaveras Dam Replacement (SV-2) project, bypass flows would be reduced from the diversion dam when flows are present. (LS)	Same as proposed program (LS)	Same as proposed program (LS)	Same as proposed program (LS)

LS = Less than Significant, no mitigation required.
SM or PSM = Significant or Potentially Significant, can be Mitigated to less than significant.
SU or PSU = Significant Unavoidable or Potentially Significant Unavoidable, cannot be mitigated to less than significant.
B = Beneficial

TABLE 8.7
SUMMARY OF WATER SUPPLY AND SYSTEM OPERATIONS IMPACTS FOR THE WSIP VARIANTS COMPARED TO EXISTING CONDITION – PENINSULA WATERSHED

Impact	Proposed Program	Variant 1 – All Tuolumne	Variant 2 – Regional Desalination for Drought	Variant 3 – 10% Rationing
Section 5.5.1, Stream Flow and Reservoir Water Levels				
Impact 5.5.1-1: Effects on flow along San Mateo Creek	In most years, WSIP improvements to Lower Crystal Springs Dam would raise average monthly water levels in Crystal Springs Reservoir by 2 to 8 feet. Every fifth year, planned system maintenance would reduce importation of water from the Tuolumne River and would require that water be withdrawn from Crystal Springs Reservoir to meet water deliveries. Maintenance activities would decrease water levels by as much as 16 feet during the months of October, November and December. Little change in average monthly storage and water levels in San Andreas Reservoir compared to existing condition. Maintenance activities would decrease water levels by as much as 14 feet during the months of October, November and December. Under the WSIP, Crystal Springs Reservoir would be operated as it is currently operated and releases to San Mateo Creek would occur infrequently, as they do under the existing condition, and would be of a similar magnitude. San Mateo Creek is currently an intermittent stream and would remain so under the proposed program. (LS)	Similar to proposed program. (LS)	Similar to proposed program. (LS)	Similar to proposed program (LS)
Impact 5.5.1-2: Effects on flow along Pilarcitos Creek	Increased water demand in the Coastside CWD service area would result in increased releases from Pilarcitos Reservoir. The reservoir would be drawn down more rapidly than under the existing condition. In some late spring and summer months of most hydrologic year types, the WSIP would result in increased flow in Pilarcitos Creek immediately below Pilarcitos Reservoir. In summer months of dry years, there would be almost no releases to the creek as occurs under the existing condition. The period without flow or with very low flow would be extended. Similar to existing conditions, flow in Pilarcitos Creek immediately below Stone Dam would be intermittent. Under the WSIP, total spills from Stone Dam to the creek would be reduced, but the magnitude of the flows in lower reaches of the creek would be similar to existing conditions. (LS)	Similar to but greater than with proposed program because lowered water levels in Crystal Springs Reservoir would enable greater diversions from Pilarcitos Creek and less spills at Stone Dam. (LS)	Similar to proposed program.(LS)	Similar to proposed program. (LS)
Section 5.5.2, Geomorphology				
Impact 5.5.2-1: Changes in sediment transport and channel morphology in the Peninsula watershed	Changes in flow along Pilarcitos Creeks and reservoir levels in Pilarcitos, San Andreas, and Crystal Springs Reservoirs would result in small incremental changes in sediment transport and channel-forming processes. (LS)	Similar to proposed program. (LS)	Similar to proposed program. (LS)	Similar to proposed program (LS)

TABLE 8.7 (Continued)
SUMMARY OF WATER SUPPLY AND SYSTEM OPERATIONS IMPACTS FOR THE WSIP VARIANTS COMPARED TO EXISTING CONDITION – PENINSULA WATERSHED

Impact	Proposed Program	Variant 1 – All Tuolumne	Variant 2 – Regional Desalination for Drought	Variant 3 – 10% Rationing
Section 5.5.3, Surface Water Quality				
Impact 5.5.3-1: Effects on water quality in Crystal Springs Reservoir, San Andreas Reservoir, and San Mateo Creek	Under future conditions, increased water storage and water levels in Crystal Springs Reservoir would increase phosphorous and nitrogen concentrations, which could increase the growth of algae in reservoir water. However, any changes in water quality would be minor and would not affect beneficial uses. Water storage and water levels in San Andreas Reservoir would be similar to the existing condition. Changes in water quality would be negligible. Releases of high-quality Crystal Springs Reservoir water would occur at about the same frequency and magnitude as under current conditions and would not affect water quality in San Mateo Creek. (LS)	Similar to proposed program. (LS)	Similar to proposed program. (LS)	Similar to proposed program. (LS)
Impact 5.5.3-2: Effects on water quality in Pilarcitos Reservoir and along Pilarcitos Creek	Proposed operations would generally be within the same range as existing conditions although replacement Measure 5.5.3-2a would cause Pilarcitos Reservoir to be drawn down earlier in the summer compared to existing conditions. Water temperature could increase and dissolved oxygen content could be reduced. During dry years summertime releases from Pilarcitos Reservoir to Pilarcitos Creek would be eliminated or reduced to a low level for a longer period of time with the WSIP, which would increase the temperature of instream flows between Pilarcitos Creek and Stone Dam and reduce the creek's ability to support designated cold freshwater habitat along this reach. Slight reductions in spill over Stone Dam would be minor and would not adversely affect water quality along Pilarcitos Creek. (PSM)	Similar to proposed program. (PSM)	Similar to proposed program. (PSM)	Similar to proposed program. (PSM)
Section 5.5.4, Groundwater				
Impact 5.5.4-1: Alteration of stream flows along Pilarcitos Creek, which could affect groundwater levels and water quality	Reduction in flows along Pilarcitos Creek below Stone Dam would be too small to have appreciable effect on groundwater recharge in lower Pilarcitos Creek watershed and would not affect groundwater quality. (LS)	Same as proposed program. (LS)	Same as proposed program. (LS)	Same as proposed program. (LS)

TABLE 8.7 (Continued)
SUMMARY OF WATER SUPPLY AND SYSTEM OPERATIONS IMPACTS FOR THE WSIP VARIANTS COMPARED TO EXISTING CONDITION – PENINSULA WATERSHED

Impact	Proposed Program	Variant 1 – All Tuolumne	Variant 2 – Regional Desalination for Drought	Variant 3 – 10% Rationing
Section 5.5.5, Fisheries				
Impact 5.5.5-1: Effects on fishery resources in Crystal Springs Reservoir (Upper and Lower)	Increased storage in Crystal Springs Reservoir would increase the volume of coldwater and warmwater habitat for resident fish species and provide greater opportunities for connectivity and migration of fish between the reservoir and upstream tributary habitat. However, elevated water levels in Crystal Springs Reservoir would inundate approximately 1,500 linear feet of trout spawning habitat upstream of the reservoir along Laguna and San Mateo Creeks.(PSU)	Same as proposed program. (PSU)	Same as proposed program. (PSU)	Same as proposed program. (PSU)
Impact 5.5.5-2: Effects on fishery resources in San Andreas Reservoir	Average monthly storage and water levels would be similar to existing conditions. Minor changes in water quality would not adversely affect fishery resources. (LS)	Same as proposed program. (LS)	Same as proposed program. (LS)	Same as proposed program. (LS)
Impact 5.5.5-3: Effects on fisheries resources along San Mateo Creek	Stream flow in San Mateo Creek would be similar to existing conditions. Overall, fishery habitat conditions along San Mateo Creek would be comparable to existing conditions. (LS)	Similar to proposed program. (LS)	Similar to proposed program. (LS)	Similar to proposed program. (LS)
Impact 5.5.5-4: Effects on fisheries resources in Pilarcitos Reservoir	Proposed operations would be within the same range as existing conditions although replacement Measure 5.5.3-2a would cause Pilarcitos Reservoir to be drawn down earlier in the summer compared to existing conditions. This would reduce the volume and quality of coldwater habitat available for resident fish species. (PSM)	Similar to proposed program. (PSM)	Similar to proposed program. (PSM)	Similar to proposed program. (PSM)
Impact 5.5.5-5: Effects on fishery resources along Pilarcitos Creek below Pilarcitos Reservoir	Under the WSIP, the extended period of no or very little flow in Pilarcitos Creek below Pilarcitos Reservoir during summer months of dry years would result in significant impacts on resident trout, other resident fish species and aquatic resources, and habitat quality and availability for anadromous steelhead. Increased drawdown of Pilarcitos Reservoir would increase the temperature of releases in summer and fall and reduce the quality and availability of habitat for coldwater fish species. A reduction in the frequency and magnitude of spills over Stone Dam would reduce flows along the lower reach. Reduced instream flows during winter months would adversely affect migratory fish habitat. (PSM)	Similar to proposed program but fishery effects would be greater because spills over Stone Dam would be less. (PSM)	Similar to proposed program. (PSM)	Similar to proposed program. (PSM)

TABLE 8.7 (Continued)
SUMMARY OF WATER SUPPLY AND SYSTEM OPERATIONS IMPACTS FOR THE WSIP VARIANTS COMPARED TO EXISTING CONDITION – PENINSULA WATERSHED

Impact	Proposed Program	Variant 1 – All Tuolumne	Variant 2 – Regional Desalination for Drought	Variant 3 – 10% Rationing
Section 5.5.6, Terrestrial Biological Resources				
Impact 5.5.6-1: Impacts on biological resources in Upper and Lower Crystal Springs Reservoirs				
• Sensitive Habitats	Implementation of the Lower Crystal Springs Dam Improvements project (PN-4) would raise average monthly water levels in Crystal Springs Reservoir and result in a short-term reduction in the overall extent of freshwater marsh as the reservoir fills. Proposed changes in operations would maintain maximum reservoir levels during summer for longer periods than under existing conditions, which could affect the composition and structure of riparian habitats. In addition, sensitive upland habitats that are unable to tolerate these longer periods of inundation would be lost. (PSM)	Same as proposed program (PSM)	Same as proposed program (PSM)	Same as proposed program (PSM)
• Key Special Status Species	Elevated reservoir levels would inundate existing populations of special status plant species, including serpentine-associated fountain thistle and Marin western flax, and their habitat could be permanently lost. The extent of available habitat for San Francisco garter snake and California red-legged frog would be temporarily reduced during reservoir refill, but wetland habitat that would establish at higher elevations could potentially be more extensive. Raised reservoir levels would provide greater opportunities for largemouth bass and other predators to access frogs and snakes. Periodic drawdown during planned maintenance could adversely affect San Francisco garter snake foraging habitat. (PSM)	Same as proposed program (PSM)	Same as proposed program (PSM)	Same as proposed program (PSM)
• Other Species of Concern	Changes in wetland habitat due to reservoir refill and proposed operations would adversely affect reptile and bird species of concern, particularly if permanent changes in the composition of wetland vegetation occur. Permanent loss of upland habitat, including upland trees, grassland, and coastal scrub, would result in significant impacts on several bird and mammal species of concern. Serpentine- and grassland-associated plant species unable to tolerate extended periods of inundation would be lost. (PSM)	Same as proposed program (PSM)	Same as proposed program (PSM)	Same as proposed program (PSM)
• Common Habitats and Species	Due to the extent of area involved, impacts on common habitats and species would be significant. (PSM)	Same as proposed program (PSM)	Same as proposed program (PSM)	Same as proposed program (PSM)

TABLE 8.7 (Continued)
SUMMARY OF WATER SUPPLY AND SYSTEM OPERATIONS IMPACTS FOR THE WSIP VARIANTS COMPARED TO EXISTING CONDITION – PENINSULA WATERSHED

Impact	Proposed Program	Variant 1 – All Tuolumne	Variant 2 – Regional Desalination for Drought	Variant 3 – 10% Rationing
Section 5.5.6, Terrestrial Biological Resources (cont.)				
Impact 5.5.6-2: Impacts on biological resources in San Andreas Reservoir				
• Sensitive Habitats	Minor changes in reservoir levels and operation would not substantially affect sensitive habitats. Minimal impacts would occur during maintenance drawdown. (LS)	Same as proposed program (LS)	Same as proposed program (LS)	Same as proposed program (LS)
• Key Special Status Species	Minor changes in reservoir levels and operation would not significantly affect the composition and extent of suitable wetland habitat for San Francisco garter snake and California red-legged frog. No impacts on terrestrial upland special-status species such as Mission blue butterfly would result. (LS)	Same as proposed program (LS)	Same as proposed program (LS)	Same as proposed program (LS)
• Other Species of Concern	Minor changes in monthly reservoir levels would not significantly affect habitat for other bird, mammal, reptile, and amphibian species of concern. (LS)	Same as proposed program (LS)	Same as proposed program (LS)	Same as proposed program (LS)
• Common Habitats and Species	Impacts on common habitats and species would be negligible. (LS)	Same as proposed program (LS)	Same as proposed program (LS)	Same as proposed program (LS)
Impact 5.5.6-3: Impacts on biological resources along San Mateo Creek below Lower Crystal Springs Dam				
• Sensitive Habitats	At the program level, potential changes in the structure and extent of freshwater marsh below the dam due to reduced instream flows would be significant. (LS)	Similar to proposed program. (LS)	Similar to proposed program. (LS)	Similar to proposed program (LS)
• Key Special Status Species	Alterations in the extent and quality of freshwater marsh habitat for California red-legged frog could be significant. No key special-status plant species would be affected. (LS)	Similar to proposed program. (LS)	Similar to proposed program. (LS)	Similar to proposed program (LS)
• Other Species of Concern	Impacts on riparian- and creek-associated species of concern would be minimal. (LS)	Same as proposed program (LS)	Same as proposed program (LS)	Same as proposed program (LS)
• Common Habitats and Species	Impacts on common upland habitats would be minimal. (LS)	Same as proposed program (LS)	Same as proposed program (LS)	Same as proposed program (LS)

TABLE 8.7 (Continued)
SUMMARY OF WATER SUPPLY AND SYSTEM OPERATIONS IMPACTS FOR THE WSIP VARIANTS COMPARED TO EXISTING CONDITION – PENINSULA WATERSHED

Impact	Proposed Program	Variant 1 – All Tuolumne	Variant 2 – Regional Desalination for Drought	Variant 3 – 10% Rationing
Section 5.5.6, Terrestrial Biological Resources (cont.)				
Impact 5.5.6-4: Impacts on biological resources in Pilarcitos Reservoir				
• Sensitive Habitats	Reduced water elevations could slightly reduce the extent of areas supporting sensitive freshwater marsh habitat. (LS)	Similar to proposed program (LS)	Same as proposed program (LS)	Similar to proposed program (LS)
• Key Special Status Species	Proposed operations would be within the same range as existing conditions, although replacement Measure 5.5.3-2a would cause Pilarcitos Reservoir to be drawn down earlier in the summer compared to existing conditions. This would reduce the extent of suitable habitat for California red-legged frog and San Francisco garter snake. Special status species that utilize adjacent upland vegetation would not be affected. (PSM)	Similar to proposed program (PSM)	Similar to proposed program (PSM)	Similar to proposed program (PSM)
• Other Species of Concern	The extent of suitable riparian habitat for reptile and bird species of concern would be slightly reduced. Species of concern that utilize adjacent upland vegetation would not be affected. (LS)	Similar to proposed program (LS)	Similar to proposed program (LS)	Similar to proposed program (LS)
• Common Habitats and Species	Changes in reservoir elevations would minimally affect common habitats and species. (LS)	Same as proposed program (LS)	Same as proposed program (LS)	Same as proposed program (LS)
Impact 5.5.6-5: Impacts on biological resources along Pilarcitos Creek below Pilarcitos Reservoir				
• Sensitive Habitats	Proposed operations would result in flows within the range of historical conditions, to which sensitive habitats have adapted. (LS)	Similar to proposed program (LS)	Similar to proposed program (LS)	Similar to proposed program (`LS)
• Key Special Status Species	Changes to suitable riparian habitat for foothill yellow-legged frog would be minimal. (LS)	Same as proposed program (LS)	Same as proposed program (LS)	Same as proposed program (LS)
• Other Species of Concern	Would result in slight reduction in extent of suitable for bird, mammal, and reptile species of concern that utilize open water and emergent vegetation. (LS)	Similar to proposed program (LS)	Similar to proposed program (LS)	Similar to proposed program (LS)
• Common Habitats and Species	Changes in operations would result in minor impacts to common species. (LS)	Same as proposed program (LS)	Same as proposed program (LS)	Same as proposed program (LS)
Impact 5.5.6-6: Impacts on biological resources along Pilarcitos Creek below Stone Dam				
• Sensitive Habitats	Slight incremental reduction in channel-forming processes and riparian habitat quality due to reduced stream flow. (LS)	Similar to but greater than proposed program because spills reduced compared to proposed program (LS)	Similar to proposed program (LS)	Similar to proposed program (LS)

TABLE 8.7 (Continued)
SUMMARY OF WATER SUPPLY AND SYSTEM OPERATIONS IMPACTS FOR THE WSIP VARIANTS COMPARED TO EXISTING CONDITION – PENINSULA WATERSHED

Impact	Proposed Program	Variant 1 – All Tuolumne	Variant 2 – Regional Desalination for Drought	Variant 3 – 10% Rationing
Section 5.5.6, Terrestrial Biological Resources (cont.)				
Impact 5.5.6-6 (cont.)				
• Key Special Status Species	Slight reduction in habitat quality for foothill yellow-legged frog due to reduced stream flow. (LS)	Similar to but greater than proposed program (LS)	Similar to proposed program (LS)	Similar to proposed program (LS)
• Other Species of Concern	Slight reduction in habitat quality for amphibian and bird species of concern due to reduced stream flow. (LS)	Similar to proposed program (LS)	Similar to proposed program (LS)	Similar to proposed program (LS)
• Common Habitats and Species	Changes in operations would result in minor impacts to common species. (LS)	Same as proposed program (LS)	Same as proposed program (LS)	Same as proposed program (LS)
Impact 5.5.6-7: Conflicts with the provisions of adopted conservation plans or other approved biological resource plans	Proposed program as a whole was found to be consistent with the provisions of the Peninsula WMP. (LS)	Same as proposed program (LS)	Same as proposed program (LS)	Same as proposed program (LS)
Section 5.5.7 Recreational and Visual Resources				
Impact 5.5.7-1: Effects on recreational facilities and/or activities	The WSIP would have no impact on water-related recreational facilities or other recreational activities in the Peninsula watershed. (LS)	Same as proposed program (LS)	Same as proposed program (LS)	Same as proposed program (LS)
Impact 5.5.7-2: Visual effects on scenic resources or the visual character of water bodies	Although elevated water levels in Crystal Springs Reservoir could change the visual appearance of the reservoir at close range, it would not change the scenic quality of the reservoir, either at close range or from distant viewpoints. (LS)	Same as proposed program (LS)	Same as proposed program (LS)	Same as proposed program (LS)

LS = Less than Significant, no mitigation required.
SM or PSM = Significant or Potentially Significant, can be Mitigated to less than significant.
SU or PSU = Significant Unavoidable or Potentially Significant Unavoidable, cannot be mitigated to less than significant.

TABLE 8.8
SUMMARY OF WATER SUPPLY AND SYSTEM OPERATIONS IMPACTS FOR THE WSIP VARIANTS COMPARED TO EXISTING CONDITION — WESTSIDE GROUNDWATER BASIN

Impact	Proposed Program	Variant 1 – All Tuolumne	Variant 2 – Regional Desalination for Drought	Variant 3 – 10% Rationing
Section 5.6, Westside Groundwater Basin				
Impact 5.6-1: Basin overdraft due to pumping from the Westside Groundwater Basin				
• North Westside Groundwater Basin	Proposed pumping could cause basin overdraft and result in potentially adverse impacts to groundwater resources. (PSM)	No impact because local groundwater projects would not be implemented. (N/A)	Same as proposed program. (PSM)	Same as proposed program. (PSM)
• South Westside Groundwater Basin	Proposed pumping in the South Westside Groundwater Basin for the regional conjunctive use program would comply with an operational agreement(s) to limit pumping to the "banked" quantity of water stored through in-lieu recharge so that pumping would not cause basin overdraft. (LS)	Similar to the proposed program (LS)	Same as proposed program. (LS)	Same as proposed program. (LS)
Impact 5.6-2: Changes in water levels in Lake Merced and other surface water features, including Pine Lake, due to decreased groundwater levels in the Westside Groundwater Basin				
• North Westside Groundwater Basin	Although pumping from the primary production aquifer would not have a direct effect on lake levels, it could potentially indirectly cause shallow groundwater levels to decline due to vertical leakage and affect water levels in Lake Merced and other surface water features. (PSM)	No impact because local groundwater projects would not be implemented. (N/A)	Same as proposed program. (PSM)	Same as proposed program. (PSM)
• South Westside Groundwater Basin	No major surface features in the South Westside Groundwater Basin would be affected by decreased groundwater levels. (N/A)	Same as proposed program. (N/A)	Same as proposed program. (N/A)	Same as proposed program. (N/A)
Impact 5.6-3: Seawater intrusion due to decreased groundwater levels in the Westside Groundwater Basin				
• North Westside Groundwater Basin	The shallow aquifer is in direct connection with the ocean from approximately Lake Merced to the north, and pumping could potentially cause saltwater intrusion. (PSM)	No impact because local groundwater projects would not be implemented. (N/A)	Same as proposed program. (PSM)	Same as proposed program. (PSM)
• South Westside Groundwater Basin	Saltwater intrusion in this aquifer has not been detected. Proposed pumping in the South Westside Groundwater Basin for the regional conjunctive use program would comply with an operational agreement(s) to limit pumping to the "banked" quantity of water stored through in-lieu recharge so that pumping would not cause basin overdraft or saltwater intrusion. (LS)	Same as proposed program. (LS)	Same as proposed program. (LS)	Same as proposed program. (LS)
Impact 5.6-4: Land subsidence due to decreased groundwater levels in the Westside Groundwater Basin if the historical low water levels are exceeded				
• North Westside Groundwater Basin	Land subsidence would not be expected because the aquifer materials are primarily composed of sands and dewatering of the fine-grained aquitards separating the aquifers would not occur (LS)	No impact because local groundwater projects would not be implemented. (N/A)	Same as proposed program. (LS)	Same as proposed program. (LS)

TABLE 8.8 (Continued)
SUMMARY OF WATER SUPPLY AND SYSTEM OPERATIONS IMPACTS FOR THE WSIP VARIANTS COMPARED TO EXISTING CONDITION — WESTSIDE GROUNDWATER BASIN

Impact	Proposed Program	Variant 1 – All Tuolumne	Variant 2 – Regional Desalination for Drought	Variant 3 – 10% Rationing
Section 5.6, Westside Groundwater Basin (cont.)				
Impact 5.6-4 (cont.)				
• South Westside Groundwater Basin	Proposed pumping in the South Westside Groundwater Basin for the regional conjunctive use program would comply with an operational agreement(s) to limit pumping to the "banked" quantity of water stored through in-lieu recharge so that groundwater pumping would not cause basin overdraft or land subsidence. (LS)	Same as proposed program. (LS)	Same as proposed program. (LS)	Same as proposed program. (LS)
Impact 5.6-5: Contamination of drinking water due to groundwater pumping in the Westside Groundwater Basin				
• North Westside Groundwater Basin	Until production well locations are selected and a drinking water source assessment performed, the potential for contamination of drinking water well cannot be evaluated. As a result, the potential for contamination is considered significant. (PSM)	No impact because local groundwater projects would not be implemented. (N/A)	Same as proposed program. (PSM)	Same as proposed program. (PSM)
• South Westside Groundwater Basin	Until production well locations are selected and a drinking water source assessment performed, potential for contamination of drinking water well cannot be evaluated. As a result, the potential for contamination is considered significant. (PSM)	Same as proposed program. (PSM)	Same as proposed program. (PSM)	Same as proposed program. (PSM)
Impact 5.6-6: Drinking water contaminants above maximum contaminant levels and adverse effects of adding treated groundwater to the distribution system				
• North Westside Groundwater Basin	Groundwater quality may exceed drinking water standards, but groundwater would be treated or blended with other waters such that the product water would meet drinking water standards. (LS)	No impact because local groundwater projects would not be implemented. (N/A)	Same as proposed program. (LS)	Same as proposed program. (LS)
• South Westside Groundwater Basin	Groundwater quality may exceed drinking water standards, but groundwater would be treated or blended with other waters such that the product water would meet drinking water standards. (LS)	Same as proposed program. (LS)	Same as proposed program. (LS)	Same as proposed program. (LS)

TABLE 8.9
SUMMARY OF WATER SUPPLY AND SYSTEM OPERATIONS IMPACTS FOR THE WSIP VARIANTS COMPARED TO EXISTING CONDITION — CUMULATIVE WATER SUPPLY IMPACTS

Impact	Proposed Program	Variant 1 – All Tuolumne	Variant 2 – Regional Desalination for Drought	Variant 3 – 10% Rationing
Section 5.7, Cumulative Impacts Related to Water Supply and System Operations				
Impact 5.7.2-1: Tuolumne River – Hetch Hetchy Reservoir to Don Pedro Reservoir.	Contribution to impacts on hydrology, geomorphology, surface water quality, groundwater, fishery resources, and recreation/visual quality would not be cumulatively considerable. (LS)	Similar to proposed program. (LS)	Similar to proposed program. (LS)	Similar to proposed program. (LS)
	Contribution to impacts on montane meadow habitat in Poopenaut Valley would be cumulatively considerable. (PSU)	Similar to but greater than proposed program. (PSU)	Similar to but less than proposed program. (PSU)	Similar to but greater than proposed program. (PSU)
Impact 5.7.2-2: Tuolumne River – Don Pedro Reservoir to San Joaquin River.	Contribution to impacts on hydrology, surface water quality, groundwater, fishery resources, terrestrial biological resources, and recreation/visual quality would not be cumulatively considerable. (LS)	Similar to proposed program. (LS)	Similar to proposed program. (LS)	Similar to proposed program. (LS)
Impact 5.7.2-3: San Joaquin River, Stanislaus River, and Delta.	Contribution to impacts on hydrology, surface water quality, water supply availability, and fishery resources would not be cumulatively considerable. (LS)	Similar to proposed program. (LS)	Similar to proposed program. (LS)	Similar to proposed program. (LS)
Impact 5.7.3-1: Alameda Creek watershed.	No cumulative impact on hydrology. (N/A)	Same as proposed program (N/A)	Same as proposed program (N/A)	Same as proposed program (N/A)
	Contribution to impacts on geomorphology, surface water quality, groundwater, terrestrial biological resources, and recreation/visual quality would not be cumulatively considerable. (LS)	Similar to proposed program. (LS)	Similar to proposed program. (LS)	Similar to proposed program. (LS)
Impact 5.7.4-1: San Mateo Creek watershed.	Contribution to impacts on hydrology, geomorphology, surface water quality, groundwater, fishery, terrestrial biological resources, and recreation/visual quality would not be cumulatively considerable. (LS)	Similar to proposed program. (LS)	Similar to proposed program. (LS)	Similar to proposed program. (LS)
Impact 5.7.4-2: Pilarcitos Creek watershed.	Contribution to impacts on hydrology, geomorphology, surface water quality, groundwater, fishery, terrestrial biological resources, and recreation/visual quality would not be cumulatively considerable. (LS)	Similar to proposed program. (LS)	Similar to proposed program. (LS)	Similar to proposed program. (LS)
Impact 5.7.5-1: North Westside Groundwater Basin.	Contribution to basin overdraft would not be cumulatively considerable. (LS)	Similar to but less than the proposed program. (LS)	Same as proposed program. (LS)	Same as proposed program. (LS)
Impact 5.7.5-2: South Westside Groundwater Basin.	Contribution to basin overdraft would not be cumulatively considerable. (LS)	Same as proposed program. (LS)	Same as proposed program. (LS)	Same as proposed program. (LS)

8.5.1 Water Supply Impacts of Variant 1

With *WSIP Variant 1 – All Tuolumne*, the water supply strategy would be the same as the proposed program, except to meet the estimated 35-mgd average annual increase in purchase request (from 265 to 300 mgd) by the year 2030, customers would be served entirely with additional water from the Tuolumne River watershed. As with the proposed program, a transfer from TID and MID and implementation of the Westside Basin conjunctive-use program would provide water during droughts. No additional water would be obtained from groundwater, additional conservation, or recycling projects in San Francisco.

Tuolumne River Watershed

With Variant 1, an annual average of 2.2 percent more water would be diverted from the Tuolumne River as compared to the WSIP.

Water levels in Lake Lloyd and Lake Eleanor would be essentially the same with Variant 1 and the WSIP. Releases from the reservoirs to Cherry and Eleanor Creeks would also be the same with Variant 1 and the WSIP.

Most of the time, more water would be diverted from the Tuolumne River at Hetch Hetchy Reservoir with Variant 1 than with the WSIP; as a result, storage in the reservoir would be drawn down farther just before the advent of the spring snowmelt. A greater proportion of snowmelt runoff would be needed to refill the reservoir, and consequently releases to the Tuolumne River in the spring would be delayed and reduced. The delay in release would usually be greater with Variant 1 than with the WSIP. Almost all of the differences in releases between Variant 1 and the WSIP would occur in May and June, with the greatest differences occurring in below-normal and dry years. With Variant 1, average monthly flow in some spring months would be 33 percent less than under the existing condition; the corresponding value with the WSIP would be 30 percent. The greatest reduction in average monthly flow in the 82-year period of hydrologic record would be 90 percent with both Variant 1 and the WSIP. The minimum required release below Hetch Hetchy Reservoir would be maintained or exceeded in all circumstances.

With Variant 1, more water would be diverted at Hetch Hetchy Reservoir and less would flow downstream to Don Pedro Reservoir than with the WSIP. Because of this reduction in inflow Don Pedro Reservoir would be drawn down farther with Variant 1 than it would with the WSIP. In a subsequent period, a higher proportion of winter and spring runoff would need to be captured to replenish Don Pedro Reservoir with Variant 1 than with the WSIP, and releases to the Tuolumne River below La Grange would be reduced. Most of the reductions in releases would occur between December and March in wet, above-normal, and below-normal years. With Variant 1, average monthly flow in some months between November and June would be 32 percent less than under the existing condition; the corresponding value with the WSIP would be 25 percent less. The greatest reduction in average monthly flow in the 82-year period of hydrologic record would be about 95 percent with both Variant 1 and the WSIP.

Alameda Watershed

The effects of Variant 1 in the Alameda watershed would be very similar to those of the WSIP. The magnitude and timing of diversions from Alameda Creek to Calaveras Reservoir and spills to Alameda Creek past the diversion dam would be the same with Variant 1 and the WSIP.

Storage in Calaveras and San Antonio Reservoirs and releases to Calaveras and San Antonio Creeks would be the same with Variant 1 and the WSIP most of the time. Storage in the two reservoirs would be drawn down more with Variant 1 than with the WSIP.

Seasonal summertime peak demand in 2030 in the Bay Area will exceed the capacity of the conveyance system from the Tuolumne River. Because of this, with the WSIP, water must be drawn from the local reservoirs to supplement the supply from the Tuolumne River. The need to draw water from local reservoirs during summertime peak demand would be greater with Variant 1 than with the WSIP. With the WSIP, additional conservation and recycling projects would effectively reduce demand for water in the Bay Area. Because Variant 1 does not include additional conservation and recycling projects, the demand for water in the Bay Area would be greater than it is for the WSIP. To meet the greater demand in the Bay Area, the local reservoirs would be drawn down further than they would be with the WSIP. Occasionally, with Variant 1, storage in Calaveras and San Antonio Reservoirs would exceed storage under the WSIP during periods when rationing is occurring or when the Westside Basin Groundwater Program is providing more water with the variant than with the WSIP. The changes in storage in the reservoirs with Variant 1 compared to the WSIP would have little or no effect on releases to Calaveras and San Antonio Creeks.

Peninsula Watershed

Storage in Crystal Springs Reservoir would be drawn down more with Variant 1 than with the WSIP fairly frequently, for the same reason noted above for Calaveras Reservoir. At certain times with Variant 1, the capacity of the conveyance system would limit the amount of water that could be conveyed from the Tuolumne River, and demand in the Bay Area would be met from local reservoirs, including Crystal Springs Reservoir. Average storage in Crystal Springs Reservoir with Variant 1 would be about 475 million gallons (1,457 acre-feet) less than with the WSIP. Because Crystal Springs Reservoir would be operated at a lower level with Variant 1, more storage capacity would be available in the reservoir to accommodate runoff during sudden storms. Releases to San Mateo Creek currently occur intermittently, primarily in wet and above-normal years, and would continue to do so with Variant 1 and with the WSIP. Current average wet-year releases are estimated to be 2.06 billion gallons (6,336 acre-feet). Releases with Variant 1 would be less frequent and smaller in magnitude than with the WSIP. Average wet-year releases to the creek would total 0.99 billion gallons (3,049 afy) with Variant 1; with the WSIP they would total 1.43 billion gallons (4,397 afy). In all cases, the estimated releases from Crystal Springs Reservoir are probably greater than the actual releases that occur because some model does not capture all of the operational flexibility available to system operators to minimize reservoir releases.

Storage in Pilarcitos Reservoir and releases to Pilarcitos Creek below the reservoir would be similar to but not identical with Variant 1 and the WSIP. Average storage in Pilarcitos Reservoir would be slightly greater for Variant 1, and releases to Pilarcitos Creek slightly less than for the WSIP. The reason for the difference is that rationing would be slightly more severe with Variant 1 than with the WSIP (See Table 8-2). Because Coastside County Water District would be subject to slightly more severe rationing with Variant 1 than with the WSIP slightly less water would be released from Pilarcitos Reservoir to serve Coastside's needs.

Spills to Pilarcitos Creek over Stone Dam currently occur primarily in wet and above-normal years and would continue to do so with Variant 1 and with the WSIP. Current average wet-year releases are estimated to be 2.29 billion gallons (7,065 acre-feet). Releases with the WSIP would be less frequent and smaller in magnitude than under the existing condition. With Variant 1 they would be less than with the WSIP. This is because with Variant 1, Crystal Springs Reservoir would be operated at a lower level than with the WSIP, enabling greater diversions from Pilarcitos Creek.

Westside Groundwater Basin

Under Variant 1, the Local Groundwater Projects (part of SF-2) would not be implemented, although the regional conjunctive-use project would continue to be implemented. In the absence of the Local Groundwater Projects, there would be no increase in pumping in the North Westside Groundwater Basin, and pumping rates would remain at about 2.5 mgd, well within the safe yield of the basin. However, without the Local Groundwater Projects, the monitoring and management of groundwater production would not occur, and the existing monitoring network would not be expanded. Overall, as shown in Table 8.8, impacts on the North Westside Groundwater Basin would be less for Variant 1 compared to the proposed program. Effects on the South Westside Groundwater Basin would be almost identical for Variant 1 and the proposed program, since both would rely on the Westside Basin conjunctive-use program as a supplemental dry-year water supply for an average of 6 mgd over the design drought. However, extraction of supplemental supplies would occur slightly more frequently with the variant in anticipation of drought.

Cumulative Water Supply Impacts

As shown in Table 8.9, cumulative water supply impacts associated with Variant 1 would be similar to those identified for the proposed program and described in Chapter 5, Section 5.7. However, due to the increased diversion from the Tuolumne River, the contribution to cumulative impacts on the terrestrial biological resources in the Poopenaut Valley would be greater than that for the WSIP. On the other hand, under Variant 1, the Local Groundwater Projects in San Francisco (part of SF-2) would not be implemented, so that the contribution to cumulative impacts related to basin overdraft in the North Westside Groundwater Basin would be less than that for the WSIP.

8.5.2 Water Supply Impacts of Variant 2

With *WSIP Variant 2 – Regional Desalination for Drought*, almost all of the additional water needed in 2030 under normal hydrologic conditions would be obtained from the Tuolumne River or from groundwater, additional conservation, and recycling in San Francisco. A small amount would come from the Bay Area watersheds through restoration of Calaveras and Crystal Springs Reservoirs. During droughts, up to 23 mgd (25,765 afy) of water would be provided from a regional desalination plant under Variant 2. Variant 2 would operate the same way as the WSIP under normal conditions, but during droughts water from the desalination plant would substitute for the water that would be transferred from TID and MID with the WSIP.

Tuolumne River Watershed

With Variant 2, about the same amount of water would be diverted from the Tuolumne River in wet, above-normal, below-normal, and dry years as with the WSIP. Much less water would be diverted in critically dry years. Average annual diversions from the Tuolumne River with Variant 2 would be 2.9 percent less than with the WSIP.

Water levels in Lake Lloyd and Lake Eleanor would be essentially the same with Variant 2 and the WSIP. Releases from the reservoirs to Cherry and Eleanor Creeks would also be the same with Variant 2 and the WSIP.

Most of the time, the same amount of water would be diverted from the Tuolumne River at Hetch Hetchy Reservoir with Variant 2 as it would with the WSIP; as a result, storage in the reservoir would be about the same with Variant 2 and the WSIP. Releases to the Tuolumne River below Hetch Hetchy Reservoir would also be about the same most of the time.

Differences would occur both during and following droughts under Variant 2. During droughts, the SFPUC would take water from the desalination plant in the Bay Area, rather than taking water from the Tuolumne River via a transfer from MID and TID. Consequently, larger amounts of water would be retained in storage in Hetch Hetchy Reservoir during droughts under Variant 2 than with the WSIP, and a smaller proportion of the spring snowmelt would be needed to refill the reservoir. As a result, releases to the Tuolumne River from Hetch Hetchy Reservoir in years following droughts would be greater with Variant 2 than with the WSIP and would be less delayed than with the WSIP. However, the differences in releases would be relatively small. With both Variant 2 and the WSIP, average monthly flow in some spring months would be 30 percent less than under the existing condition. The greatest reduction in average monthly flow in the 82-year period of hydrologic record would be 90 percent with both Variant 2 and the WSIP.

With Variant 2, storage in Don Pedro Reservoir would be almost the same as with the WSIP most of the time. During droughts under Variant 2, the SFPUC would obtain water from a desalination plant in the Bay Area. During droughts under the WSIP, Don Pedro Reservoir would be drawn down to supply water needed by the SFPUC, TID, and MID. In a series of dry years, water deficiencies would accumulate and Don Pedro Reservoir would be drawn down much farther than it is under the existing condition. With Variant 2, water deficiencies would accumulate in

Don Pedro Reservoir in a series of dry years, but to a lesser degree than with the WSIP. A smaller proportion of winter and spring runoff would need to be captured to refill Don Pedro Reservoir with Variant 2 than with the WSIP. Releases to the Tuolumne River below La Grange Dam would be greater with Variant 2 than with the WSIP. With Variant 2, average monthly flow in some months between November and June would be 21 percent less than under the existing condition. The corresponding value with the WSIP would be 25 percent less. The greatest reduction in average monthly flow in the 82-year period of hydrologic record with Variant 2 would be 78 percent; with the WSIP it would be 92 percent.

Alameda Watershed

The effects of Variant 2 in the Alameda watershed would be very similar to those of the WSIP. The magnitude and timing of diversions from Alameda Creek to Calaveras Reservoir and spills to Alameda Creek over the diversion dam would be the same with Variant 2 and the WSIP. Storage in Calaveras and San Antonio Reservoirs and releases to Calaveras and San Antonio Creeks would be the same with Variant 2 as with the WSIP.

Peninsula Watershed

Storage in Crystal Springs Reservoir would be greater at times with Variant 2 than with the WSIP. On occasion, Crystal Springs Reservoir would be drawn down with the WSIP, because the need for water in the Bay Area exceeds the amount of water that can be conveyed to the Bay Area from the Tuolumne River. This would include the occasions every five years when the conveyance system from the Tuolumne River would be shut down for a few weeks for maintenance. Because the desalination plant would meet some of the demand for water in the Bay Area during droughts, drawdown of Crystal Springs Reservoir would be less at times with Variant 2 than with the WSIP.

Average storage in Crystal Springs Reservoir with Variant 2 would be about 330 million gallons (1,014 acre-feet) more than with the WSIP. Because Crystal Springs Reservoir would be operated at a higher level with Variant 2, less storage capacity would be available in the reservoir to accommodate runoff during sudden storms. Releases to San Mateo Creek with Variant 2 would be more frequent and greater in magnitude than with the WSIP. Current total average wet year releases are estimated to be 2.06 billion gallons (6,336 acre-feet). Average wet-year releases to the creek would total 1.96 billion gallons (6,017 acre-feet) with Variant 2; with the WSIP they would total 1.43 billion gallons (4,397 acre-feet). In all cases, the estimated releases from Crystal Springs Reservoir are probably greater than the actual releases that occur because some model does not capture all of the operational flexibility available to system operators to minimize reservoir releases.

Storage in Pilarcitos Reservoir and releases to Pilarcitos Creek below the reservoir would be the same with Variant 2 and the WSIP. Spills to Pilarcitos Creek over Stone Dam currently occur primarily in wet and above-normal years and would continue to do so with Variant 2 and with the WSIP. Current average wet-year releases are estimated to be 2.29 billion gallons (7,065 acre-

feet). Releases with Variant 2 would be similar in magnitude to those with the WSIP but slightly less than under the existing condition.

Westside Groundwater Basin

As shown in Table 8.8, effects on both the North and South Westside Groundwater Basins would be the same for Variant 2 and the proposed program. Both Variant 2 and the proposed program would rely on an annual average of 10 mgd of recycled water/groundwater/additional conservation projects in San Francisco during drought and nondrought periods. Similarly, both Variant 2 and the proposed program would rely on the Westside Basin conjunctive-use program as a supplemental dry-year water supply for an average of 6 mgd over the design drought.

Cumulative Water Supply Impacts

As shown in Table 8.9, cumulative water supply impacts associated with Variant 2 would be similar to those identified for the proposed program and described in Chapter 5, Section 5.7. However, due to the decreased diversion from the Tuolumne River, the contribution to cumulative impacts on the terrestrial biological resources in the Poopenaut Valley and other similar habitats below O'Shaughnessy Dam would be less than that for the WSIP. All other cumulative impacts would be similar to those for the WSIP.

8.5.3 Water Supply Impacts of Variant 3

With *WSIP Variant 3 – 10% Rationing*, almost all of the additional water needed in 2030 under normal hydrologic conditions would be obtained from the Tuolumne River or from groundwater, additional conservation, and recycling in San Francisco. A small amount would come from the Bay Area watersheds through restoration of Calaveras and Crystal Springs Reservoirs. Variant 3 would operate in the same way as the WSIP under normal conditions, but rationing during droughts would be limited to 10 percent rather than the 20 percent permitted with the WSIP. As with the WSIP, a transfer of water from TID and MID would provide water during droughts. Because rationing would be limited to 10 percent, the transfer from TID and MID would have to be greater with Variant 3 than with the WSIP. With Variant 3, the transfers would be 35 mgd (39,207 afy); with the WSIP they would be 23 mgd (25,765 afy).

Tuolumne River Watershed

With Variant 3, slightly more water would be diverted from the Tuolumne River than with the WSIP.

Because almost the same amount of water would be diverted from the Tuolumne River at Hetch Hetchy Reservoir with Variant 3 as it would with the WSIP, storage in the reservoir would be almost the same with Variant 3 and the WSIP. Releases to the Tuolumne River below Hetch Hetchy Reservoir would also be about the same. With both Variant 3 and the WSIP, average monthly flow in some spring months would be 30 percent less than under the existing condition. Compared to the existing condition, the delay in springtime releases from Hetch Hetchy

Reservoir with Variant 3 and the WSIP would be very similar. The greatest reduction in average monthly flow in the 82-year period of hydrologic record would be 90 percent with both Variant 3 and the WSIP.

Water levels in Lake Lloyd and Lake Eleanor would be essentially the same with Variant 3 and the WSIP. Releases from the reservoirs to Cherry and Eleanor Creeks would also be the same with Variant 3 and the WSIP.

With Variant 3, storage in Don Pedro Reservoir would be almost the same as with the WSIP most of the time. As with the WSIP, additional water would be obtained with Variant 3 via a transfer from TID and MID, although with Variant 3 the transfer would be larger. The effect of the transfer would be to draw down storage in Don Pedro Reservoir. In most years, the effect of the increased drawdown attributable to Variant 3 would be small relative to the size of the reservoir. Its effect on releases to the river below La Grange Dam would also be small. In a series of dry years, water deficiencies would accumulate and Don Pedro Reservoir would be drawn down farther with Variant 3 than it would be with the WSIP. A greater proportion of winter and spring runoff would need to be captured to refill Don Pedro Reservoir with Variant 3 than with the WSIP. Releases to the Tuolumne River below La Grange Dam would be somewhat less during droughts than with the WSIP in years following droughts, but the difference would be too small to have much effect on long-term averages. With both Variant 3 and the WSIP, average monthly flow in some months between November and June would be 30 percent less than under the existing condition. The greatest reduction in average monthly flow in the 82-year period of hydrologic record would be 92 percent with Variant 3 and with the WSIP.

Alameda Watershed

The effects of Variant 3 in the Alameda watershed would be very similar to those of the WSIP. The magnitude and timing of diversions from Alameda Creek to Calaveras Reservoir and spills to Alameda Creek over the diversion dam would be the same with Variant 3 and the WSIP. Storage in Calaveras and San Antonio Reservoirs and releases to Calaveras and San Antonio Creeks would be the same with Variant 3 and the WSIP.

Peninsula Watershed

Storage in Crystal Springs Reservoir would be slightly greater at times with Variant 3 than with the WSIP. Average storage in Crystal Springs Reservoir with Variant 3 would be about 112 million gallons (344 acre-feet) more than with the WSIP. Because Crystal Springs Reservoir would be operated at a slightly higher level with Variant 3, less storage capacity would be available in the reservoir to accommodate runoff during sudden storms. Releases to San Mateo Creek with Variant 3 would be slightly more frequent and slightly greater in magnitude than with the WSIP. Current total average wet year releases are estimated to be 2.06 billion gallons (6,336 acre-feet). Average wet-year releases to the creek would total 1.5 billion gallons (4,623 acre-feet) with Variant 3; with the WSIP they would total 1.43 billion gallons (4,397 acre-feet). In all cases, the estimated releases from Crystal Springs Reservoir are probably greater than actual releases because some of the modeled releases would likely be avoided by reservoir operators.

Storage in Pilarcitos Reservoir and releases to Pilarcitos Creek below the reservoir would be similar but not identical under Variant 3 and WSIP. With Variant 3, storage in Pilarcitos Reservoir and releases to Pilarcitos Creek would differ slightly from those with the WSIP because the Coastside County Water District would be subject to a different pattern of shortages/rationing during droughts. Spills to Pilarcitos Creek over Stone Dam currently occur primarily in wet and above-normal years and would continue to do so with Variant 3 and with the WSIP. Current average wet-year releases are estimated to be 2.29 billion gallons (7,065 acre-feet). Releases with Variant 3 would be similar in magnitude to those with the WSIP but slightly less than under the existing condition.

Westside Groundwater Basin

As shown in Table 8.8, effects on both the North and South Westside Groundwater Basins would be the same for Variant 2 and the proposed program. Both Variant 2 and the proposed program would rely on an annual average of 10 mgd of recycled water/groundwater/additional conservation projects in San Francisco during drought and nondrought periods. Similarly, both Variant 2 and the proposed program would rely on the Westside Basin conjunctive-use program as a supplemental dry-year water supply for an average of 6 mgd over the design drought.

Cumulative Water Supply Impacts

As shown in Table 8.9, cumulative water supply impacts associated with Variant 3 would be similar to those identified for the proposed program and described in Chapter 5, Section 5.7. However, due to the slightly increased diversion from the Tuolumne River, the contribution to cumulative impacts on the terrestrial biological resources in the Poopenaut Valley and other similar habitats below O'Shaughnessy Dam would be slightly greater than that for the WSIP. All other cumulative impacts would be similar to those for the WSIP.

8.6 Comparison of the Proposed Program and Variants

Table 8.10 summarizes the major impacts of the variants and compares them to those of the proposed program. The table focuses on the significant unavoidable or potentially significant unavoidable impacts identified in Chapters 4, 5 and 7 for the proposed program and indicates the same for each variant. The table distinguishes between facilities-related impacts (under the general categories of construction, footprint, and operational impacts) and water supply and system operation impacts. With the exception of the BARDP component of Variant 2, all three variants would have the same significant unavoidable or potentially significant unavoidable impacts as the proposed program, although in some cases, there would be slight differences in severity of the impact. The greatest differences among the proposed program and the variants are associated with facilities-related impacts of the BARDP; other differences in facilities-related impacts are minor. Similarly, as stated previously, although the water supply and system operations impacts of the variants differ somewhat from those of the proposed program, the magnitude of the differences is small and not sufficient to change either the significance determinations or the mitigation measures identified for the WSIP.

TABLE 8.10
COMPARISON OF MAJOR IMPACTS – PROPOSED PROGRAM AND VARIANTS

Impact Area	Proposed Program	Variant 1 – All Tuolumne	Variant 2 – Regional Desalination for Drought	Variant 3 – 10% Rationing
Facilities-Related Impacts	All potential impacts could be reduced to less than significant with implementation of mitigation measures, except for potentially significant and unavoidable impacts below:	Same impacts as proposed program in all respects, except there would be fewer impacts on the west side of San Francisco because Recycled Water (SF-3) and Local Groundwater Projects (part of (SF-2) would not be implemented.	Same impacts as proposed program in all respects except there would be additional impacts associated with implementation of a regional desalination plant, including additional potentially significant and unavoidable impacts below.	Same impacts as proposed program in all respects.
▪ Construction impacts associated with construction activities	▪ Disruption of land uses during construction (PSU for New Irvington Tunnel, SV-4) ▪ Construction-related noise increases (PSU for all projects) and temporary noise disturbance along haul routes (PSU for Advanced Disinfection, SJ-1; San Joaquin Pipeline System, SJ-3; Rehabilitation of Existing San Joaquin Pipelines, SJ-4; Tesla Portal Disinfection Station, SJ-5; Bay Division Pipeline Reliability Upgrade, BD-1; BDPL Nos. 3 and 4 Crossovers, BD-2; Seismic Upgrade of BDPL Nos. 3 and 4 at Hayward Fault, BD-3; Baden and San Pedro Valve Lots Improvements, PN-1; HTWTP Long-Term Improvements, PN-3; San Andreas Pipeline No. 3 Installation, SF-1; Groundwater Projects, SF-2; and Recycled Water Projects, SF-3) ▪ Construction-related vibration disturbance (PSU for San Joaquin Pipeline System, SJ-3; Rehabilitation of Existing San Joaquin Pipelines, SJ-4; Additional 40-mgd Treated Water Supply, SV-3; Bay Division Pipeline Reliability Upgrade, BD-1; BDPL Nos. 3 and 4 Crossovers, BD-2; Seismic Upgrade of BDPL Nos. 3 and 4 at Hayward Fault, BD-3; Baden and San Pedro Valve Lot Improvements, PN-1; San Andreas Pipeline No. 3 Installation, SF-1; Groundwater Projects, SF-2; and Recycled Water Projects, SF-3) ▪ Collective, multi-regional increase in construction traffic (PSU) ▪ Cumulative traffic increases on local and regional roads (PSU) ▪ Collective, multi-regional increase in construction-related air pollutant emissions (PSU)	Same as proposed program except for PSU construction noise impact associated with Local Groundwater Projects, SF-2, and Recycled Water Projects, SF-3, would not occur.	Same as proposed program plus additional impacts associated with BARDP construction.	Same as proposed program.

TABLE 8.10 (Continued)
COMPARISON OF MAJOR IMPACTS – PROPOSED PROGRAM AND VARIANTS

Impact Area	Proposed Program	Variant 1 – All Tuolumne	Variant 2 – Regional Desalination for Drought	Variant 3 – 10% Rationing
▪ Construction impacts associated with construction activities (cont.)	▪ Cumulative impacts on cultural resources (PSU) ▪ Cumulative increases in construction-related air pollutant emissions (PSU) ▪ Localized, cumulative increases in emissions of diesel particulate matter (PSU) ▪ Collective, overlapping construction noise in San Joaquin, Bay Division, Peninsula, and San Francisco regions (PSU) ▪ Cumulative increases in construction-related noise and vibration (PSU) ▪ Collective impacts on land uses during construction in Bay Division Region (PSU) ▪ Collective impacts on land uses during construction in Bay Division Region (PSU)			
▪ Footprint impacts associated with siting of facilities	▪ Permanent displacement or long-term disruption of existing land uses (PSU for San Joaquin Pipeline System, SJ-3; Additional 40-mgd Treated Water Supply, SV-3; San Antonio Backup Pipeline, SV-6; Bay Division Pipeline Reliability Upgrade, BD-1; Crystal Springs/ San Andreas Transmission Upgrade, PN-2; Groundwater Projects, SF-2; and Recycled Water Projects, SF-3). ▪ Impacts on scenic resources associated with new permanent aboveground structures (PSU for Calaveras Dam Replacement, SV-2) ▪ Impacts on the historical significance of a historic district or a contributor to a historic district (PSU for Calaveras Dam Replacement, SV-2 and Crystal Springs/San Andreas Transmission Upgrade, PN-2), and impacts on historical significance of individual facilities (PSU for Calaveras Dam Replacement, SV-2; New Irvington Tunnel, SV-4; Crystal Springs/San Andreas Transmission Upgrade, PN-2; and Lower Crystal Springs Dam Improvements, PN-4).	Same as proposed program.	Same as proposed program plus additional footprint and siting impacts associated with the BARDP: ▪ Effects of BARDP construction on sensitive aquatic habitats and species and possibly special-status species (PSU)	Same as proposed program.

TABLE 8.10 (Continued)
COMPARISON OF MAJOR IMPACTS – PROPOSED PROGRAM AND VARIANTS

Impact Area	Proposed Program	Variant 1 – All Tuolumne	Variant 2 – Regional Desalination for Drought	Variant 3 – 10% Rationing
▪ Footprint impacts associated with siting of facilities (cont.)	▪ Collective impacts on sensitive biological resources in Sunol Valley and Peninsula regions (PSU) ▪ Collective impacts on cultural resources in Sunol Valley and Peninsula regions (PSU)			
▪ Operational impacts	No PSU or SU operational impacts.	Same as proposed program.	▪ Effects of BARDP operation on water quality associated with discharge of brine concentrate (PSU) ▪ Long-term effects of BARDP operation on sensitive biological resources, including special-status marine species (PSU) ▪ Long-term energy demand of BARDP (PSU)	Same as proposed program.
Water Supply and System Operations Impacts	All impacts could be reduced to less than significant with implementation of mitigation measures, except for potentially significant and unavoidable impacts below:			
Tuolumne River Watershed	No significant and unavoidable impacts	Similar impacts to proposed program.	Similar impacts to proposed program.	Similar impacts to proposed program.
Alameda Creek Watershed	Reduction in flow in Alameda Creek between the diversion dam and confluence with Calaveras Creek. (SU)	Similar impacts to proposed program.	Similar impacts to proposed program.	Similar impacts to proposed program.
Peninsula Watershed (San Mateo Creek and Pilarcitos Creek Watersheds)	Effects on fishery resources in Crystal Springs Reservoir. (PSU)	Similar impacts to proposed program.	Similar impacts to proposed program.	Similar impacts to proposed program
Westside Groundwater Basin	No significant and unavoidable impacts.	Same impacts as proposed program on South Westside Groundwater Basin, but PSM impacts on North Westside Groundwater Basin would be avoided	Same impacts as proposed program.	Same impacts as proposed program

TABLE 8.10 (Continued)
COMPARISON OF MAJOR IMPACTS – PROPOSED PROGRAM AND VARIANTS

Impact Area	Proposed Program	Variant 1 – All Tuolumne	Variant 2 – Regional Desalination for Drought	Variant 3 – 10% Rationing
Growth Inducement	Indirect effects of growth include the following significant and unavoidable impacts: ▪ Loss of open space (to development) on visual quality ▪ Alteration of the visual setting or degradation of existing views and cumulative visual quality impacts ▪ Conversion of agricultural land to nonagricultural uses ▪ Cumulative loss of agricultural land ▪ Increases in air pollutant emissions and/or ozone precursors or violation of air quality standards ▪ Cumulative air quality impacts ▪ Impacts on natural habitat ▪ Individual or cumulative loss of wetlands ▪ Cumulative impacts on cultural resources ▪ Exposure to seismic or geologic hazards ▪ Exposure to soil or groundwater contamination ▪ Cumulative effects from increased exposure to man-made hazards ▪ Increases in impervious surfaces and/or alterations to drainage resulting in exposure to flood hazards and/or the need for new drainage facilities ▪ Water pollution from stormwater runoff ▪ Land use impacts ▪ Cumulative impacts from the depletion of nonrenewable resources and the alteration of landforms ▪ Noise impacts, including increases in traffic noise, exposure to construction noise, and exposure to aircraft noise ▪ Impacts related to population growth (directly or indirectly induced) and jobs/housing balance	Same impacts as proposed program.	Same impacts as proposed program, plus growth-inducement effects associated with the BARDP.	Same impacts as proposed program

TABLE 8.10 (Continued)
COMPARISON OF MAJOR IMPACTS – PROPOSED PROGRAM AND VARIANTS

Impact Area	Proposed Program	Variant 1 – All Tuolumne	Variant 2 – Regional Desalination for Drought	Variant 3 – 10% Rationing
Growth Inducement (cont.)	▪ Increased demand for schools and/or other public facilities ▪ Loss of recreational open space ▪ Cumulative impacts on recreational facilities ▪ Local and regional traffic impacts ▪ Cumulative traffic impacts ▪ Impacts on landfill capacity ▪ Increases in water demand ▪ Large and wasteful increase in energy consumption and cumulative energy-related impacts ▪ Greenhouse gas emissions			

With respect to facilities-related impacts, all three variants would have essentially the same impacts and require the same mitigation measures as described for the 22 WSIP facility improvement projects evaluated in Chapter 4. Variant 1 would have slightly fewer impacts than the proposed program or Variant 3, because the Recycled Water Projects (SF-3) and Local Groundwater Projects (part of SF-2) would not be implemented. Variant 3 would have the identical facilities-related impacts as the proposed program. Variant 2 would have the most impacts due to implementation of the BARDP in addition to the WSIP facility improvement projects. Construction and operation of the BARDP would result in other environmental effects not related to the WSIP projects, including potentially significant and unavoidable impacts associated with water quality, biological resources, and long-term energy consumption, as described above in Section 8.3, and would also require additional mitigation measures beyond those described for the proposed program.

With respect to water supply and system operations, all three variants would result in similar impacts to those of the proposed program with two exceptions. First, the difference in significance determination would be the potentially significant but mitigable impacts on the North Westside Groundwater Basin associated with the proposed program; under Variant 1, this impact would be avoided since local groundwater projects would not be implemented. Second, Variant 2 would result in potentially significant impacts on another water (either San Francisco Bay or the Pacific Ocean) and related resources, in addition to all of the impacts identified for the WSIP. As described above, for impacts on all other water resources, there would be some degree of difference in physical effects among the variants and the proposed program, with some greater and some lesser effects on different aspects of the affected water resources, but these differences do not appear sufficient to warrant a change in impact significance. Similar mitigation strategies would be required for the variants and the proposed program, although there could be slight differences in the specific design and implementation of the mitigation measures under each variant.

The variants and the proposed program would have the same impacts related to growth inducement and indirect effects of growth, as described previously in this chapter. In addition, with the exception of the BARDP component of Variant 2, the variants would have the same areas of controversy, the same unavoidable effects, and the same irreversible environmental changes as the proposed program.

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