4.1 Overview

CHAPTER 4
WSIP Facility Projects – Setting and Impacts

Chapter 4 Sections

4.1 Overview

This chapter addresses the Water System Improvement Program (WSIP) facility improvement projects described in Chapter 3, Section 3.9, and provides a program-level evaluation of the potential environmental impacts of constructing and operating each of the 22 regional WSIP facility projects. This overview section describes key aspects of the approach to analysis that applies to the program-level impact evaluation of WSIP facility projects.

This chapter focuses only on the WSIP projects and does not address the effects of the proposed WSIP water supply and system operations through 2030, which are evaluated separately in Chapter 5. Chapter 5 addresses the effects of the proposed water supply and system operations on the Tuolumne River system, Alameda Creek system, Peninsula system, and Westside Basin Groundwater Resources.

The Chapter 4 impact analysis is based on preliminary information about the individual projects that are proposed for implementation following approval of the WSIP. The project information presented is conceptual in nature, based on readily available information about the projects, types of facilities proposed, and their general site locations. This level of information is appropriate for this programmatic analysis of these projects. This chapter identifies the general types of impacts that could be expected to result from the individual projects, based on existing project

information. The information about the individual projects continues to evolve as data about the project sites, design, operation, and effects are refined. All projects will be examined in more detail at the project level. If the individual WSIP projects have additional significant impacts that were not addressed in this Program EIR, the San Francisco Planning Department will prepare EIRs or negative declarations to examine the site-specific and project-specific effects of the individual projects. More detailed information about the individual projects (i.e., construction plans as well as siting and operational details) will be considered in the project-level environmental documents.

Sections 4.2 through 4.15 present program-level impacts associated with each WSIP facility project by environmental resource topic. Section 4.16 presents combined or collective impacts resulting from implementation of multiple WSIP facility projects, also organized by environmental resource topic. Section 4.17 presents cumulative impacts resulting from implementation of the WSIP as a whole in conjunction with other cumulative development.

Scope of the WSIP Facility Impact Analysis

This program-level impact analysis identifies the potential environmental effects of the individual WSIP projects based on general information about each project and project site(s). To date, many of the WSIP projects have been developed at the conceptual level only and only some projects have more detailed siting and design information. Accordingly, this program-level evaluation addresses all projects from a broad, overview perspective. It does not provide detailed, site-specific impact assessment of each project, but rather frames the nature and magnitude of the expected environmental impacts associated with the proposed WSIP projects. Based on these impacts, Chapter 6 identifies the appropriate program-level mitigation measures in general terms; these measures would be refined to specifically apply to each project as the projects are further developed.

Since there are undetermined aspects of many of the WSIP projects at this stage of program planning, this Program Environmental Impact Report (PEIR) errs on the conservative side of impact significance determination and assumes that separate, project-level California Environmental Quality Act (CEQA) review would confirm the existing conditions and degree of impact. The San Francisco Public Utilities Commission (SFPUC) is conducting detailed project development studies on many of the WSIP projects concurrent with preparation of the PEIR. For many of the WSIP projects, project-level CEQA review is being conducted or will be conducted as appropriate to provide additional information and analyses and further address the site-specific impacts outlined in this PEIR. The project-level analyses will consider whether additional project information changes the environmental impact determinations contained in the PEIR about the individual project, and whether the programmatic mitigation measures identified in this PEIR should be refined. Both project-level EIRs and negative declarations are being prepared or will be prepared for many of the WSIP projects. All projects will be assessed to determine whether additional environmental review is required.

[Additional discussion on the appropriate level of detail for environmental analysis was prepared in response to comments on the Draft PEIR. Please refer to Section 14.4, Master Response on PEIR Appropriate Level of Analysis (Vol. 7, Chapter 14).]

Study Area for WSIP Regional Facility Projects

The study area applicable to the WSIP facility projects discussed in this chapter extends from Oakdale Portal on the SFPUC regional water system, which is the easternmost location of any of the WSIP projects (i.e., the San Joaquin Pipeline System project, SJ-3), westward along the regional water system to San Francisco, which is the westernmost location of the WSIP projects. The study area for the WSIP facility projects includes the five regions described in Chapter 2, Section 2.2 and shown in Figure 2.1: the San Joaquin (SJ), Sunol Valley (SV), Bay Division (BD), Peninsula (PN), and San Francisco (SF) Regions (there are five regional WSIP projects located in both San Francisco and northern San Mateo County, overlapping with parts of the Peninsula Region). No WSIP facility projects are proposed east of Oakdale Portal in the Hetch Hetchy region of the regional system, so no discussion of this eastern region is provided in this chapter. The locations of the WSIP projects are shown in Figures 3.5a and 3.5b.

In a few instances (i.e., Section 4.15, Energy Resources, and Section 4.16, Collective Impacts Related to WSIP Facilities), the impact analysis addresses impacts of the *program area* rather than the *study area*. The program area encompasses the entire area affected by the WSIP, from Hetch Hetchy Reservoir to San Francisco.

WSIP Project Names

Chapter 3, Table 3.10, describes each WSIP project and gives the complete project name and number. Throughout this chapter, the WSIP project names are abbreviated and the project number is also referenced. To aid the PEIR reader, a complete WSIP project list is presented as **Figure 4.1-1**. The list gives the full project names, abbreviated project names, and reference numbers and is organized by region.

Proposed Project Sites

The impact analysis in this PEIR is based on project description information provided by the SFPUC with respect to facility location and conceptual project construction and operation scenarios for each of the projects. This information is summarized in Chapter 3 and further detailed in Appendix C.

In cases where the SFPUC has chosen a preferred site location for a particular project, each section in this chapter evaluates the impacts of the WSIP facility improvement projects at their preferred site locations (as listed in Table 3.12 in Chapter 3). Some WSIP projects have alternative locations (specified in Tables 3.10 and 3.11); impacts associated with potential project development at these alternative locations are not evaluated in this PEIR, although generic impacts for each type of facility that could apply to the alternative sites are described. Project location alternatives and alternative site design and layout would be evaluated as appropriate in the project-level CEQA evaluations for select WSIP projects. For some WSIP projects, specific project locations have not yet been developed. In these cases, the program-level analysis considers the range of alternatives presented and a reasonable worst-case scenario regarding the potential environmental impacts that could occur.

GUIDE TO NAMES AND NUMBERS OF WSIP FACILITY IMPROVEMENT PROJECTS

SAN JOAQUIN REGION		
No.	**Project Title**	**Abbreviated Project Title**
SJ-1	Advanced Disinfection	Advanced Disinfection
SJ-2	Lawrence Livermore Supply Improvements	Lawrence Livermore
SJ-3	San Joaquin Pipeline System	SJPL System
SJ-4	Rehabilitation of Existing San Joaquin Pipelines	SJPL Rehabilitation
SJ-5	Tesla Portal Disinfection Station	Tesla Portal Disinfection
SUNOL VALLEY REGION		
No.	**Project Title**	**Abbreviated Project Title**
SV-1	Alameda Creek Fishery Enhancement	Alameda Creek Fishery
SV-2	Calaveras Dam Replacement	Calaveras Dam
SV-3	Additional 40-mgd Treated Water Supply	40-mgd Treated Water
SV-4	New Irvington Tunnel	New Irvington Tunnel
SV-5	SVWTP – Treated Water Reservoirs	Treated Water Reservoirs
SV-6	San Antonio Backup Pipeline	SABUP
BAY DIVISION REGION		
No.	**Project Title**	**Abbreviated Project Title**
BD-1	Bay Division Pipeline Reliability Upgrade	BDPL Reliability Upgrade
BD-2	BDPL Nos. 3 and 4 Crossovers	BDPL 3 and 4 Crossovers
BD-3	Seismic Upgrade of BDPL Nos. 3 and 4 at Hayward Fault	BDPL 3 and 4 Seismic Upgrade at Hayward Fault
PENINSULA REGION		
No.	**Project Title**	**Abbreviated Project Title**
PN-1	Baden and San Pedro Valve Lots Improvements	Baden and San Pedro Valve Lots
PN-2	Crystal Springs / San Andreas Transmission Upgrade	CS/ SA Transmission
PN-3	HTWTP Long-Term Improvements	HTWTP Long-Term
PN-4	Lower Crystal Springs Dam Improvements	Lower Crystal Springs Dam
PN-5	Pulgas Balancing Reservoir Rehabilitation	Pulgas Balancing Reservoir
SAN FRANCISCO REGION		
No.	**Project Title**	**Abbreviated Project Title**
SF-1	San Andreas Pipeline No. 3 Installation	SAPL 3 Installation
SF-2	Groundwater Projects	Groundwater Projects
SF-3	Recycled Water Projects	Recycled Water Projects

SOURCE: ESA + Orion, 2007

SFPUC Water System Improvement Program . 203287

Figure 4.1-1
Guide to Names and Numbers of
WSIP Facility Improvement Projects

Impact Significance Determinations

The impact significance criteria used in this PEIR are based on San Francisco Planning Department Major Environmental Analysis (MEA) guidance regarding the environmental effects to be considered significant. MEA guidance is, in turn, based on the CEQA Guidelines Appendix G with some modifications. In cases where potential environmental issues associated with the WSIP are identified but are not clearly addressed by MEA's guidance, additional impact significance criteria are presented. Appendix B of this PEIR presents the MEA Initial Study checklist as applied to the WSIP, and indicates the criteria applicable to the WSIP and discussed in the PEIR. The significance criteria used for each environmental topic/resource area are presented in each section of Chapter 4 following the setting and before the discussion of impacts.

For the impact analyses, the following categories are used to determine impact significance:

Not Applicable (N/A). An impact is considered not applicable to a WSIP project if there is no potential for impacts or the environmental resource does not occur within the project area or the area of potential effect. For example, an impact on a biological resource may not be applicable to some projects if there are no biological resources within the construction or operation zone that could be affected by the project.

Less than Significant (LS). This determination applies if there is a potential for some limited impact, but not a substantial adverse effect that qualifies under the significance criteria as a significant impact.

Less than Significant with Program-Level Mitigation (LSM). This determination applies to the collective impact analysis only. It indicates a potential for some limited impact after implementation of program-level mitigation measures (those numbered 4.3-1 through 4.15-2, as listed in Chapter 6), but not a substantial adverse effect that qualifies under the significance criteria as a significant impact.

Potentially Significant, Mitigatable (PSM). This determination applies if there is the potential for a substantial adverse effect that meets the significance criteria, but mitigation is available to reduce the impact to a less-than-significant level. The impact is labeled "potentially" significant because there is not enough site-specific information at the program level of analysis to determine definitively that it is significant. The impacts identified as "potentially significant" are treated as significant impacts in this PEIR. Separate, project-level CEQA evaluation of the WSIP projects could confirm that the impact is significant for that project or document that the impact is less than significant.

Potentially Significant, Unavoidable (PSU). This determination applies to impacts that are significant but for which there appears to be no feasible mitigation available to reduce the impacts to a less-than-significant level. There might be some mitigation available to lessen the impact, but the residual effect remains significant and therefore unavoidable. The impact is labeled "potentially" significant and unavoidable because there is not enough site-specific information at the program level of analysis to determine definitively that it is significant or that mitigation could sufficiently reduce the severity of the impact. When project design or location information is not available at this stage of project planning, the PEIR errs on the conservative side and also applies this determination. The impacts identified as "potentially significant and unavoidable" are treated as significant and

unavoidable impacts in this PEIR. Under both these circumstances, separate, project-level CEQA evaluation of the WSIP projects could confirm that the impact is, in fact, significant and unavoidable for a specific WSIP project or document that the impact is significant but can be mitigated to a less-than-significant level. This determination is also applied if the feasibility of the mitigation is contingent on review and approval by other jurisdictional agencies (i.e., mitigation feasibility is outside SFPUC control).

Significant Unavoidable (SU). This applies to impacts that are significant but for which there appears to be no feasible mitigation available to reduce the impact to a less-than-significant level. The word "potentially" is not used for select impacts where it can be determined during this PEIR process that: (1) the impact would occur, and (2) the impact could not be mitigated to a less-than-significant level.

In determining the significance of a potential WSIP impact, the analysis first describes the nature, magnitude, and severity of a potential effect and determines whether it is potentially significant, less than significant, or not applicable for each WSIP project. The PEIR significance determinations err on the conservative side, since the impact analyses at the program level must generalize the types and classes of impacts as well as the feasibility of mitigation measures to reduce impacts to a less-than-significant level. The feasibility of mitigation measures varies based on project design and existing conditions at each project site. Also, the PEIR conservatively determines impacts to be potentially significant when there is a potential for a specific resource to be affected, even though the presence or absence of the resource has not been determined at this stage of project planning. For example, under Biological Resources, Cultural Resources, and Hazards (Sections 4.6, 4.7, and 4.14, respectively), the analysis indicates that some impacts are potentially significant and require mitigation, but this determination would only apply if the specified resource or condition is actually found to be present on the site. Site-specific conditions will be determined as part of a separate, project-level CEQA review conducted for each WSIP project. Therefore, significance determinations for a particular impact could change when more detailed project descriptions and site-specific information becomes available during these project-level reviews. This PEIR gives a broader overview of potential impacts that is appropriate for a program level of analysis.

As part of the significance determination process, the analysis evaluates whether there are applicable regulations requiring compliance with measures that could reduce a potentially significant impact to a less-than-significant level. If so, compliance with the regulation is assumed, and the impact is considered to be less than significant. The analysis also determines whether there is an applicable SFPUC Alameda or Peninsula Watershed Management Plan (WMP) policy or requirement for WSIP projects located within WMP boundaries. If they apply, compliance with the WMP policies/requirements is assumed, and the impact is considered to be less than significant.

The analysis also considers whether implementation of the SFPUC construction measures could avoid potential impacts. As described in Chapter 3, Section 3.11, the SFPUC has established 10 construction measures that are to be implemented as part of all of its projects. The main objective of these measures is to minimize potential disruption of surrounding neighborhoods during construction and to reduce impacts on existing resources to the extent feasible. Each

SFPUC project manager, environmental project manager, and contract manager would ensure that every project involving construction work contains uniform provisions to address these issues. The measures would apply to any construction activities that require environmental review and are conducted by SFPUC staff or by outside contractors under contract with the SFPUC. If the impact would be less than significant with implementation of the SFPUC construction measures, then no mitigation is identified. However, in most cases, the SFPUC construction measures are not detailed enough to ensure that impacts would be less than significant, so the PEIR identifies more specific mitigation measures that would need to be implemented, sometimes along with or as part of SFPUC construction measures, to ensure impacts are reduced to a less-than-significant level.

In cases where there are no applicable regulations or SFPUC construction measures, or such regulations and measures exist but by themselves would not reduce an impact to a less-than-significant level, then the impact is considered potentially significant. If there are feasible measures available that could reduce these potentially significant impacts to a less-than-significant level, then the impact is considered potentially significant but mitigatable (PSM), and the PEIR identifies mitigation measure(s) to address the potentially significant impact. Impacts described in this chapter are numbered so they can be cross-referenced to the mitigation measures presented in Chapter 6.

Within each section in this chapter, a summary table is included at the beginning of each impact discussion to summarize the potential impacts by project and indicate the level of impact significance. The impact discussion for the WSIP projects is organized by region, and impact significance determinations for each project are repeated in a table under each region for ease of reference. Impacts are numbered by section number, with the corresponding numbers used for mitigation measures in Chapter 6.

4.2 Plans and Policies

4.2 Plans and Policies

4.2.1 Overview

Pursuant to CEQA Guidelines Section 15125(d), Section 4.2 first describes land use plans and policies and the manner in which they apply to WSIP facility improvement projects (Section 4.2.2), and then discusses program consistency with applicable plans (Section 4.2.3). The focus of this section reflects the authority of the agencies discussed herein relative to the WSIP projects and, consequently, the applicability of their planning documents. As described in Chapter 3, Section 3.13, the agencies responsible for approving the overall WSIP and PEIR include the San Francisco Planning Commission, the SFPUC, and the San Francisco Board of Supervisors. Plans and policies addressed in this section include:

- *City and County of San Francisco*. San Francisco General Plan, Accountable Planning Initiative, San Francisco Sustainability Plan.
- *SFPUC*. Alameda and Peninsula Watershed Management Plans, Water Enterprise Environmental Stewardship Policy.
- *U.S. Department of the Interior*. Golden Gate National Recreation Area – Scenic Easement and Scenic and Recreation Easement.
- *Bay Conservation and Development Commission*. San Francisco Bay Plan.
- *Other Agencies*. Local general plans, other regional plans.

The analysis in this section complements that of Section 5.2, which focuses on plans and policies relevant to the effects of proposed changes in WSIP water supply and system operations. Sections 4.3 through 4.15 describe resource-specific plans (e.g., air quality management plans are discussed in Section 4.9, Air Quality; habitat conservation plans are discussed in Section 4.6, Biological Resources), and Chapter 7 describes plans and policies related to growth in population and employment.

4.2.2 Land Use Plans and Policies Potentially Relevant to WSIP Projects

City and County of San Francisco Plans and Policies

The City and County of San Francisco (CCSF) land use plans and policies are primarily applicable to projects within the jurisdictional boundaries of San Francisco, although in some cases they may apply to projects outside of San Francisco. The SFPUC is guided by the San Francisco City Charter along with other city plans and policies. These plans include the San Francisco General Plan, which sets forth the comprehensive, long-term land use policy for San Francisco, and the *San Francisco Sustainability Plan*, which addresses the long-term

sustainability[1] of the city. In addition, the SFPUC has adopted various plans and policies that further direct its activities, including the Alameda and Peninsula Watershed Management Plans (WMPs) and the Water Enterprise Environmental Stewardship Policy.

Extraterritorial Lands

Under the San Francisco City Charter,[2] the SFPUC has authority over the management, use, and control of extraterritorial lands; that it, properties outside of the city that the CCSF owns or leases or over which it holds easements. Although the San Francisco General Plan and Sustainability Plan were developed for lands within the jurisdictional boundaries of San Francisco, their underlying goals apply to SFPUC projects on extraterritorial lands. The Alameda and Peninsula WMPs specifically apply to CCSF-owned extraterritorial lands in Alameda, Santa Clara, and San Mateo Counties.

San Francisco General Plan

The San Francisco General Plan sets forth the comprehensive, long-term land use policy for San Francisco. One of the basic goals of the general plan is "coordination of the growth and development of the city with the growth and development of adjoining cities and counties and of the San Francisco Bay Region." The general plan consists of 10 issue-oriented plan elements—Air Quality, Arts, Commerce and Industry, Community Facilities, Community Safety, Environmental Protection, Housing, Recreation and Open Space, Transportation, and Urban Design. The plan elements that may be relevant to the WSIP facility improvement projects are briefly described below (CCSF, 1988).

Air Quality Element

This element promotes the goal of clean air planning through objectives and policies aimed at adherence to air quality regulations, focusing development near transit services, and advocating alternatives to the private automobile.

Commerce and Industry Element

This element serves as a guide for decisions related to economic growth and change in San Francisco. The three goals of the element—continued economic vitality, social equity (with respect to employment opportunities), and environmental quality—address general citywide objectives as well as objectives for each of the major sectors of San Francisco's economy.

1 Sustainability or sustainable development can be defined as development that meets the needs of the present without compromising the ability of future generations to meet their needs.

2 Section 8B.121 of the City Charter provides that ". . . the Public Utilities Commission shall have exclusive charge of the construction, management, supervision, maintenance, extension, expansion, operation, use and control of all water, clean water and energy supplies and utilities of the City as well as the real, personal and financial assets, that are under the Commission's jurisdiction or assigned to the Commission under Section 4.132."

Community Safety Element

This element addresses the potential for geologic, structural, and nonstructural hazards to affect CCSF-owned structures and critical infrastructure. The goal of this element is to protect human life and property from hazards.

Environmental Protection Element

This element addresses the impact of urbanization on the natural environment. The element promotes the protection of plant and animal life and fresh water sources; it also speaks to the responsibility of San Francisco to provide a permanent, clean water supply to meet present and future needs and to maintain an adequate water distribution system.

Urban Design Element

This element promotes the preservation of landmarks and structures with notable historic, architectural, or aesthetic value.

Recreation and Open Space Element

This element contains objectives and policies related to maintaining, creating, and enhancing recreational and open space resources.

The San Francisco General Plan also contains area plans that cover specific geographic areas within the city. One of the area plans, the *Western Shoreline Plan*, covers the western shoreline of San Francisco and includes the location of proposed WSIP facilities in the San Francisco Region (Groundwater Projects, SF-2; Recycled Water Projects, SF-3). The *Western Shoreline Plan* includes the Local Coastal Program under the California Coastal Act of 1976. This area plan addresses objectives to preserve open space, improve public access to the shoreline, and enhance recreation for 10 subareas, including Golden Gate Park, the San Francisco Zoo, and Lake Merced.

Two other San Francisco planning documents that pertain to the western shoreline area could be relevant to WSIP facilities. The *San Francisco Zoo Master Plan* contains polices that address water supply and distribution facilities. This plan calls for developing new irrigation water supplies and improving and maintaining the existing well system. The *Golden Gate Park Master Plan* (adopted by the San Francisco Recreation and Park Commission in October 1998) is intended to "provide a framework and guidelines to ensure responsible and enlightened stewardship of the park." The goal of this plan is to "manage the current and future park and recreation demands while preserving the historic significance of the park." The plan identifies objectives and policies for park landscape, circulation, recreation, visitor facilities, buildings and monuments, utilities and infrastructure, maintenance and operations areas, park management, park funding, and special area plans.

Accountable Planning Initiative

In November 1986, the voters of San Francisco approved Proposition M, the Accountable Planning Initiative, which added Section 101.1 to the City Planning Code to establish eight Priority Policies. These policies are as follows:

1. Existing neighborhood-serving retail uses shall be preserved and enhanced and future opportunities for resident employment in and ownership of such businesses enhanced.

2. Existing housing and neighborhood character shall be conserved and protected in order to preserve the cultural and economic diversity of our neighborhoods.

3. The City's supply of affordable housing shall be preserved and enhanced.

4. Commuter traffic shall not impede Muni transit service or overburden our streets or neighborhood parking.

5. A diverse economic base shall be maintained by protecting our industrial and service sectors from displacement due to commercial office development, and future opportunities for resident employment and ownership in these sectors shall be enhanced.

6. The City shall achieve the greatest possible preparedness to protect against injury and loss of life in an earthquake.

7. Landmarks and historic buildings shall be preserved.

8. Parks and open space and their access to sunlight and vistas shall be protected from development.

In accordance with the Accountable Planning Initiative, prior to issuing a permit for any project, or adopting legislation that requires an initial study under CEQA, or adopting any zoning ordinance or development agreement, and before taking any action that requires a finding of consistency with the general plan, the CCSF is required to find that the project is consistent with the Priority Policies established by Proposition M.

San Francisco Sustainability Plan

The San Francisco Board of Supervisors endorsed the *San Francisco Sustainability Plan* in 1997, but has not committed the CCSF to perform the actions addressed in the plan. The plan serves as a blueprint for sustainability, with many of its individual proposals requiring further development and public comment. The underlying goals of the plan are to maintain the physical resources and systems that support life in San Francisco and to create a social structure that will allow such maintenance. The plan is divided into 15 topic areas, 10 that address specific environmental issues (air quality; biodiversity; energy, climate change, and ozone depletion; food and agriculture; hazardous materials; human health; parks, open spaces and streetscapes; solid waste; transportation; and water and wastewater), and five that are broader in scope and cover many issues (economy and economic development, environmental justice, municipal expenditures, public information and education, and risk management). Under the topic "water" are goals addressing water reuse, water quality, water supply, groundwater supply, and infrastructure. Each topic area in the plan contains a set of indicators to be used over time in determining whether San Francisco is moving in a sustainable direction in that particular area (CCSF, 1997).

San Francisco Municipal Green Building Program

San Francisco's Green Building Program was founded in 1999 when the CCSF adopted the Resource Efficient Building Ordinance, which established green building standards for municipal buildings to increase energy efficiency, conserve CCSF finances, reduce the environmental impacts of demolition, construction, and operation of buildings, and create safe workplaces for CCSF employees and visitors. The ordinance created the inter-departmental Resource Efficient Building (REB) Task Force and charged the San Francisco Department of Environment with implementing the ordinance in partnership with the Department of Public Works and other REB Task Force departments. In 2004, amendments to Chapter 7 of the Environment Code set LEED (Leadership in Energy and Environmental Design) Silver Certification by the U.S. Building Council as the minimum environmental performance requirement for all municipal projects over 5,000 square feet. The REB Task Force assists City departments in compliance with the LEED Silver Certification requirement and helps to determine which projects are applicable for LEED ratings. For all municipal construction projects, including those projects that do not involve buildings and are not required to obtain LEED Silver Certification, the REB Task Force provides recommended best practices and sample specifications for building materials (e.g. recycled content of steel and concrete) (SF Dept of Environment, 2004-2007).

SFPUC Plans and Policies

The SFPUC adopted the Alameda and Peninsula WMPs in 2000 and 2001, respectively. In 2006, the SFPUC adopted the Water Enterprise Environmental Stewardship Policy.

Alameda and Peninsula Watershed Management Plans

As described in Chapter 2, Section 2.3.8, the SFPUC has adopted watershed management plans (CCSF, 2001, 2002) for CCSF-owned lands in the Alameda and Peninsula watersheds to provide a policy framework for the SFPUC to make decisions about activities that are appropriate on watershed lands. The plans provide goals, policies, and management actions that address watershed activities and reflect the unique qualities of each watershed. The WMPs are also intended for use by the SFPUC as watershed management implementation guidelines. Watershed lands are managed by the SFPUC Natural Resources Division, Watershed Resources Management Section.

As part of implementation of the WMPs, the SFPUC reviews all plans, projects, and activities that occur within the Alameda and Peninsula watersheds for conformity with the management plans and for compliance with environmental codes and regulations. To accomplish this, the SFPUC has established a project review team with members from various SFPUC departments as well as the City Attorney's office. Appropriate SFPUC personnel review proposals for new facilities, structures, roads, trails, projects, and leases or for improvements to existing facilities. Projects subject to this review include those that involve construction, digging or earthmoving, clearing, installation, use of hazardous materials, or other disturbance to watershed resources. In addition, projects that involve the issuance of new or revised leases and permits are subject to this review procedure.

For both WMPs, the SFPUC considers water quality protection as the first and foremost goal. The goals and policies are organized around the primary goal of water quality protection and secondary goals pertaining to water supply, natural resources, watershed protection, land use compatibility, fiscal management, and public awareness. The primary and secondary goals common to both watershed management plans are as follows:

- *Primary Goal*: Maintain and improve source water quality to protect public health and safety.

- *Secondary Goals*:
  - Maximize water supply.
  - Preserve and enhance the ecological and cultural resources of the watershed.
  - Protect the watersheds, adjacent urban areas, and the public from fire and other safety hazards.
  - Continue existing compatible uses and provide opportunities for potential compatible uses on watershed lands, including educational, recreational, and scientific uses.

- Provide a fiscal framework that balances financial resources, revenue-generating activities, and overall benefits and an administrative framework that allows implementation of the watershed management plans.
- Enhance public awareness of water quality, water supply, conservation, and watershed protection issues.

Water Enterprise Environmental Stewardship Policy

Adopted in June 2006, the Water Enterprise Environmental Stewardship Policy established the long-term management direction for CCSF-owned lands and natural resources affected by operation of the SFPUC water system within the Tuolumne River, Alameda Creek, and Peninsula watersheds (SFPUC, 2006). It also addresses rights-of-way and properties in urban surroundings under SFPUC management. The policy includes the following:

- The SFPUC will proactively manage the watersheds under its responsibility in a manner that maintains the integrity of the natural resources, restores habitats for native species, and enhances ecosystem function.

- To the maximum extent practicable, the SFPUC will ensure that all operations of the SFPUC water system (including water diversion, storage, and transport), construction and maintenance of infrastructure, land management policies and practices, purchase and sale of watershed lands, and lease agreements for watershed lands protect and restore native species and the ecosystems that support them.

- Rights-of-way and properties in urban surroundings under SFPUC management will be managed in a manner that protects and restores habitat value where available, and encourages community participation in decisions that significantly interrupt or alter current land use in these parcels.

The Environmental Stewardship Policy calls for implementation and update of the Alameda and Peninsula WMPs (described above), development of habitat conservation plans for the Alameda and Peninsula watersheds (described in Section 4.6, Biological Resources), and development and implementation of the Watershed and Environmental Improvement Program (described in Chapter 3, Section 3.12, WSIP-Related Activities), as well as specific integration of this policy into the WSIP and individual infrastructure projects.

Other Land Use Plans and Policies

In some portions of the WSIP study area, the SFPUC may be subject to certain provisions of the land use plans and policies of other agencies, such as the U.S. Department of the Interior and the National Park Service (NPS), which hold easements over some SFPUC property. Several federal, state, and regional agencies have adopted land use plans that establish guidelines regarding appropriate land uses and activities within the boundaries of their respective plans. Federal, state, and regional plans that are applicable to the WSIP are described below.

U.S. Department of the Interior, Golden Gate National Recreation Area – Scenic Easement and Scenic and Recreation Easement

In 1969, the CCSF granted two easements over the vast majority of the Peninsula watershed to the Department of the Interior. The easements were granted to the federal government in order to obtain a change in the route of Interstate 280 (I-280) (and an increase in the federal share of costs) to a less environmentally damaging location further east of Crystal Springs Reservoir. The approximately 19,000-acre Scenic Easement covers the lands west of Crystal Springs and San Andreas Reservoirs. The approximately 4,000-acre Scenic and Recreation Easement applies to lands in the vicinity of I-280. The CS/SA Transmission project (PN-2), Lower Crystal Springs Dam project (PN-4), and the Pulgas Channel and sediment catch basin components of the Pulgas Balancing Reservoir project (PN-5) are within the Scenic Easement, while the Pulgas Balancing Reservoir itself is within the Scenic and Recreation Easement. The easements cover nearly all of the CCSF-owned Peninsula watershed lands and place restrictive covenants on use of the lands that are unrelated to the SFPUC's overall management of the land for utility purposes. The provisions of the easement include:

1. The land shall be preserved in its present natural state and shall not be used for any purpose other than for the collection, storage and transmission of water and protection of water quality, and other purposes which shall be compatible with said use and preserving said land as open-space land;

2. No structures shall be erected upon said land except such structures as may be directly related to and compatible with the aforesaid uses. No trailer shall be placed, used or maintained on said land as a substitute for a caretaker's residential building. The design and location of all buildings except water utilities buildings and appurtenances, shall be subject to the concurrence of a regional representative of the Department of the Interior to be designated by the Secretary of the Interior;

3. No signs, billboards, or advertisements excepting directional signs and identification signs in connection with permitted uses, shall be displayed or placed upon the land;

4. Except as required to accomplish the improvements hereinafter permitted or as otherwise permitted to the Grantor hereunder, the general topography of the landscape shall be maintained in its present condition and no substantial excavation or topographic changes shall be made without the concurrence of a regional representative of the Department of the Interior to be designated by the Secretary of the Interior; and

5. Except as required to accomplish the purposes and uses herein permitted to Grantor, there shall be no cutting or permitting of cutting, destroying or removing any timber or brush without the concurrence in writing by a regional representative of the Department of the Interior to be designated by the Secretary of the Interior.

In 1980, Congress transferred responsibility for administration of the easements to the National Park Service/Golden Gate National Recreation Area (NPS/GGNRA). The legislation provides that the terms of the easements are to be administered by the NPS. The Peninsula watershed is not part of a national park or recreation area *per se*, as the CCSF retains ownership of the land and the NPS has only a limited interest. The NPS can object to development unrelated to utility management or other uses not permitted by the terms of the easements.

California Department of Fish and Game, Game Refuge Designation

In 1931, at the request of the SFPUC (then the San Francisco Water Department), the California Department of Fish and Game (CDFG) designated the Peninsula watershed as a game refuge. Pursuant to Section 10500 et seq. of the California Fish and Game Code, the "taking"[3] of birds or mammals or the use of firearms (or other weapons used for the purpose of taking birds or mammals) within the Peninsula watershed is prohibited without specific authorization.

San Francisco Bay Conservation and Development Commission, San Francisco Bay Plan

The San Francisco Bay Plan (SF Bay Plan), prepared by the San Francisco Bay Conservation and Development Commission (BCDC) in 1968 in accordance with the McAteer-Petris Act of 1965, is an enforceable plan that guides the protection and use of San Francisco Bay and its shoreline. Under the McAteer-Petris Act, BCDC has the authority to issue or deny permit applications for placing fill, extracting materials, or changing the use of any land, water, or structure within the area of its jurisdiction and to enforce policies aimed at protecting the bay and its shoreline.[3a] The SF Bay Plan designates shoreline areas that should be reserved for water-related purposes like ports, industry, public recreation, airports, and wildlife refugees. Since its adoption by BCDC in 1968, the SF Bay Plan has been amended periodically to keep pace with changing conditions and to incorporate new information concerning the bay. The new Bay Division Pipeline Tunnel No. 5 proposed under the BDPL Reliability Upgrade project (BD-1) includes approximately five miles of tunnel under the Don Edwards San Francisco Bay Wildlife Refuge, Newark Slough, and San Francisco Bay. The pipeline would be buried between 100 and 150 feet below mean sea level and result in approximately 355,000 cubic yards of bay mud excavation/spoils. As a result, this project could be subject to SF Bay Plan policies concerning the placement of fill in the bay, dredging, public access, and other policies and provisions contained in the SF Bay Plan (BCDC, 2005), depending on the final siting, construction, and operation of the BDPL Reliability Upgrade project.

Other Jurisdictions, General Land Use Plans[4]

General plans are long-range policy documents to guide the use and future development of private and public lands within the boundaries of a city or county. General plans represent a jurisdiction's official position on issues such as development and resource management.

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3 The term "taking" means to kill, harass, or disturb species or their habitats.

3a BCDC has jurisdiction over all of San Francisco Bay up to mean high tide, areas of marsh up to 5 feet above mean sea level, a shoreline band lying 100 feet inland from the bay, as well as salt ponds, managed wetlands, and certain waterways.

4 A variety of local general plans were reviewed in the preparation of this section. See City of Brisbane, 1994; City of Burlingame, 1969; City of Daly City, 1989; City of Daly City, 1987; City of East Palo Alto, 1999; City of Fremont, 1991; City of Hillsborough, 2005; City of Los Altos, 2002; City of Menlo Park, 1994; City of Millbrae, 1998; City of Milpitas, 1997; City of Modesto, 1997; City of Mountain View, 1992; City of Newark, 1992; City of Palo Alto, 1998; City of Redwood City, 1990; City of Riverbank, 1987; City of San Bruno, 1984; City of San Carlos, 1992; City of San Jose, 1994; City of San Mateo, 1990; City of Santa Clara, 2002; City of South San Francisco, 1999; City of Sunnyvale, 1993a; City of Sunnyvale, 1993b; Alameda County, 1975; Alameda County, 1976; San Joaquin County, 1991; San Mateo County, 1986; Santa Clara County, 1994; Stanislaus County, 1994; Tuolumne County, 1996; Town of Colma, 1987; Town of Woodside, 1988.

California planning law (Government Code Sections 65302–65303) requires that each city or county in the state develop and adopt a general plan that addresses the following subjects: land use, circulation, housing, conservation, open space, safety, and noise. In essence, general plans represent the visions of local governments for their communities' future, and provide the policy framework intended to realize those visions.

Figure 4.2-1 shows the counties, unincorporated areas, and local city jurisdictions in which WSIP facilities would be constructed, repaired, upgraded, or replaced. The following factors affect the application of these communities' general plans to the WSIP:

- *Local Agency Project Approval*. No local agency approvals would be needed for adoption of the overall WSIP (see Section 3.13, Chapter 3). Individual projects could, in select cases, require encroachment permits from local agencies. Separate, project-level CEQA review of the individual WSIP projects will provide more detailed and up-to-date information on the approvals required for each project.

- *Building and Zoning Ordinances*. Building and zoning ordinances represent the most specific expressions of general plan goals, objectives, and policies. State law and judicial interpretation of state law[5] mutually exempt cities and counties from complying with each other's building and zoning ordinances. The SFPUC, which is part of the CCSF, is therefore exempt from complying with the building and zoning ordinances of other cities and counties. This same state law also exempts public utilities and special-purpose local agencies (such as water districts) from complying with local building and zoning ordinances when locating or constructing facilities for the production, generation, storage, treatment, or transmission of water.

- *Local Government Notification and Consistency Determination Requirements*. California Government Code Section 65402(b) requires that the SFPUC inform cities and counties of its plans to construct projects or acquire or dispose of extraterritorial property. The local governments have 40 days to determine project consistency with their general plans; these consistency determinations are advisory to the SFPUC rather than binding. Approval of the WSIP would not trigger the requirements of Section 65402(b), but implementation of the individual WSIP projects would. The SFPUC would notify local governments of WSIP facilities to be constructed, repaired, upgraded, or replaced within the city or county as part of any project-level CEQA process. Prior to project implementation, local governments would be notified pursuant to California Government Code Section 65402(b).

Notwithstanding the above, where CCSF-owned facilities are sited outside of San Francisco, the SFPUC seeks to work cooperatively with local jurisdictions to avoid conflicts with local land use plans and building and zoning codes. For the WSIP, a key issue for local agencies that receive SFPUC water is whether the WSIP adequately addresses community goals regarding water service for existing and future land uses. The cities and counties that receive all or part of their water supply from the SFPUC (not including the CCSF) include:

Atherton	East Palo Alto	Los Altos Hills	Pacifica	San Jose
Belmont	Foster City	Menlo Park	Palo Alto	San Mateo
Brisbane	Fremont	Millbrae	Portola Valley	Santa Clara
Burlingame	Half Moon Bay	Milpitas	Redwood City	South San Francisco
Colma	Hayward	Mountain View	San Bruno	Sunnyvale
Daly City	Hillsborough	Newark	San Carlos	Union City
				Woodside

5 California Government Code Section 53090 et seq.

The intent of the general plans prepared by these communities is to preserve and improve the quality of life for its citizens and to consider growth in a manner that appropriately reflects the community's values; an adequate, reliable water supply is a chief public service needed to accomplish these goals.

A second issue of importance to local agencies is whether implementation of the WSIP would be consistent with community goals regarding resource protection. **Table 4.2-1** presents an overview of general plan policies and goals that address the protection of environmental resources or the mitigation of environmental impacts. All of the issues identified in the table are addressed in this PEIR in one form or another; some specific policies are used as criteria to determine the significance of physical effects on the environment. **Table 4.2-2** lists the significance criteria that directly relate to consistency with plans and policies and indicates where in this chapter the reader can find the impact evaluation.

Habitat Conservation Plans

Habitat conservation plans provide comprehensive, long-term conservation measures for species listed as threatened or endangered under the California and Federal Endangered Species Acts, or for species that could be listed in the future. Section 4.6, Biological Resources, presents a discussion of habitat conservation plans relevant to the WSIP and addresses plan consistency.

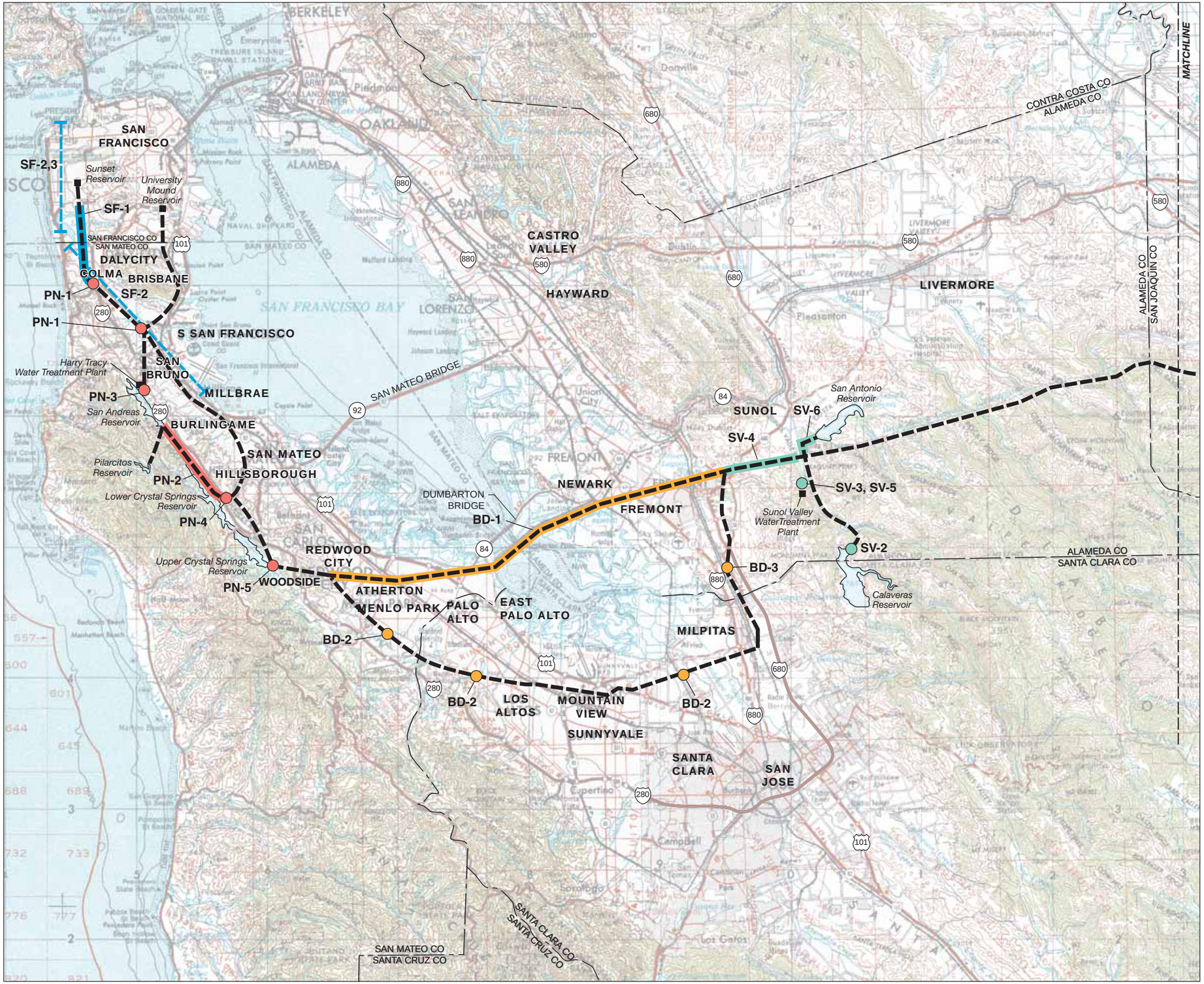
4.2.3 Plan Consistency Evaluation

The evaluation of plan consistency is based on the applicability of relevant land use plans and policies to the siting, construction, and operation of WSIP facilities. Because the policy language found in a land use plan is susceptible to varying interpretations, it is often difficult to determine whether a proposed project is consistent or inconsistent with such policies. Further, because land use plans often contain numerous policies emphasizing differing legislative goals, the WSIP projects may be consistent with a general plan, taken as a whole, even though they may appear to be inconsistent with specific policies within the plan. The board or commission that enacted the plan or policy generally determines the meaning of such policies; these interpretations prevail if they are "reasonable," even though other reasonable interpretations are also possible. In light of these considerations, the consistency evaluation in this PEIR represents the best attempt to advise the decision-makers as to whether the proposed program is consistent with applicable land use plans and policies.

Consistency with San Francisco Plans and Policies

San Francisco General Plan

As described above in Section 4.2.2, the San Francisco General Plan addresses elements such as air quality, community safety (including protection from geologic and seismic hazards), environmental protection (including protection of water resources, biological resources, and other natural resources as well as addressing construction-related noise and ambient air quality), and urban design (including protection of historic and visual resources).



Existing System Corridor

Existing System Facility

Proposed Facility Corridor

Proposed Facility Site

Proposed Facility, General Location

Note: See Figure 4.1-2 for full Project Names

0 5

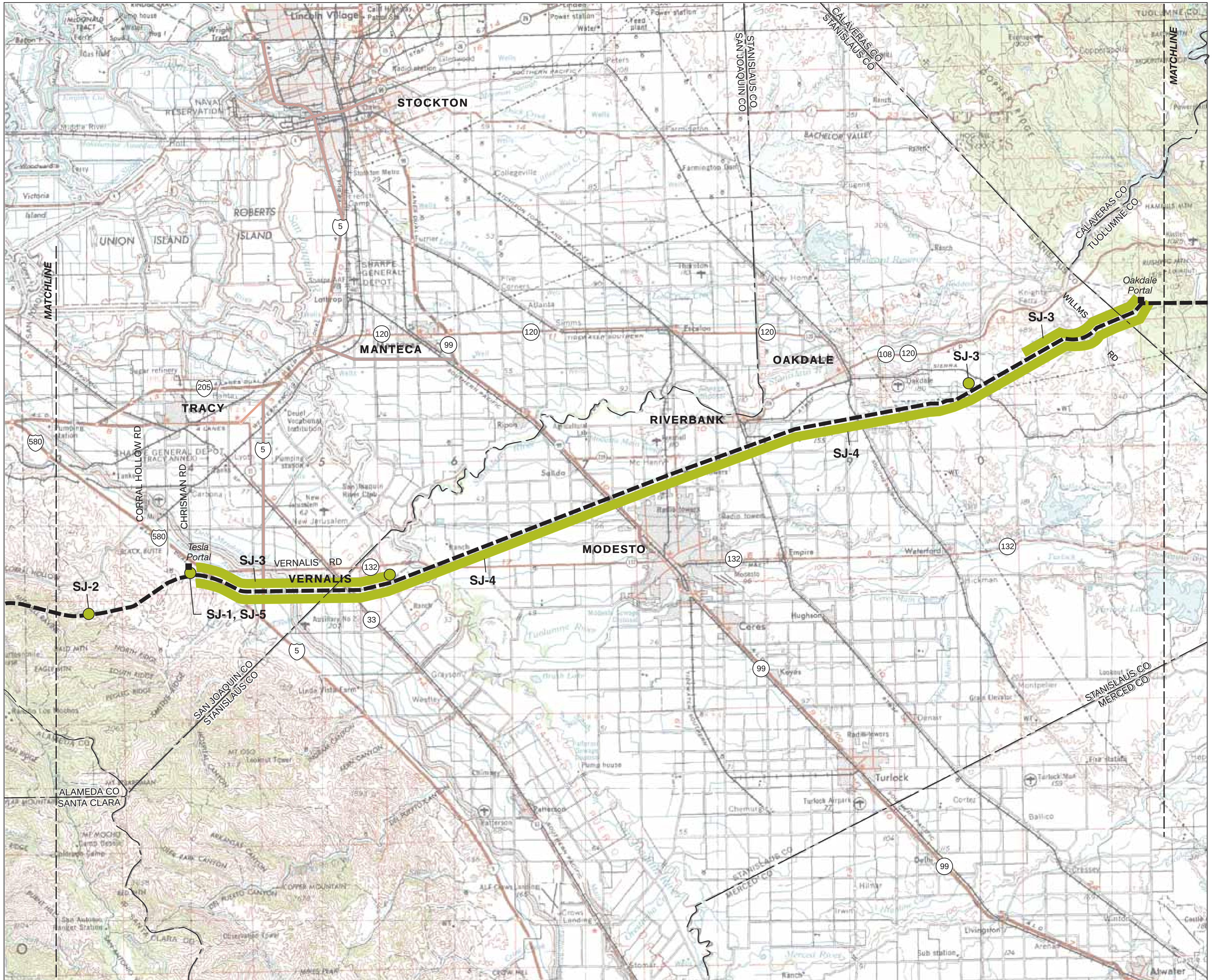
Miles

SOURCE: ESA + Orion; SFPUC, 2006

SFPUC Water System Improvement Program . 203287

Figure 4.2-1a

WSIP Projects Jurisdictions and Major Roadways



Existing System Corridor

Existing System Facility

Proposed Facility Corridor

Proposed Facility Site

Proposed Facility, General Location

Note: See Figure 4.1-2 for full Project Names

0 5 Miles

SOURCE: ESA + Orion; SFPUC, 2006

SFPUC Water System Improvement Program . 203287

Figure 4.2-1b

WSIP Projects Jurisdictions and Major Roadways

TABLE 4.2-1
SUMMARY OF GENERAL PLAN POLICIES OF OTHER JURISDICTIONS BY CEQA RESOURCE TOPIC

Resource Topic	Summary Description
Land Use and Visual Quality	General plan goals, policies, and implementation actions related to land use generally call for the use of an environmental review process to minimize potential impacts of projects, and strive to minimize the impact of construction projects on surrounding land uses.
Geology, Soils, and Seismicity	General plan policies related to geology, soils, and seismicity call for appropriate placement, design, and construction of utilities to minimize damage from seismic and geologic hazards and for the implementation of extra precautionary measures to restore utility services following earthquakes. Effective mitigation measures are required for utilities in areas prone to geologic hazards such as soil erosion, liquefaction, and slope failure.
Hydrology and Water Quality	General plan policies related to hydrology and water quality generally deal with the utilization of erosion control measures and storm water quality controls, the protection of riparian zones, and the conservation of water resources in the natural environment. Dam maintenance and monitoring are prescribed in areas potentially subject to dam failure.
Biological Resources	General plan goals, policies, and implementation programs related to biological resources are aimed at the protection of sensitive wildlife habitat and plants, including wetlands, riparian zones, native hardwoods, open space, and sensitive habitats for rare and endangered fish and wildlife species. Heritage tree programs specify guidelines for the avoidance, protection, and, when necessary, replacement of heritage trees. Use of the CEQA process to ensure that detrimental biological impacts do not occur is prescribed.
Cultural Resources	General plan policies related to cultural resources prescribe procedures to prevent detrimental impacts on archaeological/paleontological sites during construction, and the use of good planning practices to preserve cultural and historic heritage.
Traffic, Transportation, and Circulation	General plan policies related to traffic, transportation, and circulation generally require an impact analysis of new development proposals on traffic and encourage the use of utility corridors and river/ creek rights-of-way for nonmotorized transportation modes such as bicycle and pedestrian facilities.
Air Quality	General plan policies related to air quality call for air quality impact analyses for proposed projects and the use of air quality controls, such as dust abatement measures during construction, to reduce air quality impacts.
Noise and Vibration	General plan policies related to noise and vibration generally establish enforceable noise thresholds, require the use of noise suppression techniques during construction activities, encourage the incorporation of noise reduction techniques in new structures, and call for compliance with noise ordinances during facility operation.
Public Services and Utilities	General plan policies related to public services and utilities call for safeguarding utility lines from rupture or malfunction from natural or manmade hazards.
Recreational Resources	General plan policies related to recreational resources encourage the use of utility corridors and SFPUC rights-of-way for recreational uses such as parks, pedestrian and bicycle trails, open space, and other recreational facilities and programs.
Agricultural Resources	General plan policies related to agricultural resources encourage utilities to route their facilities along property lines to prevent interference with agricultural operations.
Hazards	General plan policies related to hazards call for the proper handling, use, disposal, and transport of hazardous materials and the placement, design, construction, and protection of critical utilities from potential disasters.
Energy Resources	No relevant general plan policies related to energy resources were identified.

TABLE 4.2-2
SIGNIFICANCE CRITERIA RELATED TO CONSISTENCY WITH PLANS AND POLICIES BY CEQA RESOURCE TOPIC

Resource Topic	Significance Criterion
Geology, Soils, and Seismicity (Section 4.4)	Result in the loss of availability of a locally important mineral resource recovery site delineated on a local general plan, specific plan, or other land use plan.
Biological Resources (Section 4.6)	Conflict with any local policies or ordinances protecting biological resources, such as a tree preservation policy or ordinance. Conflict with the provisions of an adopted habitat conservation plan, natural community conservation plan, or other approved local, regional, or state habitat conservation plan.
Traffic, Transportation, and Circulation (Section 4.8)	Conflict with adopted policies, plans, or programs supporting alternative transportation (e.g., conflict with policies promoting bus turnouts, bicycle racks, etc.), or cause a substantial increase in transit demand that cannot be accommodated by existing or proposed transit capacity or alternative travel modes).
Noise and Vibration (Section 4.10)	Expose people to or generate noise levels in excess of standards established in the local general plan or noise ordinance, or applicable standards of other agencies. For a project located within an area covered by an airport land use plan (or, where such a plan has not been adopted, within two miles of a public airport or public use airport), expose people residing or working in the project area to excessive noise levels.
Agricultural Resources (Section 4.13)	Conflict with existing zoning for agricultural use or a Williamson Act contract.

The WSIP includes facility improvement projects that would seismically upgrade the SFPUC regional water system facilities and serve the water supply needs of the SFPUC's service area through 2030. Although some of these projects would result in impacts on air quality and natural resources, on the whole the proposed program would mitigate such impacts, restore natural systems, and support the orderly growth and development of San Francisco and the adjoining cities and counties of the San Francisco Bay region.

Implementation of the WSIP would increase community safety by protecting the regional water system from earthquake hazards and providing redundancy in the system in the event that substantial damage and/or a failure of part of the system occurred. The WSIP would, on the whole, be consistent with the San Francisco General Plan.

San Francisco Priority Policies

Of the eight Priority Policies, only the last two would be relevant to the WSIP. The remaining six policies would not be relevant because the WSIP would: be largely constructed outside of San Francisco, be located away from San Francisco neighborhoods, have no effect on or create the need for affordable housing, not result in any commuter automobiles, and not result in commercial office development. The WSIP would have no long-term effect on open space.

With regard to the Priority Policy to protect historic buildings, the WSIP projects that could potentially affect historical resources would be implemented in a manner that is consistent with the Secretary of Interior Standards; most impacts would be mitigated to a less-than-significant

level. With regard to the Priority Policy to prepare for earthquakes: one of the primary goals of the proposed program is seismic reliability of the regional water system to reduce vulnerability to earthquakes; the WSIP proposes improvements to meet current seismic standards and would establish and implement a defined level of service response after a major earthquake. The WSIP would, on the whole, be consistent with San Francisco's Priority Policies.

San Francisco Sustainability Plan

The *San Francisco Sustainability Plan* was developed for the purpose of addressing San Francisco's long-term environmental sustainability. The WSIP facility improvement projects would be consistent with the goals of the Sustainability Plan, since it would maintain the physical resources and systems that support life in San Francisco. The WSIP would be inherently consistent with goals pertaining to increasing water reuse, ensuring an adequate water supply under normal and extraordinary conditions, restoring groundwater supplies, and upgrading infrastructure.

San Francisco Municipal Green Building Program

The San Francisco Municipal Green Building Program was developed for the purpose of improving the environmental performance of municipal buildings. The WSIP facility improvement projects would be consistent with the San Francisco Municipal Green Building Program, since all applicable facility improvement projects constructed under the WSIP would be designed, constructed, and operated in accordance with the City's Green Building requirements. The SFPUC would complete and submit LEED checklists to the REB Task Force on all applicable WSIP projects.

Consistency with SFPUC Plans and Policies

Alameda and Peninsula Watershed Management Plans

Generally, the Alameda and Peninsula WMPs guide SFPUC activities that are located within the plans' boundaries. The Alameda WMP would be applicable to six of the WSIP projects located in the Alameda watershed: Alameda Creek Fishery (SV-1), Calaveras Dam (SV-2), 40-mgd Treated Water (SV-3), New Irvington Tunnel (SV-4, which is partially within watershed boundaries), Treated Water Reservoirs (SV-5), and SABUP (SV-6). The Peninsula WMP would be applicable to three of the WSIP projects proposed to be entirely located in the Peninsula watershed: CS/SA Transmission (PN-2), Lower Crystal Springs Dam (PN-4), and Pulgas Balancing Reservoir (PN-5).

The Peninsula and Alameda WMPs are designed to guide the SFPUC's activities with respect to its watershed lands and operation of the regional water system to ensure protection and restoration of watershed resources. The WMP's goals and policies include maximizing the local water supply and improving source water quality to protect public health and safety, which are aligned with the goals of the WSIP. As part of implementing the WMPs, the SFPUC Natural Resources Division will review the WSIP plans, projects, and activities that occur within these watersheds for conformity with the WMPs as well as for compliance with environmental codes and regulations. As a result of this watershed project review process, the WSIP would, on the whole, be implemented in a manner consistent with the WMPs.

Water Enterprise Environmental Stewardship Policy

The WSIP would be consistent with the underlying goals of the Water Enterprise Environmental Stewardship Policy, particularly with respect to the WSIP sustainability goal and the WSIP objective to manage natural resources and physical systems to protect watershed ecosystems. Conversely, the Stewardship Policy implementation strategy specifically calls for integration of the policy into the WSIP. And, as stated above, WSIP projects located in the Alameda and Peninsula watersheds would be required to comply with the respective WMP policies, actions, and design guidelines and feasible mitigation measures. Mitigation measures described in

Chapter 6 identify programmatic approaches to protecting and restoring natural resources and habitats, including measures that would reduce bioregional effects and habitat fragmentation and would enhance ecosystem function.

Consistency of WSIP Projects with Other Applicable Land Use Plans and Policies

As described in Section 4.2.2, federal, state, and regional land use plans establish guidelines regarding appropriate land uses and activities within the boundaries of the respective plans. The relevant land use plans for the WSIP study area are: the GGNRA – Scenic Easement and Scenic and Recreation Easement and the *San Joaquin County Multi-species Conservation Plan and Open Space Plan*. WSIP consistency with habitat conservation plans, including the San Joaquin County's multi-species conservation plan, is addressed in Section 4.6, Biological Resources. WSIP consistency with the GGNRA – Scenic Easement and Scenic and Recreation Easement is presented below.

GGNRA – Scenic Easement and Scenic and Recreation Easement

The proposed WSIP projects in the Peninsula watershed would involve construction of new, or improvements to existing, water utility facilities. Therefore, implementation of these projects is an exercise of the CCSF's reserved rights under the terms of both easements. The WSIP would, on the whole, be consistent with the GGNRA easement covenants.

California Department of Fish and Game, Game Refuge Designation

Implementation of the WSIP projects in the Peninsula watershed would not result in the unauthorized taking of birds or mammals and, therefore, would be consistent with the area's designation as a game refuge.

San Francisco Bay Plan

Implementation of the BDPL Reliability Upgrade project (BD-1) includes construction of a tunnel to replace aboveground pipelines located in San Francisco Bay. Depending on the final scope of work undertaken with respect to this project, SF Bay Plan policies could be relevant to the project. The proposed five-mile tunnel under Don Edwards San Francisco Bay Wildlife Refuge, Newark Slough, and San Francisco Bay is generally straight, which provides for ease in constructability, but is also designed to minimize environmental disruption, particularly with respect to protected species. Programmatic mitigation measures described in Chapter 6, if determined to be applicable, identify measures to protect and restore natural resources and habitats, including special-status species. Compliance with BCDC permitting requirements and consideration of applicable SF Bay Plan policies would also ensure that relevant policies of the SF Bay Plan are addressed and carried out to minimize environmental effects on the bay. The WSIP would, on the whole, be consistent with policies contained in the SF Bay Plan.

Local General Plans

Section 4.2.2 describes the application of local general plans to the WSIP. Determinations of project consistency with general plans would be made by the pertinent land use jurisdictions following preparation of project-specific CEQA documentation and notification by the SFPUC pursuant to state law.

For those counties and cities that receive all or part of their water from the SFPUC, the WSIP would generally be consistent with goals to maintain and improve the quality of life of the local population by increasing the reliability of the water supply now and into the future. The objectives of the WSIP include maintaining high-quality water, reducing system vulnerability to earthquakes, increasing delivery reliability, meeting customer water supply needs, enhancing sustainability, and achieving a cost-effective, fully operational system. Chapter 7 of this PEIR addresses this issue in more detail by comparing the population and employment projections of the jurisdictions that rely on SFPUC water with SFPUC projections for water demand.

Regarding WSIP consistency with community goals related to resource protection, through preparation of this PEIR and attendant scoping and public outreach efforts, the CCSF has systematically identified the significant environmental impacts associated with implementation of the WSIP as well as feasible measures and alternatives to avoid or substantially lessen such effects. The significance criteria used in this PEIR dovetail with the intent of general plan goals and policies related to protecting the environment. As detailed throughout the remaining sections of Chapter 4, most of the environmental impacts attributable to the WSIP are associated with construction, and these impacts would be reduced to less-than-significant levels, either through measures proposed as part of the program or otherwise committed to by the CCSF.

4.2.5 References – Plans and Policies

Alameda County, *Noise Element of the Alameda County General Plan*, 1975, as amended through May 5, 1994.

Alameda County, *Conservation Element of the Alameda County General Plan*, 1976, as amended through May 5, 1994.

City and County of San Francisco, *Alameda Watershed Management Plan*, 2001.

City and County of San Francisco, *San Francisco General Plan*, 1988, as amended through 1996.

City and County of San Francisco, *Peninsula Watershed Management Plan*, 2002.

City and County of San Francisco, *San Francisco Sustainability Plan*, 1997.

City of Brisbane, *1994 General Plan*, 1994, as amended through October 15, 2002.

City of Burlingame, *Burlingame General Plan*, 1969.

City of Daly City, *City of Daly City General Plan: Noise, Conservation, and Open Space Elements*, 1989.

City of Daly City, *City of Daly City General Plan: Housing, Land Use, and Circulation Elements*, 1987.

City of East Palo Alto, *General Plan*, 1999.

City of Fremont, *General Plan*, 1991, as amended through February 10, 1996.

City of Hillsborough, *General Plan*, 2005.

City of Los Altos, *Los Altos General Plan 2002-2020*, 2002.

City of Menlo Park, *General Plan*, 1994.

City of Millbrae, *Millbrae General Plan*, 1998.

City of Milpitas, *Milpitas General Plan*, 1997, as amended through November 3, 1998.

City of Modesto, *City of Modesto Urban Area General Plan*, 1997.

City of Mountain View, *City of Mountain View 1992 General Plan*, 1992, as amended through December 10, 2002.

City of Newark, *General Plan Update Project 2007*, 1992.

City of Palo Alto, *Comprehensive Plan 1998-2010*, 1998.

City of Redwood City, *Strategic General Plan*, 1990.

City of Riverbank, *General Plan*, 1987.

City of San Bruno, *General Plan*, 1984.

City of San Carlos, *General Plan Update*, 1992.

City of San Jose, *City of San Jose 2020 General Plan*, 1994, as amended through January 5, 2006.

City of San Mateo, *General Plan Visions 2005*, 1990.

City of Santa Clara, *General Plan 2000-2010*, 2002.

City of South San Francisco, *South San Francisco General Plan*, 1999.

City of Sunnyvale, *Sunnyvale General Plan Community Development Element*, 1993a.

City of Sunnyvale, *Sunnyvale General Plan Environmental Management Element*, 1993b.

National Park Service (NPS), *Management Policies*, 2001.

San Francisco Bay Conservation and Development Commission (BCDC), *San Francisco Bay Plan*, 1968, as amended through August 2005.

San Francisco Department of Environment, *San Francisco Municipal Green Building Report 2004-2007*.

San Francisco Public Utilities Commission (SFPUC), *SFPUC Water Enterprise Environmental Stewardship Policy*, available online at www.sfwater.org, accessed June 27, 2006.

San Joaquin County, *General Plan 2010*, 1991.

San Mateo County, *General Plan*, 1986.

Santa Clara County, *Santa Clara County General Plan, 1995–2010*, 1994.

Stanislaus County, *Stanislaus County General Plan*, 1994.

Town of Colma, *Colma General Plan, Land Use, Circulation, Open Space/Conservation, and Housing Elements*, 1987.

Town of Woodside, *Woodside General Plan*, 1988.

Tuolumne County, *Tuolumne County General Plan*, 1996.

USDA Forest Service, *Sierra Nevada Forest Plan Amendment Final Supplemental Environmental Impact Statement*, January 2004.

4.3 Land Use and Visual Quality

4.3 Land Use and Visual Quality

This section provides an overview of existing land uses and visual character within the WSIP study area and evaluates potential land use and visual impacts that could result from implementation of the proposed WSIP projects.

4.3.1 Setting

Regional Overview

This section describes the general types of land uses and visual characteristics that occur within the WSIP facilities study area, which extends from Oakdale Portal in Tuolumne County west along the regional system to its terminus in San Francisco. **Figure 4.3-1** characterizes the WSIP study area under two main categories: (1) urbanized, which includes all levels of urban or suburban development, or (2) undeveloped, which includes all types of open space and undeveloped land uses such as parks and agriculture. From east to west, land uses across the WSIP study area generally include rangelands in the Sierra foothills, agricultural and urban and suburban uses in the Central Valley, open space/recreation/watershed areas within the urban fringe, and urban and suburban uses in the San Francisco Bay Area.

San Joaquin Region

Land Use

Most of the areas adjacent to proposed WSIP facility activities in this region are undeveloped and used for agriculture. Cities near existing regional water system facilities include Oakdale, Riverbank, and Modesto in Stanislaus County. Oakdale and Riverbank are generally comprised of rural residential and, more recently, suburban residential uses. Modesto, located in the center of this region, has mainly residential, commercial, school, and park uses.

The SFPUC's facilities in this region include Oakdale Portal on the east, which connects the western end of Foothill Tunnel and the San Joaquin Pipelines. The three San Joaquin Pipelines, which carry water from the Hetch Hetchy facilities, are almost entirely buried for their full 47-mile length (short segments extend aboveground through hilly terrain west of Oakdale Portal). These pipelines extend underground through urban land uses in Modesto and rural residential uses south of Oakdale and Riverbank. Within the western margin of this region in the Tesla Portal vicinity, the San Joaquin Pipelines extend underground through a private golf course (Tracy Golf and Country Club), agricultural land uses, and rural residential development.

Visual Resources

The visual character of the region is typical of the Central Valley, with undeveloped lands along the regional system. Except for the city of Modesto, this region consists mainly of annual grassland, irrigated pasture, and various agricultural crops. The eastern portion of this region in the Oakdale Portal vicinity is almost entirely in agricultural use. In the area of proposed

improvements in this portion of the region, Willms Road crosses the program area and is the only public road providing viewing opportunities of the regional system. Most of the SFPUC facilities are underground in this area, and the aboveground facilities are obscured from public view by the topography of the foothills. The central portion of this region includes Modesto, and aboveground facilities (e.g., crossovers) are visible from nearby public roadways. On the west side of the region, the Tesla Portal facilities are aboveground, consisting of about seven buildings and the pipelines/portal structures leading to the Coast Range Tunnel. The Tesla Portal facilities are visible from Vernalis Road and the nearby rural residential development, with distant views of the site available from I-580 (San Francisco Planning Department, 2000b).

Sunol Valley Region

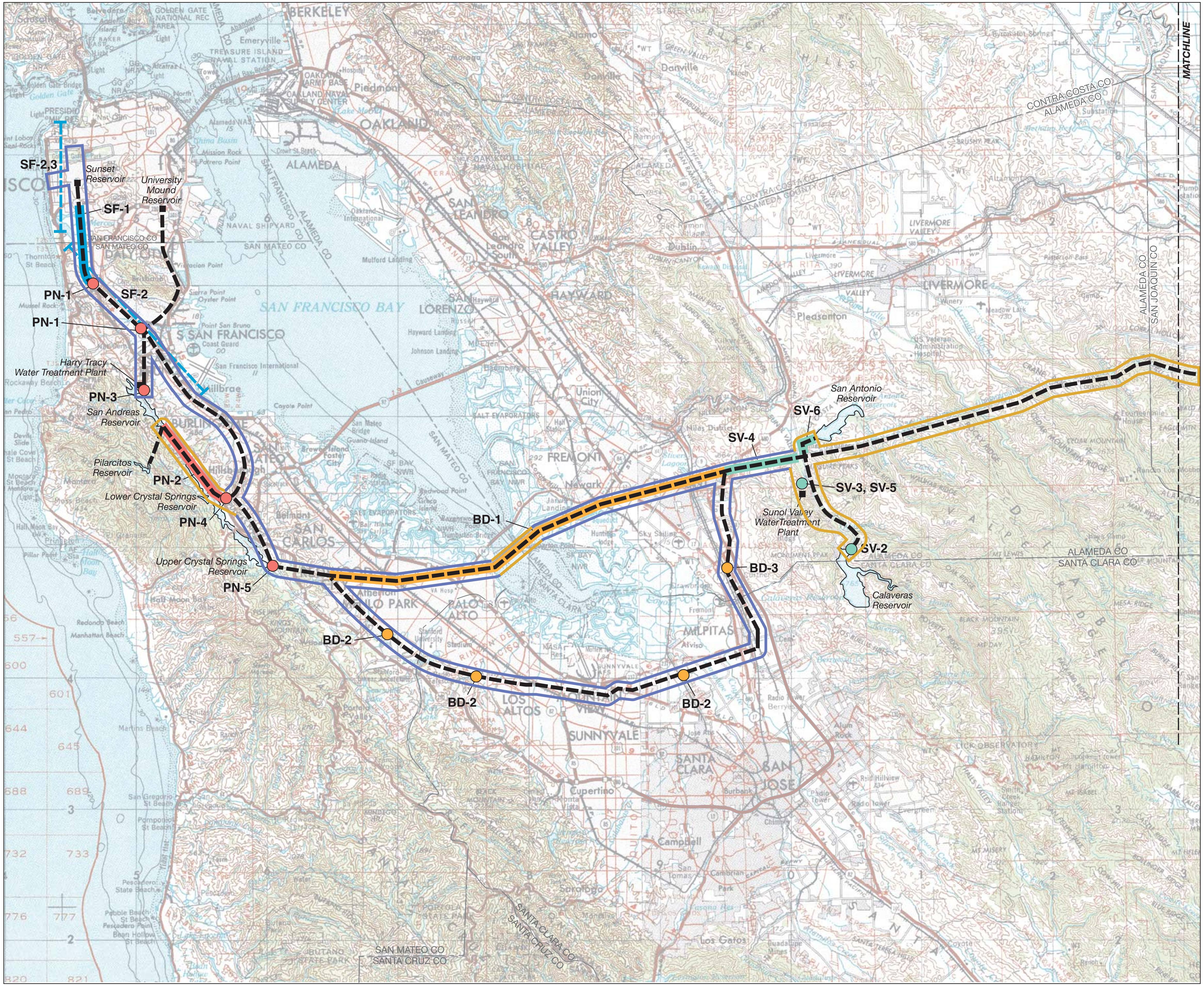
Land Use

The Sunol Valley Region includes facilities in the Sunol Valley within Alameda and Santa Clara Counties and west to the city of Fremont. Existing facilities within this region include storage facilities (Calaveras Reservoir, Calaveras Dam, San Antonio Reservoir, and James H. Turner Dam); transmission facilities (Alameda Siphons, Alameda Creek Diversion Dam and Tunnel, Calaveras Pipeline, San Antonio Pipeline, San Antonio Pump Station, and Irvington Tunnel); treatment facilities (Alameda Disinfection Facility and Sunol Valley Water Treatment Plant [WTP]); and the Irvington Tunnel Portal in Fremont on the west side of the hills.

As shown on Figure 4.3-1, the southern portion of the Sunol Valley and the area surrounding Calaveras Reservoir is mostly undeveloped, while the northern portion of the Sunol Valley includes commercial nurseries and aggregate quarries. The SFPUC system facilities in the Sunol Valley Region lie within the SFPUC's 36,000-acre Alameda watershed lands (see Figure 2.2 in Chapter 2, Existing Regional Water System), consisting primarily of rolling grassland and scattered oak woodlands that cover portions of Alameda and Santa Clara Counties. This area is largely undeveloped with recreational uses such as the Sunol Regional Wilderness, which is located on watershed land owned by the SFPUC and leased by the East Bay Regional Park District. In the western portion of this region, there are large-lot rural residential uses scattered throughout the hills between Sunol Valley and Fremont, and one private residence located about a quarter mile southeast of the existing Alameda West Portal. There are also two SFPUC Land Managers' residences, one near Calaveras Dam and the other near Alameda East Portal. Suburban residential uses on the east side of Mission Boulevard (Highway 238) in Fremont are adjacent to the Irvington Tunnel Portal, which is the westernmost existing SFPUC facility located in this region.

Visual Resources

For the most part, the SFPUC facilities in the Sunol Valley are relatively remote and not accessible to or viewed by the general public, except from Calaveras Road. Distant views of SFPUC facilities may also be available from public trails in the Sunol Regional Wilderness. Alameda and Santa Clara Counties have designated Calaveras Road as a scenic route. Calaveras Reservoir, as viewed from Calaveras Road, is one of the key features of interest (San Francisco



Urban Land Uses

Undeveloped Land Uses (includes agricultural uses)

Existing System Corridor

Existing System Facility

Proposed Facility Corridor

Proposed Facility Site

Proposed Facility, General Location

Note: See Figure 4.1-2 for full Project Names

0 5 Miles

SOURCE: ESA + Orion; SFPUC, 2006

SFPUC Water System Improvement Program . 203287

Figure 4.3-1a
Major Land Uses

SFPUC Water System Improvement Program . 203287

Figure 4.3-1b
Major Land Uses

Planning Department, 2000a). Irvington Tunnel Portal is visible from neighboring residences in the city of Fremont to the west.

Bay Division Region

Land Use

The Bay Division Region starts in Fremont and covers the general South Bay area, including parts of Alameda, Santa Clara, and San Mateo Counties, extending west to the south end of the Peninsula. The existing regional water system through this region is comprised of transmission facilities, including the Bay Division Pipelines Nos. 1, 2, 3, and 4.

For the most part, the WSIP project sites in this region are within developed urban areas. The urban areas are comprised of typical urban land uses found within a developed area, including residential, commercial, and industrial uses as well as schools, city parks, childcare centers, churches, hospitals, etc. Urban areas where WSIP projects are proposed include the cities of Newark and Fremont in Alameda County; the cities of San Jose, Santa Clara, and Palo Alto within Santa Clara County; and the cities of East Palo Alto, Menlo Park, Atherton, and Redwood City in San Mateo County. (See Chapter 3, Program Description, Table 3.11 for a review of jurisdictions relevant for each WSIP project.)

Undeveloped areas in this region consist primarily of marshland along the bay margin on the east and west sides of the bay, including the 30,000-acre Don Edwards San Francisco Bay National Wildlife Refuge. These undeveloped areas include aboveground portions of the Bay Division Pipelines Nos. 1 and 2 and valve houses.

Visual Resources

SFPUC facilities in the urban areas of the Bay Division Region are almost entirely buried and not distinguishable from the surrounding urban landscape. However, aboveground portions of the Bay Division Pipelines Nos. 1 and 2 and valve houses are present in the undeveloped areas along the east and west margins of the bay; these facilities are visible from the wildlife refuge and marshlands, with remote views available from the Dumbarton Bridge (Highway 84).

Peninsula Region

Land Use

The Peninsula Region is entirely on the Peninsula within San Mateo County. The regional water system facilities within this region include storage, transmission, and treatment facilities. This region spans the urbanized areas between San Francisco Bay and I-280, but also includes the undeveloped SFPUC Peninsula watershed lands (see Figure 2.3), which is the area surrounding the Upper and Lower Crystal Springs Reservoirs, Pilarcitos Reservoir, and San Andreas Reservoir. The watershed area is undeveloped, with heavily forested vegetation on the western slopes and grassland and scattered oak woodlands on the eastern edge.

Urbanized areas in proximity to SFPUC facilities in this region include land uses typically found in developed areas, such as commercial and residential uses, schools, churches, and hospitals. Residential uses adjacent to the Peninsula watershed are located in heavily wooded areas with narrow winding roads, hilly topography, blending with the general forested character of the watershed.

Visual Resources

While many of the SFPUC facilities located within the Peninsula watershed are aboveground structures, they are typically screened by vegetation and blend with the watershed's landscape or are buried. SFPUC reservoir facilities are an integral part of the visual character of the San Mateo County Peninsula.

The California Department of Transportation (Caltrans) has designated I-280 as a scenic highway. Key views in the area include Upper and Lower Crystal Springs Reservoirs and San Andreas Reservoir from I-280; views of Upper and Lower Crystal Springs Reservoirs from Highway 92; and views of Lower Crystal Springs Reservoir and San Andreas Reservoir from the Sawyer Camp Trail, a public hiking/bicycle trail. Features of interest in the area include the Pulgas Water Temple, a large roadside statue of Father Junipero Serra on I-280, the Eugene Doran Memorial Bridge, and the Crystal Springs Dam and vista point. As described in Section 4.2, Plans and Policies, the Peninsula watershed is part of a Scenic Easement and Scenic and Recreation Easement that were developed under a four-party agreement among the City and County of San Francisco (CCSF), the U.S. Department of the Interior, Caltrans, and San Mateo County (San Francisco Planning Department, 2001). Provisions of the easement are described in Section 4.2.2, under U.S. Department of the Interior, Golden Gate National Recreation Area – Scenic Easement and Scenic and Recreation Easement.

San Francisco Region

Land Use

The San Francisco Region includes regional facilities within San Francisco and northern San Mateo County, which overlap with a portion of the geographic area covered in the Peninsula Region. Existing regional water system facilities within this region include storage facilities (University Mound Reservoir, Sunset Reservoir, and Merced Manor Reservoir) and transmission facilities (San Andreas Pipeline, Crystal Springs Pipeline, and Sunset Supply Pipeline).

Most of the SFPUC facilities in the San Francisco Region are located in densely populated, urbanized areas of the west and south sides of the city. Proposed WSIP facilities in San Francisco are located as far north as Lincoln Park, as far south as Lake Merced, and as far east as McLaren Park. Proposed facilities in San Mateo County consist of regional transmission facilities (pipelines) extending from Peninsula facilities to terminal reservoirs in San Francisco. As shown in Figure 4.3-1, land uses in proximity to WSIP facilities in this region are entirely developed, comprising a mix of commercial and residential land uses, including schools, churches, golf courses, cemeteries, and parks.

Visual Resources

The visual setting surrounding SFPUC facility sites in this region is characterized by suburban commercial districts, residential neighborhoods, some industrial areas in northern San Mateo County, and predominantly urban commercial and residential areas in San Francisco.

Regulatory Framework

Please see Section 4.2, Plans and Policies, for a discussion of the regulatory setting related to land use plans and policies and for analysis of the consistency of proposed WSIP projects with relevant plans and policies.

4.3.2 Impacts

Significance Criteria

The CCSF has not formally adopted significance standards for impacts related to land use and visual quality, but generally considers that implementation of the proposed program would have significant impacts on these resources if it were to:

Land Use

- Physically divide an existing community (Not evaluated in this section, see Appendix B)
- Conflict with any applicable land use plan, policy, or regulation of an agency with jurisdiction over the project (including but not limited to the general plan, specific plan, local coastal program, or zoning ordinance) adopted for the purpose of avoiding or mitigating an environmental effect (Evaluated in Section 4.2, Plans and Policies)
- Have any substantial impact on the existing character of the vicinity (Evaluated in this section)
- Substantially disrupt or displace existing land uses or land use activities (Evaluated in this section)

Visual Quality

- Have a substantial adverse effect on a scenic vista (Evaluated in this section)
- Substantially damage scenic resources, including but not limited to trees, rock outcroppings, and other features of the built or natural environment that contribute to a scenic public setting (Evaluated in this section)
- Substantially degrade the existing visual character or quality of the site and its surroundings (Evaluated in this section)
- Create a new source of substantial light or glare that would adversely affect day or nighttime views in the area or substantially affect other people or properties (Evaluated in this section)

Approach to Analysis

Land Use

This program-level land use analysis evaluates short-term impacts on existing land uses resulting from temporary construction activity as well as long-term impacts resulting from the siting of WSIP project facilities. Impacts specific to recreational and agricultural land uses are discussed in Sections 4.12 and 4.13, respectively.

Generally, construction and operation of most WSIP projects would occur at existing SFPUC facility sites or within existing SFPUC rights-of-way. Some projects would be constructed outside of existing CCSF-owned watersheds, land, or rights-of-way, and additional new land would need to be acquired for facilities and/or for temporary construction easements or staging areas (see Table 4.3-3). Information regarding potential WSIP facility locations and projects that might require land acquisition is based on the project siting and construction information, provided by the SFPUC; this information is summarized in Chapter 3 and further detailed in Appendix C for each of the WSIP projects.

Local planning documents and maps (including maps available electronically via the Internet) were reviewed to characterize existing land uses within proximity to the pipelines, tunnels, vaults/valve lots, pump stations, treatment facilities, and storage facilities proposed under the WSIP.

In suburban and urban areas, a considerable number of schools are located near proposed WSIP project sites (see Table 4.3-2). These schools have been identified because they represent the predominant land use that could be affected by WSIP construction activities. This list of schools is not necessarily a definitive list for each WSIP project site, since facility site locations have not yet been finalized for all WSIP projects. The evaluation of potential impacts on schools provides an indication of the potential extent to which WSIP projects might affect schools and other sensitive land uses.

Potential physical environmental effects on surrounding land uses resulting from implementation of the WSIP projects are addressed in the respective sections of this PEIR, including Section 4.7, Cultural Resources; Section 4.8, Traffic, Transportation, and Circulation; Section 4.9, Air Quality; Section 4.10, Noise and Vibration; and Section 4.12, Recreational Resources.

Visual Resources

The analysis of visual resources identifies potential temporary and permanent adverse visual impacts that WSIP projects could have on scenic vistas, as seen from scenic highways and local scenic roads, or on other visual resources identified by local jurisdictions. For the analysis of impacts on scenic vistas, information was compiled from Caltrans' list of designated scenic highways and from local governments' general plans. Local jurisdictions also identified other visual resources, such as trees, rock outcroppings, viewsheds, ridgelines, gateways, waterways, and open space corridors. It is expected that project-level visual assessments would be completed as part of separate, project-level CEQA review of individual WSIP projects, at which time

specific project design information would allow for a more detailed analysis of potential visual effects. Most of the potentially significant permanent visual impacts identified for each region would not likely result in significant impacts at the project level when specific information becomes available concerning the height, mass, and location of structures. However, this PEIR uses a conservative approach in order to identify all visual effects that could possibly be considered significant.

Impact Summary by Region

Table 4.3-1 provides a summary of potential land use and visual quality impacts associated with implementation of the WSIP. The summary includes the expected level of significance of each potential impact.

Construction Impacts

Impact 4.3-1: Temporary disruption or displacement of existing land uses during construction.

The construction of pipelines, tunnels, dams, and other WSIP facilities could result in temporary adverse land use impacts in the WSIP study area by causing a temporary disruption or displacement of existing land uses.

Most WSIP projects would involve improvements to existing SFPUC facilities that would occur within existing facility sites and SFPUC rights-of-way in areas isolated from other developed land uses, thereby reducing the likelihood for temporary land use disruption or conflicts during construction. However, some project facilities would involve construction on CCSF-owned land within densely developed areas or outside of CCSF-owned lands and thus would be more likely to affect adjacent land uses. In some project areas, temporary land use disruption due to adjacent construction activity could generate a combination of effects, including noise, vibration, dust, traffic congestion, and/or access disruption. Each of these potential construction effects is evaluated separately in the following sections: 4.8, Traffic, Transportation, and Circulation; 4.9, Air Quality; and 4.10, Noise and Vibration; however, the intensity or potential combination of these construction effects is considered in this section as a land use disruption issue.

In most cases, construction effects would be relatively short term and intermittent, and land use disruption would be considered less than significant. Furthermore, for all WSIP projects, the SFPUC would implement construction measures to limit certain temporary construction effects on nearby land uses. However, WSIP project construction activities could substantially disrupt certain land use activities in areas where the duration of construction is lengthy and/or these effects, either individually or combined, are particularly intense. For example, schools could be particularly sensitive to a combination of access restriction, noise, and dust from construction activities; these effects could substantially disrupt the indoor or outdoor activities at the school site, making it difficult to effectively continue the existing land use activity during the construction period. The potential for substantial temporary land use disruption is site and project specific and would be further assessed during separate, project-level CEQA environmental review of the WSIP

TABLE 4.3-1
POTENTIAL IMPACTS AND SIGNIFICANCE – LAND USE AND VISUAL RESOURCES

Projects	Project Number	4.3-1: Temporary disruption or displacement of existing land uses during construction	4.3-2: Permanent displacement or long-term disruption of existing land uses	4.3-3: Temporary construction impacts on scenic vistas or visual character	4.3-4: Permanent adverse impacts on scenic vistas or visual character	4.3-5: New permanent sources of light glare
San Joaquin Region						
Advanced Disinfection	SJ-1	LS	LS	LS	PSM	PSM
Lawrence Livermore Supply Improvements	SJ-2	LS	N/A	LS	LS	PSM
San Joaquin Pipeline System	SJ-3	PSM	PSU	LS	LS	PSM
Rehabilitation of Existing San Joaquin Pipelines	SJ-4	PSM	N/A	LS	N/A	PSM
Tesla Portal Disinfection Station	SJ-5	LS	LS	LS	PSM	PSM
Sunol Valley Region						
Alameda Creek Fishery Enhancement	SV-1	LS	N/A	LS	PSM	PSM
Calaveras Dam Replacement	SV-2	LS	N/A	LS	PSU	PSM
Additional 40-mgd Treated Water Supply	SV-3	LS	PSU	LS	LS	PSM
New Irvington Tunnel	SV-4	PSU	LS	LS	PSM	PSM
SVWTP – Treated Water Reservoirs	SV-5	LS	N/A	LS	LS	PSM
San Antonio Backup Pipeline	SV-6	LS	PSU	LS	PSM	PSM
Bay Division Region						
Bay Division Pipeline Reliability Upgrade	BD-1	PSM	PSU	LS	PSM	PSM
BDPL Nos. 3 and 4 Crossovers	BD-2	PSM	LS	LS	PSM	PSM
Seismic Upgrade of BDPL Nos. 3 and 4 at Hayward Fault	BD-3	LS	N/A	LS	N/A	PSM
Peninsula Region						
Baden and San Pedro Valve Lots Improvements	PN-1	LS	N/A	LS	LS	PSM
Crystal Springs/San Andreas Transmission Upgrade	PN-2	LS	PSU	LS	PSM	PSM
HTWTP Long-Term Improvements	PN-3	LS	N/A	LS	PSM	PSM
Lower Crystal Springs Dam Improvements	PN-4	LS	N/A	LS	PSM	PSM
Pulgas Balancing Reservoir Rehabilitation	PN-5	LS	N/A	LS	PSM	PSM
San Francisco Region						
San Andreas Pipeline No. 3 Installation	SF-1	PSM	N/A	LS	PSM	PSM
Groundwater Projects	SF-2	PSM	PSU	LS	PSM	PSM
Recycled Water Projects	SF-3	PSM	PSU	LS	PSM	PSM

LS = Less than Significant impact, no mitigation required
PSM= Potentially Significant impact, can be mitigated to less than significant
PSU = Potentially Significant Unavoidable impact
N/A = Not Applicable

projects. This program-level analysis considers the general WSIP project location information available at this time, the proximity to uses such as residential areas and schools, and the potential to displace these existing uses during construction.

Temporary land use displacement could result from the short-term use of properties adjacent to WSIP facility sites for equipment and materials staging areas and/or for temporary construction easements. The SFPUC constructs its facilities on CCSF-owned land to the extent feasible. However, in cases where construction easements or staging areas are required on non-CCSF-owned land, uses such as vacant lots, parking lots, and open space (parks and agricultural fields) on private or other public land could be temporarily displaced. The SFPUC and its construction contractors often have flexibility in locating temporary staging areas, and are typically able to identify staging sites that are acceptable to landowners for short-term use. Where a willing property owner makes arrangements for short-term property use during project construction, temporary displacement of an existing land use would be considered a less-than-significant impact. Potential changes in the existing land use character in the vicinity of these staging areas would also be less than significant due to the temporary or short-term nature of construction staging.

In other cases, however, temporary use of non-CCSF-owned land for construction activity or staging could constitute a potentially significant impact if the SFPUC has little to no flexibility in using a certain property, and the owner's use of the property would be halted or substantially reduced as a result of the temporary construction activity (e.g., a property next to an SFPUC facility requires repair or improvement, and that property must be used to access or work on the SFPUC facility). Mitigation measures such as providing the property owner with an acceptable alternate site for the displaced use could mitigate this impact to a less-than-significant level. Such relocation could temporarily alter the land use character in the vicinity of the displaced use; however, this effect would be less than significant due to its temporary nature.

The potential temporary land use conflicts resulting from construction of WSIP facilities are generally described below, first by facility type and then more specifically by region.

Pipelines. Where feasible, WSIP pipeline construction would be accomplished using standard open-cut or cut-and-cover construction methods, progressing at a rate of approximately 120 to 160 feet per day, depending on the presence of road, utility, or stream crossings. Staging areas would be required for stockpiling supplies and equipment close to the construction area. Depending on the location of staging areas and pipeline construction activities in relation to existing land uses, these activities have the potential to cause adverse but temporary land use impacts, either at the staging site or in proximity to pipeline alignments. While these impacts could be significant, they would for the most part be reduced to a less-than-significant level with the incorporation of mitigation measures, such as maintaining access to residences, installing noise barriers to minimize noise effects on adjacent uses, or prohibiting nighttime construction to avoid noise, vibration, and light and glare effects on nearby uses; however, a site-specific analysis would be necessary to characterize the existing land uses and the potential for impacts along each pipeline alignment. The level of impact significance from pipeline projects would depend on the pipeline's proximity to noise-sensitive land uses and the duration of construction at any one location.

Tunnels. Tunnel projects could affect existing land uses in the vicinity of entry/exit portal or shaft locations, which would serve as construction staging areas. Land use impacts could occur if the portals resulted in a disruption of onsite uses, if access to land uses were impeded by construction traffic or grading for new construction access roads, or if construction activities near sensitive land uses (such as residences or schools) lasted for an extended period of time. Tunneling operations typically occur 24 hours per day, as is being proposed by the SFPUC. One of the two tunnel portals (the entry portal) is designated as the location for most of the tunneling activity, involving the removal of the excavated spoils material, staging, and mobilization of the tunnel building materials and crew. While these activities would be temporary, lasting only as long as the tunnel construction requires, the construction activities and effects at the entry portal site are substantial and would last for an extended duration (a year or more). Land use disruption could be a significant effect on sensitive land uses near the active tunnel portal site. The level of impact significance from tunnel projects would depend on the project's proximity to existing land uses and the duration and severity of the impact.

Vaults, Valve Lots, and Crossover Facilities. These facilities would be constructed at isolated locations near existing SFPUC facilities along the regional system. Design would vary by location, but facilities would typically occupy approximately 4,000 square feet and would be partially or completely buried. Surface structures might be constructed to house associated electrical controls and emergency generators. Crossover structures could require permanent discharge or drainage piping for maintenance or emergency repairs. Construction activities would be confined to the immediate site vicinity. If these facilities are located in or near existing land uses, they could temporarily disrupt such uses.

Pump Stations. The WSIP includes proposals to construct new pump stations and to upgrade existing pump stations along the regional system. Upgrading pump stations, which would involve removing equipment and replacing it with new equipment, would not affect existing land uses. The construction of new pump stations could temporarily affect existing land uses if proposed facility sites are located on or in close proximity to existing uses.

Treatment Facilities. The WSIP includes proposals to upgrade and expand treatment facilities at two treatment plants as well as at the system's primary disinfection facility. Construction activities at existing treatment plants would occur within the property boundaries or on SFPUC lands and would not be expected to affect existing land uses. Temporary construction impacts associated with a new treatment facility would depend on the site location in relation to existing land uses.

Storage Facilities. The WSIP calls for improvements to water storage facilities, including reservoirs and dams. For reservoirs, construction activities would include excavation at the reservoir location, offsite hauling of excavated soils, installation of new pumping and electrical equipment, and seismic strengthening. Dam improvements would include raising the dam parapet wall at Lower Crystal Springs Dam and replacing Calaveras Dam. Construction activities at these WSIP project sites would not likely affect existing land uses since these projects are generally within undeveloped areas on property owned by the CCSF, except for offsite staging areas and adjacent access roadways in the Lower Crystal Springs Dam vicinity.

San Joaquin Region

Impact 4.3-1: Temporary disruption or displacement during construction		
Advanced Disinfection	SJ-1	LS
Lawrence Livermore	SJ-2	LS
SJPL System	SJ-3	PSM
SJPL Rehabilitation	SJ-4	PSM
Tesla Portal Disinfection	SJ-5	LS

The WSIP project sites within this region would be located in largely undeveloped areas that generally contain open space or agricultural uses. Of the five WSIP projects in the San Joaquin Region, three of the projects (Advanced Disinfection, SJ-1; Lawrence Livermore, SJ-2; and Tesla Portal Disinfection, SJ-5) would involve improvements at existing SFPUC facility sites that are situated in undeveloped areas and currently used for water system purposes. Thus, these projects would have a *less than significant* effect on existing land uses, since they would not disrupt or displace land uses during construction.

The SJPL System project (SJ-3) would entail construction of a new valve house at the Tesla Portal facility, open-trench construction of approximately 16 to 22 miles of pipeline, and construction of two crossover facilities for the existing San Joaquin Pipeline system. Most construction would occur within the existing SFPUC right-of-way, but additional right-of-way could be required to accommodate the pipeline, access roads, associated power facilities, or construction staging, depending on the final locations selected. The 10-mile western segment of the pipeline would extend through residential areas as well as the Tracy Golf and Country Club, which is located on both sides of the freeway. The temporary construction impacts of the SJPL System project could be *potentially significant* in this area due to the proximity of adjoining residential uses (in some cases residences could be within 100 feet of the right-of-way); the potential land use disturbance and disruption would primarily be associated with noise and recreation impacts.

The SJPL Rehabilitation project (SJ-4) would involve a condition assessment to determine the need for the rehabilitation of the existing San Joaquin Pipelines. Project construction, if needed, would occur at discrete locations along the pipeline alignment, although construction requirements for this project have not yet been identified. Since these pipelines extend through the city of Modesto and the southern margins of Riverbank and Oakdale, this project could result in temporary conflicts with existing rural suburban and urban land uses during construction, particularly through Modesto, which could be *potentially significant*. There are several schools located near this pipeline alignment, as listed in **Table 4.3-2**. The potential land use impacts of this project would be evaluated in more detail as part of separate, project-level CEQA review, which would identify appropriate mitigation measures, if needed, to reduce impacts to a less-than-significant level.

The potentially significant, temporary construction impacts associated with the SJPL System (SJ-3) and SJPL Rehabilitation (SJ-4) projects on adjacent land uses could be reduced to a less-than-significant level with implementation of SFPUC Construction Measure #1 (neighborhood notice), Construction Measure #3 (reduction of construction-related emissions), Construction Measure #5 (traffic control plan), Construction Measure #6 (compliance with local noise ordinances to the extent feasible), and Construction Measure #10 (construction site maintenance/ restoration), as well as mitigation measures identified in Chapter 6 under 4.8, Traffic,

TABLE 4.3-2
SCHOOLS LOCATED NEAR PROPOSED WSIP PROJECT SITES – PRELIMINARY LIST[a]

WSIP Project	School (District) Location
San Joaquin Region	
SJ-4: Rehabilitation of Existing San Joaquin Pipelines	▪ Agnes M. Elementary School (Stanislaus Union Elementary School District), Modesto ▪ Josephine Chrysler Elementary School (Stanislaus Union Elementary School District), Modesto ▪ George Eisenhut Elementary School (Stanislaus Union Elementary School District), Modesto
Sunol Valley Region – none	
Bay Division Region	
BD-1: BDPL Reliability Upgrade	▪ Walters Junior High School (Fremont Unified School District), Fremont ▪ Mission San Jose High School (Fremont Unified School District), Fremont ▪ Bunker Elementary School (Newark Unified School District), Newark ▪ Cesar Chavez Academy (Ravenswood City School District), East Palo Alto ▪ Constaño Elementary School (Ravenswood City School District), East Palo Alto ▪ Belle Haven Elementary School (Ravenswood City School District), Menlo Park ▪ James Flood Magnet School (Ravenswood City School District), Menlo Park ▪ Gill School (Redwood City School District), Redwood City ▪ Hawes School (Redwood City School District), Redwood City ▪ Washington School (Redwood City School District), Redwood City
BD-2: BDPL 3 and 4 Crossovers	▪ San Jose Elementary School (San Jose Unified School District), San Jose ▪ Gunn High School (Palo Alto Unified School District), Palo Alto
Peninsula Region – none	
San Francisco Region	
SF-2: Groundwater Projects	▪ Francisco Scott Key School (San Francisco Unified School District), San Francisco

[a] Because many WSIP project locations are still under development by the SFPUC, this preliminary list is not considered definitive, but rather serves to highlight project areas where schools could be affected by the WSIP projects.

SOURCE: ESA+Orion (compiled from map review).

Transportation, and Circulation (Measures 4.8-1a and 4.8-1b); 4.9, Air Quality (Measures 4.9-1a, 4.9-1b, and 4.9-2a); 4.10, Noise and Vibration (Measures 4.10-1a, 4.10-2a, 4.10-2b, 4.10-3a, and 4.10-3b); and 4.12, Recreational Resources (Measure 4.12-1). It is expected that the SFPUC and its contractors would be able to make arrangements with willing property owners for temporary staging areas such that displacement of existing land uses would not be a significant impact. Separate, project-level CEQA review would be conducted on these projects to determine if potential land use disruption impacts would occur and to refine the mitigation measures to address site-specific conditions if appropriate.

Sunol Valley Region

Impact 4.3-1: Temporary disruption or displacement of existing land uses during construction		
Alameda Creek Fishery	SV-1	LS
Calaveras Dam	SV-2	LS
40-mgd Treated Water	SV-3	LS
New Irvington Tunnel	SV-4	PSU
Treated Water Reservoirs	SV-5	LS
SABUP	SV-6	LS

The WSIP project sites in the Sunol Valley Region are largely within undeveloped areas or Alameda watershed lands. Construction impacts associated with the Alameda Creek Fishery (SV-1) and Treated Water Reservoirs (SV-5) projects would be *less than significant*, as construction activities would occur on or near existing SFPUC facilities currently used for water system purposes, or within undeveloped areas that are not in the immediate vicinity of sensitive developed land uses.

The Calaveras Dam project (SV-2) would replace the existing Calaveras Dam and restore the capacity of Calaveras Reservoir. This project would require closure of the southern section of Calaveras Road during the two- to three-year construction period, temporarily blocking access to the Sunol Regional Wilderness from the south. The Sunol Regional Wilderness would remain accessible from the north during project construction, and this temporary impact would therefore be *less than significant*. The effects of closing Calaveras Road are discussed in detail in Section 4.8, Traffic, Transportation, and Circulation, and Section 4.12, Recreational Resources. The 40-mgd Treated Water project (SV-3) would include improvements to the Sunol Valley WTP as well as construction of a two-mile pipeline to connect to the Alameda Siphons or the New Irvington Tunnel. This project would also use Calaveras Road for access, but would not require temporary closure of this road. This project would also require temporary and permanent use of private property for installation of the new pipeline within a new easement.

Project construction of the Calaveras Dam (SV-2), 40-mgd Treated Water (SV-3), and SABUP (SV-6) projects would temporarily disrupt access from Calaveras Road to adjacent land uses, including nurseries, quarry operations, and large-lot residential uses. This impact would be temporary and intermittent and would be *less than significant* with implementation of SFPUC Construction Measure #5 (traffic control plan), which is designed to preserve access to these land uses. Establishment of a permanent easement across private property for the new pipeline and potential temporary use of additional private property during construction under the 40-mgd Treated Water and SABUP projects would displace land now used in the Sunol Valley area for agriculture (ranchland or nurseries); however, given the relatively narrow swath of land required for pipeline installation, the extent of this displacement and the potential for land use disruption on surrounding land would be *less than significant*. In addition, following project completion, agricultural use on the surface could likely resume.

Construction of the New Irvington Tunnel project (SV-4) would require construction of two new tunnel portals and associated construction staging areas. The new portal in the Sunol Valley would be about 75 feet south of the existing Alameda West Portal, and the new portal in Fremont would be about 175 feet south of the existing Irvington Portal. The new portal in the Sunol Valley would be in the vicinity of a privately owned ranch located to the south. In addition, construction staging would require temporary use of the northern portion of the private ranch property for construction

staging. As currently planned, the majority of the tunneling construction activity and staging would occur at the new portal in the Sunol Valley. As a result, the ranch property would experience 24-hour construction effects for the full duration of the tunneling activity. Although implementation of several SFPUC construction measures (#1, neighborhood notice; #3, reduction of construction-related emissions; #6, compliance with local noise ordinances to the extent feasible; #10, construction site maintenance/restoration) and other mitigation measures identified in this PEIR (Traffic Measure 4.8-1, Air Quality Measures 4.9-1 and 4.9-2, and Noise Measures 4.10-1 through 4.10-3) would reduce the impact of the tunneling activity on the neighboring ranch property, the residual impacts would remain *potentially significant and unavoidable*. Separate, project-level CEQA review of this project would determine the extent and severity of this impact and determine if mitigation measures could reduce the effects to a less-than-significant level. On the west end of the tunnel, the new west portal would be constructed in the vicinity of single-family residences located west of the Irvington Portal in the city of Fremont. Although this portal would not host the majority of the tunneling activity, tunnel completion activity at this portal would have the potential to significantly disrupt nearby residential uses. This activity would take place over a period of months, involve 24-hour construction work at times, and occur in close proximity to several homes.

With the exception of construction disruption effects at the two new portals for the New Irvington Tunnel (SV-4), the potential short-term land use disruption effects at WSIP project sites in this region would be less than significant with implementation of SFPUC Construction Measure #1 (neighborhood notice), Construction Measure #3 (reduction of construction-related emissions), Construction Measure #5 (traffic control plan), Construction Measure #6 (compliance with local noise ordinances to the extent feasible), and Construction Measure #10 (construction site maintenance/restoration).

The potential land use impacts associated with the Calaveras Dam project (SV-2), 40-mgd Treated Water project (SV-3), and the New Irvington Tunnel (SV-4) would also be evaluated in more detail as part of separate, project-level CEQA review. This review would identify appropriate mitigation measures, if needed, to reduce this impact to a less-than-significant level.

Bay Division Region

Impact 4.3-1: Temporary disruption or displacement of existing land uses during construction		
BDPL Reliability Upgrade	BD-1	PSM
BDPL 3 and 4 Crossovers	BD-2	PSM
BDPL 3 and 4 Seismic Upgrade at Hayward Fault	BD-3	LS

The Bay Division facilities are located in urbanized areas that are more densely developed than the outlying study area regions. Construction of the BDPL Reliability Upgrade (BD-1), BDPL 3 and 4 Crossovers (BD-2), and BDPL 3 and 4 Seismic Upgrade at Hayward Fault (BD-3) projects could potentially affect existing land uses, since WSIP construction would occur in densely developed areas and near uses that are potentially sensitive to construction effects such as schools and residences.

Of the WSIP projects proposed for construction in the Bay Division Region, the BDPL Reliability Upgrade project (BD-1) would have the most extensive impact on existing land uses. This project would consist of approximately 16 miles of pipeline and 5 miles of bay tunnel extending from Fremont and Newark in southern Alameda County through East Palo Alto, Menlo Park, and Redwood City and unincorporated areas in the central-eastern portion of San Mateo County.

There are a number of schools located on, adjacent to, or near the BDPL Reliability Upgrade (BD-1) pipeline alignment, as listed in Table 4.3-2. While the 16-mile project alignment crosses a wide range of land uses, schools are called out because these facilities are particularly sensitive to construction emissions and noise impacts, more vulnerable to safety hazards, and typically do not have alternative locations where construction impacts could be avoided. Depending on the specific location, schedule, and type of construction activity, temporary conflicts with and disruption to school uses during construction could be *potentially significant*, particularly along the open-trench sections of the pipeline. However, pipeline construction activities would move to the next segment as installation of the pipeline occurs, so that construction activities for this pipeline project would generally not occur at any one location for an extended period of time.

The BDPL Reliability Upgrade project's (BD-1) *potentially significant* impact related to land use disruption during construction would be reduced to a less-than-significant level with implementation of SFPUC Construction Measure #1 (neighborhood notification), Construction Measure #3 (reduction of construction-related emissions), Construction Measure #5 (traffic control plan), Construction Measure #6 (compliance with local noise ordinances to the extent feasible), and Construction Measure #10 (construction site maintenance/restoration), in addition to mitigation measures identified in Chapter 6 (under 4.8, Traffic, Transportation, and Circulation (Measures 4.8-1a and 4.8-1b); 4.9, Air Quality (Measures 4.9-1c, 4.9-1d, and 4.9-2a); and 4.10, Noise and Vibration (Measures 4.10-1a, 4.10-2a, 4.10-2b, 4.10-3a, and 4.10-3b). The potential land use impacts of this project would be evaluated in more detail as part of separate, project-level CEQA review, during which appropriate, site-specific mitigation measures would be tailored as needed to reduce impacts to a less-than-significant level.

The BDPL 3 and 4 Crossovers project (BD-2) would involve construction of pipeline crossovers at three separate locations along a 32-mile stretch of the existing Bay Division Pipelines Nos. 3 and 4. One of these crossover locations would be near an existing water storage facility. The two other locations would be near Barron Creek, adjacent to the running track and sports fields at Gunn High School in Palo Alto, and another would be near an existing publicly accessible nature area. Temporary construction impacts could be *potentially significant* in areas adjacent to these two crossovers, but could be reduced to a less-than-significant level with implementation of SFPUC Construction Measure #1 (neighborhood notification), Construction Measure #3 (reduction of construction-related emissions), Construction Measure #5 (traffic control plan), Construction Measure #6 (compliance with local noise ordinances to the extent feasible), and Construction Measure #10 (construction site maintenance/restoration), as well as mitigation measures identified in Chapter 6 (under 4.8, Traffic, Transportation, and Circulation (Measures 4.8-1a and 4.8-1b); 4.9, Air Quality (Measures 4.9-1c, 4.9-1d, and 4.9-2a); and 4.10, Noise and Vibration (Measures 4.10-1a, 4.10-2a, 4.10-2b, 4.10-3a, and 4.10-3b).

The third WSIP project in the Bay Division Region is the BDPL 3 and 4 Seismic Upgrade at Hayward Fault (BD-3). Construction would be conducted in existing SFPUC right-of-way on either side of the I-680/Mission Boulevard interchange. As there are no sensitive land uses nearby, temporary construction impacts of BD-3 would be *less than significant*.

Peninsula Region

Impact 4.3-1: Temporary disruption or displacement of existing land uses during construction		
Baden and San Pedro Valve Lots	PN-1	LS
CS/SA Transmission	PN-2	LS
HTWTP Long-Term	PN-3	LS
Lower Crystal Springs Dam	PN-4	LS
Pulgas Balancing Reservoir	PN-5	LS

Construction of the Baden and San Pedro Valve Lots (PN-1) and HTWTP Long-Term (PN-3) projects within the Peninsula Region would occur on existing SFPUC facility sites; thus, no land use disruption or displacement would occur. Although there is residential development near the Baden and Harry Tracy WTP facility sites, it is expected that with implementation of SFPUC Construction Measure #1 (neighborhood notification), Construction Measure #3 (reduction of construction-related emissions), Construction Measure #5 (traffic control plan), Construction Measure #6 (compliance with local noise ordinances to the extent feasible), and Construction Measure #10 (construction site maintenance/restoration), temporary community disruption impacts during construction would be *less than significant*.

The CS/SA Transmission (PN-2), Lower Crystal Springs Dam (PN-4), and Pulgas Balancing Reservoir (PN-5) projects are located in unincorporated San Mateo County, outside of urbanized areas. Construction activities for these facilities would not affect existing land uses, with the exception of recreational uses. These projects are in the vicinity of recreational facilities on the Peninsula watershed, including Crystal Springs Golf Course and Sawyer Camp Trail (CS/SA Transmission project) and the Pulgas Water Temple (Pulgas Balancing Reservoir). Lower Crystal Springs Dam construction activity would be coordinated with the County's replacement of the San Mateo County Bridge. This bridge, along with a nearby vista point, provides sightseeing opportunities of the reservoir. There is a parking area north of the bridge for sightseers. Project construction could disturb recreational users and disrupt recreational uses. This impact would be *less than significant* for these three projects with implementation of SFPUC Construction Measure #1 (neighborhood notification), Construction Measure #3 (reduction of construction-related emissions), Construction Measure #5 (traffic control plan), Construction Measure #6 (compliance with local noise ordinances to the extent feasible), and Construction Measure #10 (construction site maintenance/restoration). Potential temporary land use impacts during project construction would be assessed in more detail as part of separate, project-level CEQA review for each of these three projects.

San Francisco Region

Impact 4.3-1: Temporary disruption or displacement of existing land uses during construction		
SAPL 3 Installation	SF-1	PSM
Groundwater Projects	SF-2	PSM
Recycled Water Projects	SF-3	PSM

Within the San Francisco Region, all WSIP facilities would be constructed in a dense urban environment with a mix of uses, including schools. The SAPL 3 Installation (SF-1) project could result in potentially significant short-term disturbance of adjacent residential land uses due to the proximity of residences along the pipeline alignment in some locations (less than 25 feet in some areas). Although pipeline construction activities do not generally occur for extended periods of time in any one area, in some cases, such as in areas of jack-and-bore operations or difficult construction (e.g., around other existing major underground utilities), construction activities could occur for several weeks. If construction activities occurred for extended periods near residences, schools, or other sensitive uses, the combination of construction effects (including noise, vibration, dust, traffic congestion, and access restrictions) could result in significant short-term land use disruption impacts. This *potentially significant* impact would be reduced to a less-than-significant level with implementation of SFPUC Construction Measure #1 (neighborhood notification), Construction Measure #3 (reduction of construction-related emissions), Construction Measure #5 (traffic control plan), Construction Measure #6 (compliance with local noise ordinances to the extent feasible), and Construction Measure #10 (construction site maintenance/restoration), as well as mitigation measures identified in Chapter 6 (under 4.8, Traffic, Transportation, and Circulation (Measures 4.8-1a and 4.8-1b); 4.9, Air Quality (Measures 4.9-1c, 4.9-1d, and 4.9-2a); and 4.10, Noise and Vibration (Measures 4.10-1a, 4.10-2a, 4.10-2b, 4.10-3a, and 4.10-3b).

The SAPL 3 Installation (SF-1) project could also require additional rights-of-way for construction staging, stockpiling, and laydown areas. While it is expected that the SFPUC and its contractors would be able to make arrangements with willing property owners for temporary staging areas (such that displacement of existing land uses would not be a significant impact), there is the potential for significant short-term land use displacement to occur. Implementation of SFPUC Construction Measure #1 and Construction Measure #10 result in a less than significant impact on displacement of existing land uses.

Under the Groundwater Projects (SF-2), new groundwater wells would be installed at various locations within San Francisco and the upper Peninsula region in urban, suburban, and perhaps open space areas. One proposed location for a new well is Francis Scott Key Elementary School in San Francisco (in the parking lot of the annex structures). Well installation involves 24-hour drilling activities, which could disrupt sensitive land uses such as schools and nearby residential uses. This *potentially significan*t impact would be reduced to a less-than-significant level with implementation of SFPUC Construction Measure #1 (neighborhood notification, including the provision for coordinating the construction schedule with school facility managers), Construction Measure #3 (reduction of construction-related emissions), Construction Measure #5 (traffic control plan), Construction Measure #6 (compliance with local noise ordinances to the extent feasible), and Construction Measure #10 (construction site maintenance/restoration), as well as mitigation measures identified in Chapter 6 (under 4.8, Traffic, Transportation, and Circulation

(Measures 4.8-1a and 4.8-1b); 4.9, Air Quality (Measures 4.9-1c, 4.9-1d, and 4.9-2a); and 4.10, Noise and Vibration (Measures 4.10-1a, 4.10-2a, 4.10-2b, 4.10-3a, and 4.10-3b). Potential impacts associated with these projects would be assessed in more detail as part of separate, project-level CEQA review.

The Recycled Water Projects (SF-3) facilities would be constructed within urban residential and commercial neighborhoods in San Francisco. Potential sites for treatment and storage facilities are located adjacent to the San Francisco Zoo and in the vicinity of Lincoln Park. Temporary construction impacts could be *potentially significant* in some areas, such as near schools and close to residences. Implementation of SFPUC Construction Measure #1 (neighborhood notification), Construction Measure #3 (reduction of construction-related emissions), Construction Measure #5 (traffic control plan), Construction Measure #6 (compliance with local noise ordinances to the extent feasible), and Construction Measure #10 (construction site maintenance/restoration), as well as mitigation measures identified in Chapter 6 (under 4.8, Traffic, Transportation, and Circulation (Measures 4.8-1a and 4.8-1b); 4.9, Air Quality (Measures 4.9-1c, 4.9-1d, and 4.9-2a); and 4.10, Noise and Vibration (Measures 4.10-1a, 4.10-2a, 4.10-2b, 4.10-3a, and 4.10-3b) would reduce temporary construction effects of the Recycled Water Projects to a less-than-significant level. It is expected that the SFPUC and its contractors would be able to make arrangements with willing property owners for temporary staging areas such that displacement of existing land uses would not be a significant impact. Potential impacts of proposed recycled water facilities would be assessed in more detail as part of separate, project-level CEQA review.

Long-Term Facility Siting Impacts

Impact 4.3-2: Permanent displacement or long-term disruption of existing land uses.

This section addresses potential impacts on existing land uses associated with permanent operation and siting of WSIP facility projects in each region. Siting and operation of proposed WSIP facilities could, under certain circumstances, result in adverse impacts on existing land uses in the project regions. Adverse land use impacts would not be expected to occur for WSIP facilities constructed on CCSF-owned land used for water system purposes, as these projects would neither displace or relocate an existing land use nor change an existing water system use. Therefore, WSIP projects on CCSF-owned land would not result in adverse effects on surrounding uses, as land use conditions would remain similar. For WSIP projects where acquisition of non-CCSF-owned land would be required to build, operate, or access a WSIP project facility or facility component (e.g., discharge outfall of a pipeline), adverse impacts could occur if the WSIP facilities located on non-CCSF-owned property were not compatible with the surrounding land uses or would result in the permanent displacement of an existing land use.

Most of the WSIP projects would be located on CCSF-owned property on, or adjacent to, existing SFPUC facilities, and the SFPUC would seek to locate any required ancillary or additional easements on CCSF-owned land to the extent feasible. Eight WSIP projects have been identified

to date that would require acquisition of additional permanent easements or property (see **Table 4.3-3**). (In developing detailed plans for the WSIP projects, the SFPUC may identify other land acquisition requirements for WSIP projects in addition to those listed here. This program-level analysis describes the nature and magnitude of potential land use effects that could result from such land acquisition.) Additional land acquisition could be required to access existing or new facilities, construct new facility components, and/or to expand or upgrade existing facilities. In most cases, land acquisition would be required for new pipeline alignments and relatively minor facility components such as access roads, power utilities, or a new discharge outfall. Land acquisition would almost always occur next to or near existing SFPUC facilities sites that are within existing SFPUC right-of-way and that have been zoned or designated as a public facility or water system use. Acquisition of permanent easement and property could have a significant land use effect if such acquisition displaced an existing use that would be difficult to relocate. For WSIP projects located entirely on CCSF-owned property and where no land acquisition is required (as listed in Table 4.3-3), displacement or relocation of an existing land use would not occur, and land use impacts related to displacement would not be applicable.

San Joaquin Region

Impact 4.3-2: Permanent displacement or long-term disruption of existing land uses

Advanced Disinfection	SJ-1	LS
Lawrence Livermore	SJ-2	N/A
SJPL System	SJ-3	PSU
SJPL Rehabilitation	SJ-4	N/A
Tesla Portal Disinfection	SJ-5	LS

The WSIP project sites in the San Joaquin Region are within largely undeveloped areas that contain open space or agricultural uses, except for the city of Modesto, a moderately dense urban center. Three projects in this region could require land acquisition outside of the SFPUC right-of-way.

The Advanced Disinfection (SJ-1), SJPL System (SJ-3), and Tesla Portal Disinfection (SJ-5) projects could each require land acquisition outside of the SFPUC right-of-way for power equipment and structures and access roads. Generally, a relatively narrow strip of land would be required to extend new or additional power service infrastructure to the site (i.e., underground or aboveground powerlines), and a small additional site could be required for power station facilities. Given that these three project sites are for the most part located in undeveloped, agricultural areas, it is likely that power facilities could be sited along the margin of existing roads and/or private properties without causing significant land use displacement or disruption. For the Advanced Disinfection and Tesla Portal Disinfection projects, this impact is expected to be *less than significant*.

Agriculture is the predominant land use along the pipeline segments of the SJPL System project (SJ-3); however, rural and suburban residential and recreational uses are also located adjacent to the alignment, including the Tracy Golf and Country Club near I-580. Since the locations of power supply facilities have not yet been determined, the PEIR analysis errs on the conservative side and has determined that any permanent displacement of these existing residential or recreational uses would be a *potentially significant and unavoidable* impact. It is possible that this impact could be reduced to a less-than-significant level by implementing the recommendations of facility siting studies for power facilities and access roads (Measure 4.3-2). Although it is expected

TABLE 4.3-3
POTENTIAL LAND ACQUISITION REQUIRED OUTSIDE OF SFPUC RIGHT-OF-WAY

No.	Project Title	Potential Need for Permanent Easement or Land Acquisition
SJ-1	Advanced Disinfection	Land possibly needed for associated power infrastructure requirements.
SJ-2	Lawrence Livermore Supply Improvements	None at Thomas Shaft site.
SJ-3	San Joaquin Pipeline System	Additional right-of-way/easement possibly needed for associated power requirements and access roads. Presumably, power facilities would be located near two new crossovers (both located in Stanislaus County, with one about 20 miles east of Modesto and the other about 15 miles west of Modesto).
SJ-4	Rehabilitation of Existing San Joaquin Pipelines	None
SJ-5	Tesla Portal Disinfection Facility	Land possibly needed for associated power infrastructure requirements.
SV-1	Alameda Creek Fishery Enhancement	None
SV-2	Calaveras Dam Replacement	None
SV-3	Additional 40-mgd Treated Water Supply	Easement possibly needed across private property for new pipeline.
SV-4	New Irvington Tunnel	Could need additional right-of-way/easement for access to new west portal in Fremont.
SV-5	SVWTP – Treated Water Reservoirs	None
SV-6	San Antonio Backup Pipeline	Potential land acquisition to be determined (possible easement for new pipeline).
BD-1	Bay Division Pipeline Reliability Upgrade	Easements could be required along the existing Bay Division Pipeline right-of-way for access along the alignment. An easement could be required north of the Hayward fault crossing. Other easements would be required in the areas near the beginning (Irvington Portal area) and terminus (Newark Valve House area) of the eastern pipeline segments within Fremont and Newark; and the beginning (Ravenswood Valve House) and terminus (Edgewood Valve Lot) at the eastern segment within East Palo Alto and the unincorporated Edgewood community in San Mateo County.
BD-2	BDPL Nos. 3 and 4 Crossovers	Additional right-of-way/easement could be needed for permanent discharge outfalls at all three locations. Preferred locations are in undeveloped areas on Veterans Administration Medical Center–Gunn High School lands (Barron Creek), Ulistac Natural Area (Guadalupe Creek), and reservoir lands (Bear Gulch).
BD-3	Seismic Upgrade of BDPL Nos. 3 and 4 at Hayward Fault	None
PN-1	Baden and San Pedro Valve Lots Improvements	None
PN-2	Crystal Springs/San Andreas Transmission Upgrade	Land acquisition to be determined.
PN-3	HTWTP Long-term Improvements	None
PN-4	Lower Crystal Springs Dam Improvements	None
PN-5	Pulgas Balancing Reservoir Rehabilitation	None
SF-1	San Andreas Pipeline No. 3 Installation	None
SF-2	Groundwater Projects	None within San Francisco for local projects (these would be on CCSF-owned property or in public right-of-way). Regional projects – acquisition to be determined. None in San Francisco (all sites located on city property, except one located at Francis Scott Key School on school district property).
SF-3	Recycled Water Projects	None but proposed sites on CCSF-owned property developed with other uses. Treatment Plant Site: Oceanside Water Pollution Control Plant / San Francisco Zoo vicinity; Storage: Golden Gate Park (existing 2-million-gallon reservoir); another could be required in the Lincoln Park area, which is owned/operated by the San Francisco Recreation & Park Department.

SOURCE: SFPUC (see Appendix C, Table C.1).

that power supply facilities could be located to avoid permanent impacts on existing land uses, the significance of any potential land use impacts would be evaluated as part of separate, project-level CEQA review, and this evaluation would determine if impacts could be mitigated to a less-than-significant level. Following project construction and installation of power supply facilities, no long-term disruption of adjacent land uses would result from operation of the pipelines.

The Lawrence Livermore (SJ-2) and SJPL Rehabilitation (SJ-4) projects would not require acquisition of land or right-of-way. Therefore, these projects would not have long-term land use impacts due to permanent displacement or disruption of existing land uses, and this impact would *not apply*.

Sunol Valley Region

Impact 4.3-2: Permanent displacement or long-term disruption of existing land uses		
Alameda Creek Fishery	SV-1	N/A
Calaveras Dam	SV-2	N/A
40-mgd Treated Water	SV-3	PSU
New Irvington Tunnel	SV-4	LS
Treated Water Reservoirs	SV-5	N/A
SABUP	SV-6	PSU

Two projects in this region, the 40-mgd Treated Water (SV-3) and New Irvington Tunnel (SV-4), would require acquisition of land outside of the existing SFPUC right-of way.

The Treated Water Reservoirs (SV-5) project would be entirely contained within existing SFPUC facilities, and therefore this impact would not be applicable to this project. The Alameda Creek Fishery (SV-1) and Calaveras Dam (SV-2) projects would involve development of new facilities on currently undeveloped sites, but entirely within Alameda watershed lands owned by the CCSF. Therefore, these projects would not displace or disrupt any existing land uses, and this impact would *not apply* to these projects. The SFPUC has not yet determined if land would need to be acquired for the SABUP project (SV-6). However, to address the remote possibility that acquisition of additional pipeline easement on private property might be necessary, the PEIR analysis errs on the conservative side and has determined that any permanent displacement of existing uses would be a *potentially significant and unavoidable* impact. It is possible that this impact could be reduced to a less-than-significant level by implementing the recommendations of facility siting studies (Measure 4.3-2). Although it is expected that project facilities could be located to avoid permanent impacts on existing land uses, the significance of any potential land use impacts would be evaluated as part of separate, project-level CEQA review, and this evaluation would determine if impacts could be mitigated to a less-than-significant level.

The 40-mgd Treated Water project (SV-3) could require a permanent easement across private property adjacent to the Sunol Valley WTP for a new pipeline, although a specific alignment for this pipeline has not yet been determined. Existing land uses in the Sunol Valley, besides SFPUC water system facilities and public open space and recreation uses, include rangeland, nurseries, and quarries. The proposed easement would occupy a relatively narrow strip of land, and it is likely that the existing land use activities could return following pipeline installation. While it is expected that the proposed pipeline easement could be located without significant permanent impacts on existing land uses (i.e., the need to relocate the existing use), the PEIR analysis errs on

the conservative side and has determined that any permanent impacts on existing uses would be a *potentially significant and unavoidable* impact. It is possible that this impact could be reduced to a less-than-significant level by implementing the recommendations of facility siting studies (Measure 4.3-2). Although it is expected that project facilities could be located to avoid permanent impacts on existing land uses, the significance of any potential land use impacts would be evaluated as part of separate, project-level CEQA review, and this evaluation would determine if impacts could be mitigated to a less-than-significant level.

The New Irvington Tunnel project (SV-4) would require construction of two new tunnel portals and associated construction staging areas. This project also involves construction of a new access road within existing SFPUC right-of-way to accommodate truck traffic during construction and provide permanent site access. The new road would be located within the SFPUC's existing Bay Division Pipeline easement up to the Irvington Portal area, adjacent to residences in Fremont. This existing right-of-way extends through a residential neighborhood and creates an undeveloped, open space corridor behind these homes. The proposed access road would be a distinct change of land use from the current condition and use. Although this change in use could be significant during the construction phase when the road would be used by construction vehicles (see Impact 4.3-1, above), long-term use of this road would be limited to SFPUC maintenance vehicles and would be a continuation of an existing SFPUC water-related corridor and use (i.e., an access road), which would limit the potential for long-term disruption of existing residences. Therefore, this impact would be *less than significant*.

The New Irvington Tunnel project (SV-4) would also require acquisition of several parcels of land in the vicinity of the existing Irvington Tunnel in order to extend the new access road to the new portal on the west side of the new tunnel. This land is currently undeveloped and zoned for large-lot residential use. The proposed new access road could reduce the size and alter the configuration of some of these undeveloped parcels, but would not preclude future residential development and use in this area. Potential effects with respect to future residential use of this area would be less than significant.

Bay Division Region

Impact 4.3-2: Permanent displacement or long-term disruption of existing land uses		
BDPL Reliability Upgrade	BD-1	PSU
BDPL 3 and 4 Crossovers	BD-2	LS
BDPL 3 and 4 Seismic Upgrade at Hayward Fault	BD-3	N/A

The BDPL Reliability Upgrade (BD-1) and BDPL 3 and 4 Crossovers (BD-2) projects would be located in densely urbanized areas that include a mix of land uses. The BDPL Reliability project involves approximately 16 miles of pipeline and 5 miles of bay tunnel extending from Fremont and Newark in southern Alameda County through East Palo Alto, Menlo Park, and Redwood City and unincorporated areas in the central-eastern portion of San Mateo County. The existing right-of-way crosses through urban areas with a mix of land uses, including residential and school uses. A narrow strip of additional land adjacent to the existing SFPUC right-of-way would need to be acquired for pipeline easements along the BDPL Reliability Upgrade alignment. This additional land would be on the order of 5 to 15 feet wide, extending up to one-half mile or more. New

easements could be required in areas north of the Hayward fault crossing, and in the vicinities of the Newark and Ravenswood Valve Houses and the Edgewood Valve Lot. Except for the Hayward fault location in a residential area, the proposed easements are adjacent to existing SFPUC facilities and are within undeveloped lands in industrial or open space areas; in the Hayward fault crossing location, the pipeline extends through residential areas.

Establishing this additional easement would impose some restrictions on land uses within the easement, but would not necessarily prohibit continuation of the existing land use. For example, the new easement might be established along the border of residential backyards adjacent to the current Bay Division Pipeline right-of-way or along the border of a park where the open areas, playfields, and gardens now present could be restored following pipeline installation. Similarly, the new easement might extend across a commercial property in a back parking lot or storage area, the use of which could be restored following pipeline construction. In other cases, some existing structures might need to be relocated, which could restrict the current use. In general, land uses and activities that make use of open, outdoor space could likely continue within the new easement area, while uses that involve permanent structures would need to be relocated, outside of the easement. In such cases, it might be possible to relocate structures such as garages or storage facilities elsewhere on the same property but outside the required easement area, thus resulting in a minor modification of the existing site use and land use configuration. The site-specific impacts on existing land uses of establishing additional pipeline easements would be analyzed in separate, project-level CEQA review of the BDPL Reliability Upgrade project (BD-1). While it is expected that the proposed pipeline easement could be located without the need to relocate an existing use, the PEIR analysis errs on the conservative side and has determined that any permanent impacts on existing uses would be a *potentially significant and unavoidable* impact. It is possible that this impact could be reduced to a less-than-significant level by implementing the recommendations of facility siting studies (Measure 4.3-2). Although it is expected that project facilities could be located to avoid permanent impacts on existing land uses, the significance of any potential land use impacts would be evaluated as part of separate, project-level CEQA review, and this evaluation would determine if impacts could be mitigated to a less-than-significant level. This project, an underground pipeline, would not result in long-term operational effects that would be incompatible with surrounding uses and thus would not result in permanent land use disruption.

Within the BDPL Reliability Upgrade project (BD-1) alignment, a number of existing land uses or improvements have encroached onto the SFPUC right-of-way, including residential fencing, schoolyards, play fields, landscaping, and parking lots. These uses would be removed or would be otherwise authorized (e.g., SFPUC leases or permits) according to the policies and procedures set forth in the SFPUC Right-of-Way Encroachment Removal Policy (SFPUC, 2007). The removal or authorization of these encroachments is not part of the BDPL Reliability Upgrade, as the SFPUC would enforce its encroachment removal policy with or without implementation of this project. Therefore, removal of these uses would not constitute a permanent displacement or change in land use for purposes of this PEIR.

The BDPL 3 and 4 Crossovers project (BD-2) would involve construction of pipeline crossovers at three separate locations along a 32-mile stretch of the existing Bay Division Pipelines Nos. 3 and 4. Additional right-of-way or easements could be required for discharge outfalls associated with the crossover facilities at three locations: Guadalupe Creek in Santa Clara, Bear Gulch Reservoir in Atherton, and Barron Creek in Palo Alto. The proposed outfalls would be installed within creek corridors; although temporary disruption of such uses as recreation trails might occur, these uses would be restored following installation, and no long-term displacement of existing land use activities would occur. The crossover and discharge outfall near Barron Creek is adjacent to the running track and sports fields at Gunn High School in Palo Alto; it is not known at this time if any easement would be required on the school property. However, placement of a new crossover facility near an open sports field would not restrict, disrupt, or displace existing uses. Also, the crossover facility would be located near, and would be similar in use to, the existing outfall facility at Barron Creek and thus would not constitute a change in use. This project would not result in long-term operational effects that would be incompatible with surrounding uses and thus would not result in permanent land use disruption. Therefore, these long-term operational impacts would be *less than significant*.

The BDPL 3 and 4 Seismic Upgrade at Hayward Fault project (BD-3) would involve improvements at an existing CCSF-owned facility site that is currently used for water system purposes. No new land uses would be introduced to this site, nor would this project require the acquisition of additional property. Therefore, this would not displace or disrupt any existing land uses, and this impact would *not apply*.

Peninsula Region

Impact 4.3-2: Permanent displacement or long-term disruption of existing land uses

Baden and San Pedro Valve Lots	PN-1	N/A
CS/SA Transmission	PN-2	PSU
HTWTP Long-Term	PN-3	N/A
Lower Crystal Springs Dam	PN-4	N/A
Pulgas Balancing Reservoir	PN-5	N/A

The five WSIP project sites within the Peninsula Region would be located within existing SFPUC facilities or on SFPUC right-of-way or property. They would not involve the acquisition of additional land, with the possible exception of the CS/SA Transmission project (PN-2). Therefore, with the possible exception of PN-2, this impact would *not apply* to these projects.

At this time, the SFPUC believes that the CS/SA Transmission project (PN-2) would not require additional easement or land acquisition. If replacement of the existing pipeline were needed, a new parallel pipeline would most likely be located on the SFPUC property within the Peninsula watershed. However, since the need for and location of a new alignment has not been determined, to address the remote possibility that additional pipeline easement might be needed on private property, the PEIR analysis errs on the conservative side and has determined that any permanent impacts on existing uses would be a *potentially significant and unavoidable* impact. It is possible that this impact could be reduced to a less-than-significant level by implementing the recommendations of facility siting studies (Measure 4.3-2). Although it is expected that project facilities could be located to avoid permanent impacts on existing land uses, the significance of any

potential land use impacts would be evaluated as part of separate, project-level CEQA review, and this evaluation would determine if impacts could be mitigated to a less-than-significant level.

San Francisco Region

Impact 4.3-2: Permanent displacement or long-term disruption of existing land uses		
SAPL 3 Installation	SF-1	N/A
Groundwater Projects	SF-2	PSU
Recycled Water Projects	SF-3	PSU

The SAPL 3 Installation project (SF-1) would involve the installation, repair, or replacement of up to 4.17 miles of pipeline through densely populated urbanized areas. The SFPUC expects that this project would not require additional easement or land acquisition, and permanent land use impacts would *not apply*.

In some cases, existing land uses have encroached onto the SFPUC right-of-way along this alignment, including two golf courses, mature landscaping, and permanent or temporary structures. These uses would either be removed or would be authorized according to the policies and procedures set forth in the SFPUC Right-of-Way Encroachment Removal Policy (SFPUC, 2007). The removal or authorization of these encroachments is not part of the SAPL 3 Installation project, but would be implemented in accordance with the SFPUC policy as part of its ongoing right-of-way maintenance program. Thus, while the SAPL 3 Installation project would necessitate SFPUC action on these encroachments in a timely manner to accommodate the WSIP schedule, such enforcement action is not part of the WSIP project, and any effects of implementing such enforcement actions are not analyzed in this PEIR. Enforcement actions will occur irrespective of whether the WSIP projects are implemented.

The Groundwater Projects (SF-2) and Recycled Water Projects (SF-3) could require additional right-of-way to accommodate wells and recycled storage, treatment, and pumping facilities. The Groundwater Projects would result in the installation of new wells, wells stations, and associated piping. Potential sites that could be affected include Francis Scott Key School or other sites in San Francisco and northern San Mateo County. While it is expected that the proposed groundwater and recycled water facilities could be located without significant permanent impact on existing land uses (i.e., the need to relocate the existing use), the PEIR analysis errs on the conservative side and has determined that any permanent impacts on existing uses would be a *potentially significant and unavoidable* impact. It is possible that this impact could be reduced to a less-than-significant level by implementing SFPUC Construction Measure #6 (compliance with local noise ordinances to the extent feasible) and Construction Measure #10 (locating staging areas away from public view and directing nighttime lighting away from residential areas) as well as recommendations of facility siting studies (Measure 4.3-2). Although it is expected that project facilities could be located to avoid permanent impacts on existing land uses, the significance of any potential land use impacts would be evaluated as part of separate, project-level CEQA review, and this evaluation would determine if impacts could be mitigated to a less-than-significant level. With Measure 4.3-2, the Groundwater Projects are not expected to result in long-term operational effects that would be incompatible with surrounding uses, and thus would not result in permanent land use disruption; wells and associated facilities are generally small utility type structures that would not alter the use of an existing site.

Recycled Water Projects (SF-3) facilities could require land acquisition for a new treatment facility at or near the Oceanside Water Pollution Control Plant (WPCP) or within Golden Gate Park, as well as multiple storage facilities for recycled water in the vicinity of Lincoln Park, Golden Gate Park, and the San Francisco Zoo. These facilities could also affect recreation and visitor-oriented uses at the zoo, Golden Gate Park, and the Lincoln Park golf course. The Recycled Water Projects (SF-3) could establish more substantial treatment and/or pump station facilities in residential areas. Since facility locations are undetermined at this stage of project planning, the PEIR analysis errs on the conservative side and has determined that any permanent impacts on existing uses would be a *potentially significant and unavoidable* impact. It is possible that this impact could be reduced to a less-than-significant level with implementation of SFPUC Construction Measure #6 (compliance with local noise ordinances to the extent feasible) and Construction Measure #10 (locating staging areas away from public view and directing nighttime lighting away from residential areas) as well as the recommendations of facility siting studies (Measure 4.3-2). Although it is expected that project facilities could be located to avoid permanent impacts on existing land uses, the significance of any potential land use impacts would be evaluated as part of separate, project-level CEQA review, and this evaluation would determine if impacts could be mitigated to a less-than-significant level.

Visual Quality

This analysis identifies three potential impacts on visual quality. The first type of impact is the temporary construction-related effect that WSIP projects could have on vistas, as seen from scenic highways and local scenic routes, or on the visual character of a community. The second is the permanent visual impact that projects would have on these same vistas or on visual character. The third impact relates to new sources of light and glare that could be created through implementation of WSIP projects.

Impact 4.3-3: Temporary construction-related adverse impacts on scenic vistas or the visual character of a community.

WSIP projects could result in temporary construction-related impacts on scenic vistas, depending on the location of the WSIP project in relation to those resources. With implementation of SFPUC Construction Measure #10 (maintaining a clean and orderly site, locating staging areas away from public view, and directing nighttime lighting away from residential areas), this impact would be less than significant.

All Regions

Construction activities typically have only temporary effects on visual quality and therefore are generally considered to have a less-than-significant impact. However, construction projects that would be located at one site for a year or more could result in construction-related visual impacts. Although pipeline projects progress along the alignment and typically affect a specific location for a short period of time (less than one year), staging areas associated with these projects could

be used for more than one year. In addition, any projects involving nighttime construction (e.g., tunnel portals or shafts) would require lighting, and adjacent areas could be subject to visual impacts associated nighttime lighting for more than one year. Based on the construction schedule presented in Chapter 3 (Figure 3.6) and Appendix C (Table C.4), construction activities associated with all WSIP projects would occur for at least one year. It should be noted, however, that construction of some of these projects could actually last for less than a year.

Although construction activities associated with all WSIP projects could occur over one year or longer, temporary visual impacts would be *less than significant* with implementation of SFPUC Construction Measure #10 (maintaining a clean and orderly site, locating staging areas away from public view, and directing nighttime lighting away from residential areas).

Impact 4.3-4: Permanent adverse impacts on scenic vistas or the visual character of a community.

The long-term visual impacts of WSIP projects could be potentially significant, depending on site selection, facility scale and design, and location relative to public viewing opportunities. The major factor affecting visual impacts is the visibility of the proposed improvements. Pipelines and tunnels are typically underground and would have no permanent visual impacts. Treatment facilities, storage basins, vaults and valve houses, crossovers, and other facilities can be partially buried, but in general have a visible aboveground component. Construction of permanent new facilities as well as renovation or repair of existing facilities could result in negative aesthetic effects, depending on the existing character of the project site and the degree of proposed changes, such as the height and mass of proposed structures or whether mature trees would be removed. **Table 4.3-4** summarizes key information used to assess potential visual impacts, including aboveground structures proposed as part of each project, scenic roads and highways in the vicinity of each project site, site visibility from these scenic roads, and other considerations.

San Joaquin Region

Impact 4.3-4: Permanent adverse impacts on scenic vistas or visual character		
Advanced Disinfection	SJ-1	PSM
Lawrence Livermore	SJ-2	LS
SJPL System	SJ-3	LS
SJPL Rehabilitation	SJ-4	N/A
Tesla Portal Disinfection	SJ-5	PSM

The Advanced Disinfection (SJ-1) and Tesla Portal Disinfection (SJ-5) projects would construct new buildings at the Tesla Portal facility. The Advanced Disinfection project would construct a new structure up to 35 feet high, and four partially buried vaults up to 30 inches high. The Tesla Portal Disinfection (SJ-5) project involves building a structure up to 30 feet high. These projects could also require the purchase of additional land for associated power supply facilities, depending on the final locations selected (see Table 4.3-4). There are distant views of the Tesla Portal facility from I-580, a Caltrans-designated scenic highway (from I-5 to the Alameda County line) and a San Joaquin County–designated scenic route (where I-5 and I-580 are combined). These two projects would expand the existing cluster

TABLE 4.3-4
POTENTIAL PERMANENT VISUAL IMPACTS OF WSIP PROJECTS

Project No.	Project Name	Proposed New Permanent Aboveground Structures	Scenic Routes in the Project Region	Would WSIP Facilities Be Visible from Scenic Routes or Other Visually Sensitive Areas?	Visual Considerations (including whether WSIP project is located in Alameda or Peninsula Watershed Management Plan [WMP] areas)	Impact Significance Determination
SJ-1	Advanced Disinfection	*Tesla Portal*: ▪ 1 new structure (up to 35 feet high) ▪ 4 partially buried vaults (typically up to 30 inches high) ▪ Modification of Tesla Portal	*Caltrans:* ▪ I-580 from I-5 to Alameda County line *San Joaquin County:* ▪ I-580 and I-5 (where combined)	Yes, distant views of this building would be available from I-580.	There are about seven existing structures at Tesla Portal that are currently visible from I-580, and this project would expand the cluster of buildings currently visible from this road. Potentially significant impacts would be reduced to less than significant with implementation of mitigation measures to ensure visual compatibility with existing adjacent SFPUC facilities.	PSM
SJ-2	Lawrence Livermore Supply Improvements	New structures at Thomas Shaft (size, height, appearance to be determined)	*San Joaquin County:* ▪ Corral Hollow Road	No, depending on building height. Facility located approximately 1.5 miles south of Corral Hollow Road where topography and distance would limit the potential for visibility.	Thomas Shaft not visible from Corral Hollow Road.	LS
SJ-3	San Joaquin Pipeline System	▪ No new buildings ▪ 2 partially buried vaults at crossover locations (typically up to 30 inches high) ▪ Modification of Oakdale Portal	*Caltrans:* ▪ I-580 from I-5 to Alameda County line ▪ I-5 from Merced County line to San Joaquin County line *San Joaquin County:* ▪ I-580 and I-5 (where combined)	No, facilities near scenic roads would be underground and not visible. No pipelines are currently visible from Willms Road and this would not change with this project. Although this road is not designated as a scenic road, Willms Ranch, a California landmark, is located on Willms Road.	Vaults would be visible, but they would not be located near scenic roads.	LS
SJ-4	San Joaquin Pipeline Rehabilitation	None, existing pipelines would be rehabilitated.	*Caltrans:* ▪ I-580 from I-5 to Alameda County line ▪ I-5 from Merced County line to San Joaquin County line *San Joaquin County:* ▪ I-580 and I-5 (where combined)	No change in visibility from scenic roads compared to existing conditions.	Existing pipelines are mostly underground, with some aboveground sections at the east end (west of Oakdale Portal) in agricultural areas, and rehabilitation would not alter visibility.	N/A
SJ-5	Tesla Portal Disinfection Station	*Tesla Portal*: ▪ 1 new structure to replace/upgrade existing disinfection facility (up to 30 feet high)	*Caltrans:* ▪ I-580 from I-5 to Alameda County line *San Joaquin County:* ▪ I-580 and I-5 (where combined)	Yes, distant views of this building would be available from I-580.	Since there are existing structures at Tesla Portal that are currently visible from I-580, this project would expand the cluster of buildings currently visible from this road. Mitigation measures would ensure visual compatibility with existing adjacent SFPUC facilities.	PSM

TABLE 4.3-4 (Continued)
POTENTIAL PERMANENT VISUAL IMPACT OF WSIP PROJECTS

Project No.	Project Name	Proposed New Permanent Aboveground Structures	Scenic Routes in the Project Region	Would WSIP Facilities Be Visible from Scenic Routes or Other Visually Sensitive Areas?	Visual Considerations (including whether WSIP project is located in Alameda or Peninsula Watershed Management Plan [WMP] areas)	Impact Significance Determination
SV-1	Alameda Creek Fishery Enhancement	*Alameda Creek, downstream from Sunol Valley WTP*: ▪ Facilities not yet determined	*Alameda and Santa Clara Counties:* ▪ Calaveras Road	Yes, new facilities could be visible from Highway 84/Niles Canyon Road, Calaveras Road, or I-680, if any aboveground facilities are located in segments of Alameda Creek that are currently visible from these roadways.	All project alternatives would be located within the Alameda WMP area. With implementation of the WMP's required design guidelines and mitigation measures, visual impacts would be less than significant.	PSM
SV-2	Calaveras Dam Replacement	*Calaveras Dam site*: ▪ Replacement of dam, spillway, and inlet tower (maximum height of dam: 220 feet from foundation to dam crest) ▪ 2 vaults (typically up to 30 inches high)	*Alameda and Santa Clara Counties:* ▪ Calaveras Road	Yes, views could be available from immediately surrounding ridges, with distant views possible from the Sunol Regional Wilderness (although topography would likely block distant views). Although the dam would not be visible from Calaveras Road, the reservoir, borrow areas, and the road between the borrow areas and dam could be visible from this road and trails within the Sunol Regional Wilderness.	The dam itself is not visible from Calaveras Road, but the reservoir as well as potential changes in the surrounding topography (from borrow areas and access roads) would be visible from Calaveras Road and trails within the Sunol Regional Wilderness. The project would alter views of the reservoir and surrounding hillsides when water levels are raised and oak woodland cover is removed in areas subject to excavation and grading. WMP design guidelines and mitigation measures would help to minimize visual impacts somewhat from Calaveras Road.	PSU
SV-3	Additional 40-mgd Treated Water Supply	*Sunol Valley WTP*: ▪ One new building (up to 10 feet high)	*Alameda and Santa Clara Counties:* ▪ Calaveras Road	No, existing Sunol Valley WTP facilities are not visible from Calaveras Road, since trees in the Alameda Creek riparian corridor screen views of facilities from this road. Likewise, proposed facilities would not be visible from this road.	The new building would not be visible from Calaveras Road. With implementation of the WMP's required design guidelines, any potential visual impacts from the new building (up to 10 feet high) at the Sunol Valley WTP facility would be less than significant.	LS
SV-4	New Irvington Tunnel	*New Irvington Tunnel East Portal in Sunol Valley and West Portal in Fremont*: ▪ New portals ▪ 9–12 concrete vaults to be built across the fault (typically up to 30 inches high) ▪ Modification of Irvington Portal and Alameda West Portal	*Alameda and Santa Clara Counties:* ▪ Calaveras Road	Yes, distant views of the new and existing portals in the Sunol Valley could be available from Calaveras Road, although the riparian corridor along Alameda Creek could obscure these views. Views of the new and existing portals east of Mission Boulevard in Fremont could be visible from nearby homes to the west, but these homes would obscure views of the portal from Mission Boulevard.	With the implementation of the WMP's required design guidelines and mitigation measures, visual impacts on Calaveras Road due to the new portal and vaults in the Sunol Valley would be less than significant. Mitigation measures would reduce visual impacts of the new portal in Fremont.	PSM

TABLE 4.3-4 (Continued)
POTENTIAL PERMANENT VISUAL IMPACT OF WSIP PROJECTS

Project No.	Project Name	Proposed New Permanent Aboveground Structures	Scenic Routes in the Project Region	Would WSIP Facilities Be Visible from Scenic Routes or Other Visually Sensitive Areas?	Visual Considerations (including whether WSIP project is located in Alameda or Peninsula Watershed Management Plan [WMP] areas)	Impact Significance Determination
SV-5	SVWTP – Treated Water Reservoirs	Sunol Valley WTP: ▪ 1 new structure (up to 15 feet high) ▪ 1 new vault	*Alameda and Santa Clara Counties:* ▪ Calaveras Road	No, existing Sunol Valley WTP facilities are not visible from Calaveras Road, since trees in the Alameda Creek riparian corridor screen views of facilities from this road. Likewise, proposed facilities would not be visible from this road.	The new building would not be visible from Calaveras Road. With implementation of the WMP's design guidelines, potential visual impacts from the proposed structure (up to 15 feet high) at the Sunol Valley WTP facility would be less than significant.	LS
SV-6	San Antonio Backup Pipeline	Alameda East Portal: ▪ 2 new vaults ▪ Modification of Alameda East Portal	*Alameda and Santa Clara Counties:* ▪ Calaveras Road	Yes, views of any aboveground features associated with the discharge facility could be available from Calaveras Road, although the Alameda Creek riparian corridor would likely obscure these views. All pipeline facilities would be underground, and long-term views from this road would not be altered.	With implementation of the WMP's design guidelines and mitigation measures, visual impacts from the new vaults (up to 30 inches high) on Calaveras Road would be less than significant.	PSM
BD-1	Bay Division Pipeline Reliability Upgrade	8 electrical control buildings at valve lots (up to 30 feet high) and tunnel shaft facilities at Ravenswood and Newark Valve Houses	*Alameda County, Cities of Fremont and Newark (routes and interchanges):* ▪ Dumbarton Freeway (Dumbarton Bridge/Highway 84) and Newark Boulevard ▪ Dumbarton Freeway (Dumbarton Bridge/Highway 84) and Thornton Avenue ▪ Nimitz Freeway (I-880) and Thorton Avenue ▪ Nimitiz Freeway (I-880) and Mowry Avenue ▪ Nimitz Freeway (I-880) and Stevenson Boulevard ▪ I-880 from the northern city limits to the southern city limits ▪ Mission Boulevard (northern city limits to I-880) ▪ Fremont Boulevard (northern city limits to Warm Springs Boulevard)	Possibly, depending on proximity of one-story buildings to scenic roads, although the visibility of project facilities at tunnel shafts from I-880 and Dumbarton Freeway/Highway 84 would be limited by level topography and intervening development. With the level topography in the bay vicinity (Ravenswood Valve House near East Palo Alto and Newark Valve House in Newark), intervening vegetation obscures views of the tunnel portal areas from scenic roadways or waterways. In addition, industrial buildings located south of Thornton Avenue and west of Willow Street block views of the Newark Valve House from Thornton Avenue and the Dumbarton Freeway. Views of the easternmost pipeline alignment from I-680 would also be obscured by distance (approximately one-half mile north of the freeway), intervening development and landscape trees.	New one-story buildings could be visible from adjacent roadways (and possibly scenic roadways depending on their location), but they would be located near existing development, which is adjacent to most of the pipeline alignment. Mitigation measures would reduce potential visual impacts of new vaults by addressing architectural design, landscaping plans, landscape screens, and tree removal.	PSM

TABLE 4.3-4 (Continued)
POTENTIAL PERMANENT VISUAL IMPACT OF WSIP PROJECTS

Project No.	Project Name	Proposed New Permanent Aboveground Structures	Scenic Routes in the Project Region	Would WSIP Facilities Be Visible from Scenic Routes or Other Visually Sensitive Areas?	Visual Considerations (including whether WSIP project is located in Alameda or Peninsula Watershed Management Plan [WMP] areas)	Impact Significance Determination
BD-1 (cont.)	Bay Division Pipeline Reliability Upgrade (cont.)		▪ Washington Boulevard (Fremont to Mission Boulevards) ▪ Mowry Avenue (from I-880 to Mission Boulevard) ▪ Stevenson Boulevard (from I-880 to Mission Boulevard) ▪ Thornton Avenue in Newark ▪ Newark Slough and Mowry Slough in Newark *City of East Palo Alto:* ▪ University Avenue (an important gateway to the city) *San Mateo County* ▪ *Edgewood Road from Alameda de las Pulgas to Cañada Road*			
BD-2	BDPL Nos. 3 and 4 Crossovers	3 new aboveground control buildings and/or vaults along the Bay Division Pipeline (3 to 8 feet high)	*City of Palo Alto:* ▪ Junipero Sierra Boulevard/ Foothill Expressway *Town of Woodside:* ▪ I-280 ▪ Highway 84	Possibly, although crossover facilities would generally be located away from public streets due to their proximity to creeks, rivers, and other waterways. However, nearby scenic roads include: ▪ Foothill Boulevard, adjacent to Veterans Administration Medical Center and near Gunn High School (Barron Creek) ▪ I-280 and Highway 84, near Bear Gulch Reservoir	New buildings would be 3 to 8 feet high. Existing visual character of the three crossover sites, including views from public rights-of-way, would be considered for all permanent aboveground facilities, if applicable. New building adjacent to Bear Gulch Reservoir could be visible from nearby residential development. The new building at Barron Creek would be near the Veterans Administration Medical Center and Gunn High School, while the building at Guadalupe Creek would be located in the Ulistac Natural Area. Mitigation measures would reduce potential visual impacts of the control buildings at these locations by addressing architectural design, landscaping plans, landscape screens, and tree removal.	PSM

TABLE 4.3-4 (Continued)
POTENTIAL PERMANENT VISUAL IMPACT OF WSIP PROJECTS

Project No.	Project Name	Proposed New Permanent Aboveground Structures	Scenic Routes in the Project Region	Would WSIP Facilities Be Visible from Scenic Routes or Other Visually Sensitive Areas?	Visual Considerations (including whether WSIP project is located in Alameda or Peninsula Watershed Management Plan [WMP] areas)	Impact Significance Determination
BD-3	Seismic Upgrade of BDPL Nos. 3 and 4 at Hayward Fault	None	▪ I-880 from Fremont's northern city limits to its southern city limits ▪ Mission Boulevard (northern city limits to I-880)	N/A	N/A	N/A
PN-1	Baden and San Pedro Valve Lots Improvements	*San Pedro Valve Lot*: ▪ 2 structures *Baden Valve Lot*: ▪ 4 new structures (all new structures, 1 to 3 feet high)	*Caltrans:* ▪ I-280 from Highway 17 to I-80 north of First Street in San Francisco	Possibly, but views would be limited. Baden Valve Lot located west of El Camino Real (Highway 82), and trees along the west side of this street obscure views of this facility. San Pedro Valve Lot is adjacent to I-280 and Junipero Serra Boulevard and would be visible from these streets.	Proposed facilities would be located within these existing valve lots and would not significantly alter existing views of these facilities. Expected low height (1 to 3 feet) would minimize the potential for changes in views.	LS
PN-2	Crystal Springs/ San Andreas Transmission Upgrade	1 or 2 existing structures could be replaced and would be the same height as existing structures (25 feet high).	*Caltrans:* ▪ I-280 from Highway 17 to I-80 north of First Street in San Francisco *Santa Clara County and City of San Mateo:* ▪ Highway 35 (northern end of the Skyline Scenic Recreation Route) ▪ Skyline Boulevard (in the Crystal Springs Reservoirs vicinity) ▪ Crystal Springs Road ▪ Black Mountain Road	Yes, structures in the Crystal Springs Pump Station vicinity could be visible from Highway 35/Skyline Road bridge over Lower Crystal Springs Dam or Crystal Springs Road, but views would be limited by elevational differences and vegetation.	Potentially visible, but the existing pump station structure is currently visible and within the Peninsula WMP area. Implementation of the WMP's design guidelines for structures and roads within the watershed plan area and mitigation measures addressing visual impacts from vegetation/tree removal would reduce visual impacts to less than significant.	PSM
PN-3	HTWTP Long-Term Improvements	To be determined	*Caltrans:* ▪ I-280 from Highway 17 to I-80 north of First Street in San Francisco	Possibly; this project is located east of I-280, but views of this facility are limited by intervening topography and trees. This site is already developed with structures associated with water facilities.	Locations and designs of any above-ground facilities/structures have not yet been determined, but they would be located within the existing water treatment facility. Since this site is already developed with water facilities, the project is not expected to significantly alter existing views of this facility. However, due to the visual sensitivity of the area, any change in visual character would be a potentially significant impact. Mitigation	PSM

TABLE 4.3-4 (Continued)
POTENTIAL PERMANENT VISUAL IMPACT OF WSIP PROJECTS

Project No.	Project Name	Proposed New Permanent Aboveground Structures	Scenic Routes in the Project Region	Would WSIP Facilities Be Visible from Scenic Routes or Other Visually Sensitive Areas?	Visual Considerations (including whether WSIP project is located in Alameda or Peninsula Watershed Management Plan [WMP] areas)	Impact Significance Determination
PN-3 (cont.)	HTWTP Long-Term Improvements (cont.)				measures would reduce potential visual impacts of the control buildings at these locations by addressing architectural design, landscaping plans, landscape screens, and tree removal.	
PN-4	Lower Crystal Springs Dam Improvements	To be determined	*Caltrans:* ▪ I-280 from Highway 17 to I-80 north of First Street in San Francisco *San Mateo County and City of San Mateo:* ▪ Highway 35 (northern end of the Skyline Scenic Recreation Route) ▪ Skyline Boulevard (in the Crystal Springs Reservoirs vicinity) ▪ Crystal Springs Road ▪ Black Mountain Road	Yes, existing dam is visible from Highway 35/Skyline Road bridge over this dam and scenic overlook located west of this road. Also, visible from I-280 and Crystal Springs Road.	This dam would be visible from a number of scenic roads and scenic overlooks, and visual sensitivity of this structure would be high. The dam is located in the Peninsula WMP area and would be subject to WMP design guidelines. Design of the dam parapet wall has not yet determined, but would be evaluated as part of separate, project-level CEQA review. Implementation of the WMP's design guidelines would reduce the visual impacts of new structures, and additional mitigation measures would be required to specifically address changes in views from visually sensitive areas. Raising the water levels in the reservoir could also affect views from the scenic overlook (see Chapter 5 for more discussion). However, the scenic quality of the reservoir vicinity would not change with this project.	PSM
PN-5	Pulgas Balancing Reservoir Rehabilitation	No new structures, but includes work on the Pulgas Channel.	*Caltrans:* ▪ I-280 from Highway 17 to I-80 north of First Street in San Francisco *San Mateo County:* ▪ Cañada Road	Yes, any changes to Pulgas Channel would be visible from Cañada Road, a designated scenic route. Scenic vistas from I-280 would not be affected by this project, since this freeway is located almost one mile to the east. Project would be located adjacent to Pulgas Water Temple, an important visual and historic resource, and cross under Cañada Road.	Any required tree/vegetation removal could alter views of the Pulgas Channel from Cañada Road. This facility is located in the Peninsula WMP area, and any changes to the reservoir facility or channel would be subject to WMP design guidelines. Additional mitigation measures would be required to specifically address vegetation/tree removal.	PSM

TABLE 4.3-4 (Continued)
POTENTIAL PERMANENT VISUAL IMPACT OF WSIP PROJECTS

Project No.	Project Name	Proposed New Permanent Aboveground Structures	Scenic Routes in the Project Region	Would WSIP Facilities Be Visible from Scenic Routes or Other Visually Sensitive Areas?	Visual Considerations (including whether WSIP project is located in Alameda or Peninsula Watershed Management Plan [WMP] areas)	Impact Significance Determination
SF-1	San Andreas Pipeline No. 3 Installation	2 new structures to replace out-of-service pipeline (up to 8 feet high) 2 vaults (typically up to 30 inches high)	*Caltrans:* ▪ I-280 from Highway 17 to I-80 north of First Street in San Francisco ▪ Highway 1: from Highway 35 to Highway 101 North of the Golden Gate Bridge	Yes, this pipeline alignment traverses the Lake Merced Golf & Country Club and San Francisco Golf Club.	Depending on location, new structures (up to eight feet high) could be visible from visually sensitive areas like the Lake Merced Golf & Country Club and San Francisco Golf Club. Pipeline construction could result in visual impacts due to damage or loss of mature trees at Lake Merced Golf & Country Club and San Francisco Golf Club. Mitigation measures would be required to minimize potential visual impacts due to facility design and loss of trees.	PSM
SF-2	Groundwater Projects	*San Francisco*: ▪ 6 new structures for wells and well stations *Northern San Mateo County*: 10 new structures	*Caltrans:* ▪ I-280 from Highway 17 to I-80 north of First Street in San Francisco *City of Colma:* ▪ El Camino Real ▪ Hillside Boulevard ▪ Junipero Serra Boulevard	Possibly, depending on final locations of facilities. Facilities could be within the scenic viewshed of I-280, Great Highway, Lake Merced, Pine Lake, San Francisco Zoo, and/or Golden Gate Park.	The potential for visual impacts would depend on final locations. Up to 16 single-story structures could be developed at various locations on the west side of San Francisco or in northern San Mateo County. These buildings would be small in scale and located generally in urbanized areas. Mitigation measures would reduce potential visual impacts by addressing architectural design, landscaping plans, landscape screens, and tree removal, as appropriate.	PSM
SF-3	Recycled Water Projects	1 to 4 new structures (for a recycled water treatment facility at or near Oceanside Water Pollution Control Plant) (up to 40 feet high)	*Caltrans:* ▪ Highway 1/19th Avenue	Possibly; if the recycled water treatment facility is located in the vicinity of the San Francisco Zoo and Oceanside WPCP, it could be visible from the Great Highway and Skyline Boulevard (Highway 35).	Any new facilities (up to 40 feet high) in the vicinity of the San Francisco Zoo and Oceanside WPCP could affect views from the Great Highway, Skyline Boulevard (Highway 35), or other scenic routes in this area. At 40 feet high, this building might have to be constructed partially below grade in order to minimize visual impacts on nearby scenic roads. Mitigation measures would reduce potential visual impacts by addressing architectural design, landscaping plans, landscape screens, and tree removal, as appropriate.	PSM

of buildings at the Tesla Portal facility that can be viewed at a distance from I-580. The two buildings and aboveground portions of the four vaults would alter the visual character of the area by intensifying the scale and mass of buildings and structures at the Tesla Portal site. Because the surrounding area is largely undeveloped, impacts on scenic vistas and visual character could be *potentially significant*. However, with implementation of mitigation measures addressing architectural design (Measure 4.3-4a), landscaping plans (Measure 4.3-4b), landscape screens (Measure 4.3-4c), and tree removal (Measure 4.3-4d), these potentially significant impacts could be reduced to a less-than-significant level.

The Lawrence Livermore project (SJ-2) would involve improvements at Thomas Shaft, an existing SFPUC facility site. Because the new structures have not been designed, their size, height, and appearance are not yet known. The closest scenic route is Corral Hollow Road (as designated by San Joaquin County), which is approximately 1.5 miles north of the project. Given the distance from the facility and the surrounding topography, the project would not likely be visible from Corral Hollow Road. The impact on the visual character and resources due to this project would be *less than significant*.

The SJPL System project (SJ-3) would build two partially buried vaults (up to 30 inches high) at crossover locations. The nearby scenic routes are I-580 (as designated by Caltrans from I-5 to the Alameda County line), I-5 (as designated by Caltrans from the Merced County line to the San Joaquin County line), and I-580 and I-5 (as designated by San Joaquin County where the two routes combine). The SJPL System's facilities are underground near these scenic routes. These vaults would be visible but would not be located near the scenic roads. Therefore, the visual impact from this project would be *less than significant*.

The SJPL Rehabilitation project (SJ-4) would involve work on existing pipelines. There would be no change in visibility from scenic roads (which are the same roads listed for the SJPL System project above). The existing pipelines are mostly underground, but there are aboveground sections at the east end (west of the Oakdale Portal); however, the rehabilitation of these pipelines would not alter their visibility or the visual character of the area. Therefore, the impact on visual resources from this project would be *not applicable*.

Sunol Valley Region

Impact 4.3-4: Permanent adverse impacts on scenic vistas or visual character		
Alameda Creek Fishery	SV-1	PSM
Calaveras Dam	SV-2	PSU
40-mgd Treated Water	SV-3	LS
New Irvington Tunnel	SV-4	PSM
Treated Water Reservoirs	SV-5	LS
SABUP	SV-6	PSM

All of the Sunol Valley Region projects are located within the Alameda Watershed Management Plan (WMP) area. The plan describes the following design guidelines (under *"Action des 5"*) that would apply to these projects:

- Where grading is necessary, contour slopes and landforms to mimic the surrounding environment as much as possible

- Design and site new roads and trails to minimize grading and the visibility of cut banks and fill slopes
- Incorporate architectural siting/design elements that are compatible with the applicable surrounds
- Site, shield, and direct downward exterior lighting such that it is not highly visible or obtrusive
- Maintain the silhouette of new structures below the skyline of bluffs, cliffs, or ridges
- Design any new structural additions to historic structures to harmonize with older structural features and comply with scenic easements and aesthetic guidelines
- Encourage the salvage and selective reuse of building features if historic structures are demolished

Views of the Calaveras Dam project (SV-2) would be available from the immediately surrounding ridges, and distant views could also be visible from the Sunol Regional Wilderness. The borrow areas and possibly access roads associated with this project would be visible from Calaveras Road, which is designated by Alameda and Santa Clara Counties as a scenic route. Although the dam itself would not be visible from this road, the reservoir and surrounding hillsides, are considered important visual features in the Alameda watershed. Excavation and grading activities associated with this project would require removal of a large area of existing oak woodland cover. This removal of vegetation would create visual discontinuity within the existing pattern of oak woodland cover on the north- and east-facing slopes in the immediate vicinity of the dam. Although these areas of disturbance would be contoured and revegetated, to the extent feasible, as part of the proposed project, fast-growing grasses and scrub would cover the disturbed areas until a cover of oak woodland could mature. Due to the visual sensitivity of the area and the extent of surface disturbance that would occur, implementation of design guidelines in the Alameda WMP and mitigation measures addressing architectural design (Measure 4.3-4a), landscaping plans (Measure 4.3-4b), landscape screens (Measure 4.3-4c), and tree removal (Measure 4.3-4d) would be required to help reduce potential visual impacts. However, because recovery of oak woodland on disturbed areas could require decades, the visual discontinuity in the cover and color of vegetation would persist for decades as evidence of ground disturbance. The impact of site disturbance would therefore extend beyond the construction phase and would be considered a long-term, *potentially significant and unavoidable* visual impact of the project.

The tunnel component of the New Irvington Tunnel project (SV-4) would be buried, but the portals at either end of the tunnel would be visible. Between 9 and 12 concrete vaults (up to 30 inches high) would also be built along the tunnel alignment. Project facilities at the new tunnel portal and modifications at the existing portal could be visible at a distance from Calaveras Road in the Sunol Valley, although the riparian corridor at Alameda Creek could obscure these views. Views of the new portal east of Mission Boulevard in Fremont could be visible from nearby homes to the west, but these homes would partially obscure views of the portal from Mission Boulevard. The project's impact on the visual character of the Sunol Valley and the adjacent neighborhood in Fremont at tunnel portals would be *potentially significant*, but could be reduced

to a less-than-significant level with implementation of design guidelines in the Alameda WMP and mitigation measures addressing architectural design (Measure 4.3-4a), landscaping plans (Measure 4.3-4b), landscape screens (Measure 4.3-4c), and tree removal (Measure 4.3-4d).

While the design of the Alameda Creek Fishery project (SV-1) has not yet been determined, it is likely to include facilities on or adjacent to Alameda Creek downstream of the Sunol Valley WTP. This project could be visible from Highway 84/Niles Canyon Road or I-680 (both designated by Caltrans as scenic highways) or from Calaveras Road. Any removal of riparian vegetation along Alameda Creek to accommodate project facilities could alter the visual character of this reach of the creek. Depending on final design and siting of project facilities, implementation of the Alameda Creek Fishery project could result in *potentially significant* changes in the visual character of this reach of Alameda Creek. The project's impact could be reduced to a less-than-significant level with implementation of design guidelines in the Alameda WMP and mitigation measures addressing architectural design (Measure 4.3-4a), landscaping plans (Measure 4.3-4b), landscape screens (Measure 4.3-4c), and tree removal (Measure 4.3-4d).

The SABUP project (SV-6) would construct two new vaults that could be visible from Calaveras Road, although the Alameda Creek riparian corridor would likely obscure these views. All pipeline facilities would be underground, and long-term views from this road would not be altered. However, any removal of riparian vegetation along San Antonio or Alameda Creeks to accommodate outfall and pipeline facilities could alter the visual character of these creeks. Depending on final design and siting of the various project facilities, implementation of this project could result in *potentially significant* changes in the visual character of San Antonio and Alameda Creeks. The project's impact could be reduced to a less-than-significant level with implementation of design guidelines in the Alameda WMP and mitigation measures addressing architectural design (Measure 4.3-4a), landscaping plans (Measure 4.3-4b), landscape screens (Measure 4.3-4c), and tree removal (Measure 4.3-4d).

Two projects would construct new buildings at the Sunol Valley WTP. The 40-mgd Treated Water project (SV-3) would construct a new 10-foot-high building. The Treated Water Reservoirs project (SV-5) would construct a new structure (up to 15 feet high) and one new vault. The water treatment plant is not visible from Calaveras Road because trees in the Alameda Creek riparian corridor block the view. With implementation of the WMP's design guidelines, the visual impacts from these projects would be *less than significant*.

Bay Division Region

Impact 4.3-4: Permanent adverse impacts on scenic vistas or visual character		
BDPL Reliability Upgrade	BD-1	PSM
BDPL 3 and 4 Crossovers	BD-2	PSM
BDPL 3 and 4 Seismic Upgrade at Hayward Fault	BD-3	N/A

The BDPL Reliability Upgrade project (BD-1) would consist primarily of underground pipelines and a tunnel, which would not be visible from any scenic highways. Although tunnel portal staging areas could be visible during tunnel construction, there would not be any

permanent aboveground structures associated with tunnel portals. In any case, the level topography in the bay vicinity (Ravenswood Valve House near East Palo Alto and Newark Valve House in Newark) and intervening vegetation obscure views of the tunnel portal areas from scenic roadways or waterways. In addition, industrial buildings located south of Thornton Avenue and west of Willow Street block views of the Newark Valve House from Thornton Avenue and the Dumbarton Freeway. The project would also construct eight new structures for electrical controls with aboveground heights of up to 30 feet. The new one-story buildings could be visible from adjacent roadways (and possibly scenic roadways, depending on their location), which could alter the visual character of adjacent areas, a *potentially significant* impact. However, the project's impact could be reduced to a less-than-significant level with implementation of mitigation measures addressing architectural design (Measure 4.3-4a), landscaping plans (Measure 4.3-4b), landscape screens (Measure 4.3-4c), and tree removal (Measure 4.3-4d).

Because the BDPL Reliability Upgrade project (BD-1) traverses mostly developed urban locations—many of which are older, established residential areas—construction of the project could result in the damage or loss of mature trees adjacent to the SFPUC right-of-way, which would alter the visual character of these communities. This *potentially significant* impact could be reduced to a less-than-significant level with implementation of mitigation measures addressing landscaping plans (Measure 4.3-4b), landscape screens (Measure 4.3-4c), and tree removal (Measure 4.3-4d).

The BDPL Nos. 3 and 4 Crossovers project (BD-2) would construct three new aboveground control buildings and/or vaults along the existing Bay Division Pipeline alignments. These structures would be 3 to 8 feet high. The proposed structure at Barron Creek in Palo Alto could be visible from nearby Foothill Boulevard to the south, a designated scenic route, but adjacent structures associated with Gunn High School and the Veterans Administration Medical Center would obscure views of this facility from this and other nearby roadways. The proposed structure at Bear Gulch Reservoir in Atherton could be visible from nearby residences, but topography would block visibility from the closest designated scenic routes, I-280 to the west and Highway 84 to the north. The proposed structure at Guadalupe Creek could be visible from the adjacent Ulistac Natural Area, Tasman Drive, and development in Santa Clara. Due to the proximity of existing development to these three facility sites, proposed structures could adversely affect the existing visual character, a *potentially significant* impact. However, the project's impact could be reduced to a less-than-significant level with implementation of mitigation measures addressing architectural design (Measure 4.3-4a), landscaping plans (Measure 4.3-4b), landscape screens (Measure 4.3-4c), and tree removal (Measure 4.3-4d).

The BDPL 3 and 4 Seismic Upgrade at Hayward Fault (BD-3) would not result in the construction of any new permanent aboveground structures. Therefore, the impact on scenic vistas or visual character from this project would be *not applicable*.

Peninsula Region

Impact 4.3-4: Permanent adverse impacts on scenic vistas or visual character		
Baden and San Pedro Valve Lots	PN-1	LS
CS/SA Transmission	PN-2	PSM
HTWTP Long-Term	PN-3	PSM
Lower Crystal Springs Dam	PN-4	PSM
Pulgas Balancing Reservoir	PN-5	PSM

The CS/SA Transmission project (PN-2) could involve the replacement or upgrade of various aboveground structures in the vicinity of the Crystal Springs Reservoir, San Andreas Reservoir, and Harry Tracy WTP. The largest structure to be upgraded or replaced would be the Crystal Springs Pump Station, and the new structure would maintain its current 25-foot maximum height. The structures in the Crystal Springs Pump Station vicinity could be visible from Highway 35 (Skyline Road Bridge over Lower Crystal Springs Dam) or Crystal Springs Road, both designated scenic routes, but these views would be limited somewhat by elevational differences and intervening vegetation. Due to the visual sensitivity of this area, any changes to scenic vistas or the existing visual character associated with project facilities would be a *potentially significant* impact. Any changes to the existing pump station structure or development of new structures would be subject to the Peninsula WMP design guidelines for structures and roads within the watershed plan area (the same as the design guidelines for the Alameda WMP, presented above under the Sunol Valley Region). Implementation of the WMP's guidelines would reduce impacts, but mitigation measures addressing architectural design (Measure 4.3-4a), landscaping plans (Measure 4.3-4b), landscape screens (Measure 4.3-4c), and tree removal (Measure 4.3-4d) would also be required to reduce potential visual impacts to a less-than-significant level.

The structures to be constructed at the Harry Tracy WTP as part of the HTWTP Long-Term project (PN-3) have not yet been designed or located. Although this facility is located immediately east of I-280 (a designated scenic highway), views of the facility from the highway are limited by intervening topography and trees. Since this site is already developed with water treatment structures, the project is not expected to significantly alter existing views of this facility from surrounding areas. However, given the visual sensitivity of the area, any change in the visual character would be considered a *potentially significant* impact. Since the Harry Tracy WTP is located outside the WMP area and is not subject to WMP design guidelines, mitigation measures addressing architectural design (Measure 4.3-4a), landscaping plans (Measure 4.3-4b), landscape screens (Measure 4.3-4c), and tree removal (Measure 4.3-4d) would be required to reduce potential visual impacts to a less-than-significant level.

The Lower Crystal Spring Dam project (PN-4) would make major repairs and improvements to the dam to provide adequate protection from the probable maximum flood. The project would restore the reservoir's historical capacity of 69,300 acre-feet (from the current level of 58,400 acre-feet). The project would lower the existing parapet wall to lengthen the overflow weir from the reservoir; raise the remaining parapet walls and add one new spillway bay on each side of the central spillway; and install four gates (with a control building) and a fixed weir. The dam is visible from a number of scenic roads and scenic overlooks, and the visual sensitivity of this structure would be high. Therefore, any changes in scenic vistas and visual character as a result of the Lower Crystal Spring Dam project would be a *potentially significant* impact. Raising

the water levels in the reservoir could also alter views from the scenic overlook (see Chapter 5 for more discussion), although this project would not change the scenic quality of the reservoir vicinity. The dam is located in the Peninsula WMP area and would be subject to WMP design guidelines. The dam parapet wall has not yet been designed, but would be evaluated as part of separate, project-level CEQA review. Implementation of the WMP's design guidelines would require new structures to be consistent in design with existing SFPUC facilities, thus reducing potential visual impacts. However, implementation of mitigation measures addressing architectural design (Measure 4.3-4a), landscaping plans (Measure 4.3-4b), landscape screens (Measure 4.3-4c), and tree removal (Measure 4.3-4d) could be required to specifically address changes in views from visually sensitive areas and reduce visual impacts in these areas to a less-than-significant level.

The Pulgas Balancing Reservoir project (PN-5) would not construct new buildings but would modify the Pulgas Channel. Any changes to the Pulgas Channel would be visible from Cañada Road, a designated scenic route. Scenic vistas from I-280 would not be affected by this project, since this freeway is located almost one mile to the east. This project would be located adjacent to the Pulgas Water Temple, an important visual and historic resource, and would cross under Cañada Road. Any required tree or vegetation removal could alter views of the Pulgas Channel from Cañada Road, a *potentially significant* visual impact. Potential changes in views from Cañada Road would be evaluated as part of separate, project-level CEQA review. This facility is located in the Peninsula WMP area, and any changes to the reservoir facility or channel would be subject to WMP design guidelines. However, due to the visual sensitivity of the area, it is expected that additional mitigation measures addressing architectural design (Measure 4.3-4a), landscaping plans (Measure 4.3-4b), landscape screens (Measure 4.3-4c), and tree removal (Measure 4.3-4d) could be required to specifically address changes in views from visually sensitive areas and reduce visual impacts to a less-than-significant level.

The Baden and San Pedro Valve Lots project (PN-1) would construct two structures, which would be 1 to 3 feet tall. The Baden Valve Lot is located west of El Camino (Highway 82), and trees and fencing along the west side of this street obscure views of this facility. The San Pedro Valve Lot is adjacent to I-280 and Junipero Serra Boulevard, and existing facilities are visible from these streets. Caltrans has designated I-280 as a scenic highway (from the Santa Clara County line to north of the city limit in San Bruno). Proposed facilities would be located within these existing valve lots and would not significantly alter the existing visual character of these facilities or vicinity. The proposed height of project facilities (1 to 3 feet) would also minimize the potential for changes in views. Therefore, the visual impact from this project would be *less than significant*.

San Francisco Region

Impact 4.3-4: Permanent adverse impacts on scenic vistas or visual character		
SAPL 3 Installation	SF-1	PSM
Groundwater Projects	SF-2	PSM
Recycled Water Projects	SF-3	PSM

The SAPL 3 Installation project (SF-1) would construct two new structures (up to 8 feet high) and two new vaults (up to 30 inches high). The pipeline alignment traverses or extends along the boundary of the Lake Merced Golf & Country Club and San Francisco Golf Club

properties. The alignment would be within the viewshed of I-280 and 19th Avenue in San Francisco, both scenic routes. Depending on location, new structures (up to 8 feet high) could be visible from sensitive areas such as these two golf clubs. Pipeline construction could result in visual impacts if damage or loss of mature trees were to occur at the Lake Merced Golf & Country Club or the San Francisco Golf Club. The visual impacts from this project could be *potentially significant,* but implementation of mitigation measures addressing architectural design (Measure 4.3-4a), landscaping plans (Measure 4.3-4b), landscape screens (Measure 4.3-4c), and tree removal (Measure 4.3-4d) would reduce potential visual impacts to a less-than-significant level.

The Groundwater Projects (SF-2) would build new wells and well stations in San Francisco and San Mateo Counties. The facilities could be within the viewsheds of I-280 and the Great Highway, both designated scenic routes, as well as Lake Merced, Pine Lake, San Francisco Zoo, and/or Golden Gate Park. The potential for visual impacts would depend on the final locations. Up to 16 single-story structures could be developed at various locations on the west side of San Francisco or in northern San Mateo County. These buildings would be small in scale and generally located in urbanized areas, reducing the potential for adverse changes to the existing surrounding visual character. Therefore, visual impacts would be *potentially significant,* but implementation of mitigation measures addressing architectural design (Measure 4.3-4a), landscaping plans (Measure 4.3-4b), landscape screens (Measure 4.3-4c), and tree removal (Measure 4.3-4d) would reduce potential visual impacts to a less-than-significant level.

The Recycled Water Projects (SF-3) would construct up to four new structures for a recycled water facility. The structures could be visible if the recycled water treatment facility is located in the vicinity of the San Francisco Zoo and Oceanside WPCP, which are visible from the Great Highway and Skyline Boulevard (Highway 35) as well as from within Golden Gate Park. Any new facilities (up to 40 feet high) in the vicinity of the San Francisco Zoo and Oceanside WPCP could affect views from the Great Highway, Skyline Boulevard (Highway 35), or other scenic roads in this area, a *potentially significant* impact. With implementation of mitigation measures addressing architectural design (Measure 4.3-4a), landscaping plans (Measure 4.3-4b), landscape screens (Measure 4.3-4c), and tree removal (Measure 4.3-4d), as appropriate, these potentially significant impacts would be reduced to a less-than-significant level.

Impact 4.3-5: New permanent sources of light and glare.

Some of the WSIP projects would involve the installation of permanent new outdoor lighting on aboveground project components. Lighting design information is not yet available for WSIP projects. It is expected that visual impacts associated with light and glare would be evaluated as part of separate, project-level CEQA review when more detailed project designs become available.

All Regions

Development of some WSIP projects, particularly those located in urban areas, would have the potential to introduce new sources of light and glare. Until project-specific design information becomes available, this impact is considered *potentially significant* for all WSIP projects. However, two of these WSIP projects involve the rehabilitation or development of underground facilities only except for existing vaults (SJPL Rehabilitation, SJ-4, and BDPL 3 and 4 Seismic Upgrade at Hayward Fault, BD-3). Since there are no new aboveground structures, the potential need for outdoor lighting would be low. It is expected that implementation of design measures to limit lighting effects (Measure 4.3-5) would reduce this impact to a less-than-significant level for all WSIP projects.

4.3.3 References – Land Use and Visual Quality

San Francisco Planning Department, *Alameda Watershed Management Plan, Final Environmental Impact Report*, August 2000a.

San Francisco Planning Department, *Hetch Hetchy Water Treatment Project Chloramine Conversion, Final Environmental Impact Report*, December 2000b.

San Francisco Planning Department, *Peninsula Watershed Management Plan, Final Environmental Impact Report*, 2001.

San Francisco Public Utilities Commission (SFPUC), Right of Way Encroachment Policy, www.sfwater.org, 2007.

4.4 Geology, Soils, and Seismicity

4.4 Geology, Soils, and Seismicity

4.4.1 Setting

Regional Physiography

California has an extremely varied landscape and physiography, which ranges from broad, nearly flat valleys to jagged, glaciated mountains. To help distinguish these areas, California has been divided into 12 geomorphic provinces that are topographic-geologic groupings of convenience based primarily on landforms and geologic history (Norris and Webb, 1976). WSIP facilities would be located within two geomorphic provinces of California: the Coast Ranges and Great Valley provinces. The westernmost facility in the San Joaquin Region (Lawrence Livermore, SJ-2) and all facilities in the Sunol Valley, Bay Division, Peninsula, and San Francisco Regions are located in the Coast Ranges Geomorphic Province. The remaining San Joaquin Region facilities are located on the eastern and western edges of the Great Valley Geomorphic Province.

Coast Ranges Geomorphic Province

The Coast Ranges province extends approximately 600 miles, from the Santa Ynez River in Santa Barbara County to the Oregon border in northern Humboldt County. The region consists of northwest-trending mountain ranges, broad basins, and elongated valleys generally parallel to the San Andreas fault. The Coast Ranges are generally divided in two sub-provinces, north and south of San Francisco Bay. In the Coast Ranges, older, consolidated rocks are characteristically exposed in the mountains but are buried beneath younger, unconsolidated alluvial fan and fluvial sediments in the valleys and lowlands. In the coastal lowlands, these younger sediments commonly interfinger with marine deposits.

The portions of the program area in the Coast Ranges province are located in the southern Coast Ranges sub-province. The major geographic features in this area include: the Diablo Range, Santa Cruz Mountains, San Francisco Peninsula, and San Francisco Bay.

Great Valley Geomorphic Province

The Great Valley province is an elongated depression that lies between the Coast Ranges and the Sierra Nevada. It is about 430 miles long and 75 miles wide. At its extreme northern and southern ends, the elevation is about 400 feet. At its center, east of San Francisco Bay, it is slightly below sea level.

The Great Central Valley is actually two large valleys lying end to end, each drained by a major river. The Sacramento Valley is drained by the Sacramento River, and the San Joaquin Valley is drained by the San Joaquin River. The confluence of these two rivers is east of San Francisco Bay. This area, the Sacramento–San Joaquin Delta, was formerly a massive wetland. It is now one of California's important agricultural areas. The Great Valley is a trough in which sediments have been deposited almost continuously since the Jurassic (about 160 million years ago). Sands and gravel over 30,000 feet deep lie upon Sierran basement rocks that extend downward at an

angle from the western slope of the Sierra Nevada. Great oil fields have been found in southernmost San Joaquin Valley and along its southwestern margin.

Regional Geologic Hazards

Slope Failure

Slope failures, commonly referred to as landslides, include many phenomena that involve the downslope displacement and movement of material, either triggered by static (i.e., gravity) or dynamic (i.e., earthquake) forces. Exposed rock slopes undergo rockfalls, rockslides, or rock avalanches, while soil slopes experience soil slumps, rapid debris flows, and deep-seated rotational slides. Slope stability can depend on a number of complex variables, including the geology, structure, and amount of groundwater, as well as external processes such as climate, topography, slope geometry, and human activity. The factors that contribute to slope movements include those that decrease the resistance in the slope materials and those that increase the stresses on the slope.

Landslides can occur on slopes of 15 percent or less, but the probability is greater on steeper slopes that exhibit old landslide features such as scarps, slanted vegetation, and transverse ridges. Landslides typically occur within slide-prone geologic units that contain excessive amounts of water or are located on steep slopes, or where planes of weakness are parallel to the slope angle.

The best available predictor of where slides and earth flows might occur is the distribution of past movements (Nilsen and Turner, 1975). In 1997, the U.S. Geological Survey (USGS) released a preliminary map and geographic information system (GIS) database that provides a summary of the distribution of landslides evident in the landscape of the San Francisco Bay region (USGS, 1997). The map is a digitized nine-county compilation of existing landslides that has been used to divide the area into four landslide zones. These four zones are designated as follows:

- *Mostly Landslide*. Consists of mapped landslides, intervening areas typically narrower than 1,500 feet, and narrow borders around landslides; defined by drawing envelopes around groups of mapped landslides.

- *Many Landslides*. Consists of mapped landslides and more extensive intervening areas than in "mostly landslide"; defined by excluding areas free of mapped landslides; outer boundaries are quadrangle and county limits to the areas in which this unit was defined.

- *Few Landslides*. Contains few, if any, large mapped landslides, but locally contains scattered small landslides and questionably identified larger landslides; defined in most of the region by excluding groups of mapped landslides, but defined directly in areas containing the "many landslides" unit by drawing envelopes around areas free of mapped landslides.

- *Flat Land*. Areas of gentle slope at low elevations that have little or no potential for the formation of slumps, landslides, or earth flows, except along stream banks and terrace margins; defined by the distribution of surficial deposits (Wentworth, 1997).

Unsuitable Soils

Soil mapping by the U.S. Department of Agriculture, Natural Resources Conservation Service (NRCS) has provided information on surface and near-surface subsurface soil materials in the program area. A generalized soil map for the state of California, generated using GIS data provided in the NRCS State Soil Geographic (STATSGO) database, was used to identify soil conditions at the WSIP project sites. The STATSGO map combines individual soil units from more detailed maps into larger map units of soils with similar general characteristics. The distribution of soil units is highly variable within the program area. Although tables of soil characteristics are included in the STATSGO database, the data in the tables are divided into a much greater level of detail than the map and cannot be directly correlated to the generalized map units on the STATSGO soil map. These data could not be effectively used to evaluate specific soil parameters along the alignments; therefore, the following discussions regarding the potential for corrosive, expansive, and erodible soil conditions provide only a general discussion of these potential soil issues.

Corrosive Soils

Corrosivity of soils is commonly related to several key parameters: soil resistivity, the presence of chlorides and sulfates, oxygen content, and pH. Typically, the most corrosive soils are those with the lowest pH and highest concentration of chlorides and sulfates. Wet/dry conditions can result in a concentration of chlorides and sulfates as well as movement in the soil that tends to break down protective corrosion films and coatings on the surface of building materials. High-sulfate soils are also corrosive to concrete and may prevent complete curing, reducing its strength considerably. Low pH and/or low-resistivity soils can corrode buried or partially buried metal structures.

Expansive Soils

Expansive soils are characterized by their ability to undergo significant volume change (i.e., to shrink and swell) due to variations in soil moisture content. Changes in soil moisture can result from rainfall, landscape irrigation, utility leakage, roof drainage, and/or perched groundwater.[1] Expansive soils are typically very fine grained with a high to very high percentage of clay.

Squeezing Ground

Squeezing ground is a time-dependent phenomenon usually associated with tunnel construction through a fault zone. Squeeze occurs when the in-situ stresses are high relative to the strength of the material. A high stress-to-strength ratio causes a slow creep of ground around the tunnel toward the excavated opening (Brown et al., 1981). Squeezing ground occurs when soil pressure above the tunnel leads to a lateral squeezing of the tunnel walls, and can cause tunneling difficulties that require special tunneling techniques. Squeezing ground conditions are expected where shear zones[2]

[1] Perched groundwater is a local saturated zone above the water table. It typically exists above an impervious layer (such as clay) with limited extent.

[2] A shear zone is a zone of rock fracturing consisting of many closely spaced, roughly parallel, discontinuous cracks. Shear zones typically occur along faults.

are encountered, especially within the Hayward Fault Zone. This phenomenon can be controlled and is further discussed in the impact analysis.

Mineral Resources

Mineral resources in central California include a mix of fuel and nonfuel resources. Fuel resources in the central California region consist of oil and gas, which are found in the San Joaquin Region. Nonfuel resources, found in all of the regions, include gravel and sand, aggregate, clay, stone/rock, and salt. Sand, clay, gravel, and rock products are the most important mineral resources in California and are still actively mined or quarried in the Sunol Valley. As discussed in Section 4.14, Hazards, the western segment of the SJPL System (SJ-3) alignment passes between the Vernalis and Southwest Vernalis Gas Fields. Active gas wells in the Vernalis Field are more than one mile north of the alignment, although plugged and abandoned dry oil exploration holes are located about one-half mile from the alignment.

Regional Faulting and Seismic Hazards

Seismicity

The San Francisco Bay Area is situated near the boundary between two major tectonic plates, the Pacific Plate to the southwest and the North American Plate to the northeast. Since the Miocene (approximately 23 million years ago), about 200 miles of right-lateral slip has occurred along the San Andreas Fault Zone to accommodate the relative movement between these two plates. This movement has juxtaposed the granitic rocks southwest of the San Andreas fault with the Franciscan rocks lying to the northeast. The movement between the Pacific Plate and the North American Plate generally occurs across a 50-mile zone extending from the San Gregorio fault in the southwest to the Great Valley Thrust Belt to the northeast. In addition to the right-lateral slip movement between tectonic plates, a compressional component of relative movement has developed during the last 3.5 million years between the Pacific Plate and the Sierran micro-plate of the North American Plate at the latitude of San Francisco Bay (Fenton and Hitchcock, 2001). Strain produced by the relative motions of these plates is relieved by right-lateral strike-slip faulting on the San Andreas and related faults, and by vertical reverse-slip displacement on the Great Valley and other thrust faults in the central California area.

The San Francisco Bay Area and surrounding areas are characterized by numerous geologically young faults. These faults can be classified based on the following criteria (CGS, 1999):

- *Historically Active*. Faults that have generated earthquakes accompanied by surface rupture during historic time (approximately the last 200 years) and faults that exhibit aseismic fault creep.[3]

- *Active*. Faults that show geologic evidence of movement within Holocene time (approximately the last 11,000 years).

[3] Fault creep is movement along a fault that does not entail earthquake activity.

- *Potentially Active*. Faults that show geologic evidence of movement during the Quaternary (approximately the last 1.6 million years).

- *Inactive*. Faults that show direct geologic evidence of inactivity during all of Quaternary time or longer.

Although it is difficult to quantify the probability that an earthquake will occur on a specific fault, this classification is based on the assumption that if a fault has moved during the Holocene epoch, it is likely to produce earthquakes in the future.

Thrust faults have no surface expression and have been located using subsurface geologic and geophysical methods. Since movement along these faults occurs on subsurface planes, the activity classification is predominantly based on historical earthquakes and microseismic activity along the fault, unlike faults with surface expression.

Because periodic earthquakes accompanied by surface displacement can be expected to continue in the program area through the lifetime of the proposed WSIP projects, the effects of strong groundshaking and fault rupture are of primary concern with respect to the safe operation of WSIP facilities. **Figure 4.4-1** shows the locations of active and potentially active faults (representing possible seismic sources) in the program vicinity. **Table 4.4-1** indicates the faults in the program vicinity that represent substantial potential seismic sources. The USGS Working Group on California Earthquake Probabilities (WG02) concluded that there is a 62 percent probability of a strong earthquake (magnitude ≥6.7) occurring in the San Francisco Bay region in a 30-year period between 2003 and 2032 (USGS, 2003).

The San Andreas, San Gregorio, Hayward, Rodgers Creek, Calaveras, and Greenville strike-slip faults[4] are active faults of the San Andreas system that predominantly accommodate lateral movement between the North American and Pacific tectonic plates. Active blind- and reverse-thrust faults[5] in the program vicinity include the Monte Vista–Shannon, Mount Diablo, Great Valley 7, and Great Valley 8 faults. The eastern portions of the SFPUC regional water system may also be affected by movement on the potentially active Foothills Fault System, which comprises range-front faults[6] in the Sierra Nevada foothills that are responsible for the uplift of the Sierra Nevada mountains.

Groundshaking

An earthquake is classified by the amount of energy released, which traditionally has been quantified using the Richter scale. Seismologists have begun using a moment magnitude (M) scale because it provides a more accurate measurement of the size of major and great earthquakes. For earthquakes of less than M 7.0, the moment and Richter magnitude scales are

4 Strike-slip faults involve the two blocks moving parallel to each other without a vertical component of movement.
5 A reverse fault is one with predominantly vertical movement in which the upper block moves upward in relation to the lower block; a thrust fault is a low-angle reverse fault. Blind-thrust faults are low-angled subterranean faults that have no surface expression.
6 Range-front faults are faults along the front of mountain ranges responsible for the uplift of the mountains.

nearly identical. For earthquake magnitudes greater than M 7.0, readings on the moment magnitude scale are slightly greater than a corresponding Richter magnitude.

The intensity of the seismic shaking, or strong ground motion, during an earthquake is dependent on the distance between the project area and the epicenter of the earthquake, the magnitude of the earthquake, and the geologic conditions underlying and surrounding the project area. Earthquakes occurring on faults closest to the project area would most likely generate the largest ground motions.

A review of historical earthquake activity during the period from 1800 to 2004 indicates that 23 earthquakes of M 6.0 or greater occurred within and near the program area during this timeframe. **Table 4.4-2** presents a summary of significant and/or damaging earthquakes.[7] There were an additional 35 earthquakes in the program area with magnitudes between M 5.5 and M 6.0 during this time period, including numerous aftershocks of larger earthquakes.

The intensity of earthquake-induced ground motions can be described using peak ground accelerations, represented as a fraction of the acceleration of gravity (g).[8] The interactive California Geological Survey (CGS) Probabilistic Seismic Hazard Assessment map (CGS, 2007) provides data to estimate peak ground accelerations in California. Taking into consideration the uncertainties regarding the size and location of earthquakes and the resulting ground motions that can affect a particular site, the map depicts peak ground accelerations with a 10 percent probability of being exceeded in 50 years, which equals an annual probability of 1 in 475 of being exceeded each year.

Another commonly used measure of earthquake intensity is the Modified Mercalli Scale, which is a subjective measure of the strength of an earthquake at a particular place as determined by its effects on people, structures, and earth materials. **Table 4.4-3** presents the Modified Mercalli Scale for Earthquake Intensity, along with approximate earthquake magnitudes and average peak accelerations associated with each intensity value.

Fault Rupture

Surface rupture occurs when movement on a fault deep within the earth breaks through to the surface. Surface ruptures associated with the 1906 San Francisco earthquake extended for more than 260 miles, with displacements of up to 21 feet. However, not all earthquakes result in surface rupture. The Loma Prieta earthquake of 1989 caused major damage in the San Francisco Bay Area, but the fault movement did not break through to the ground surface.

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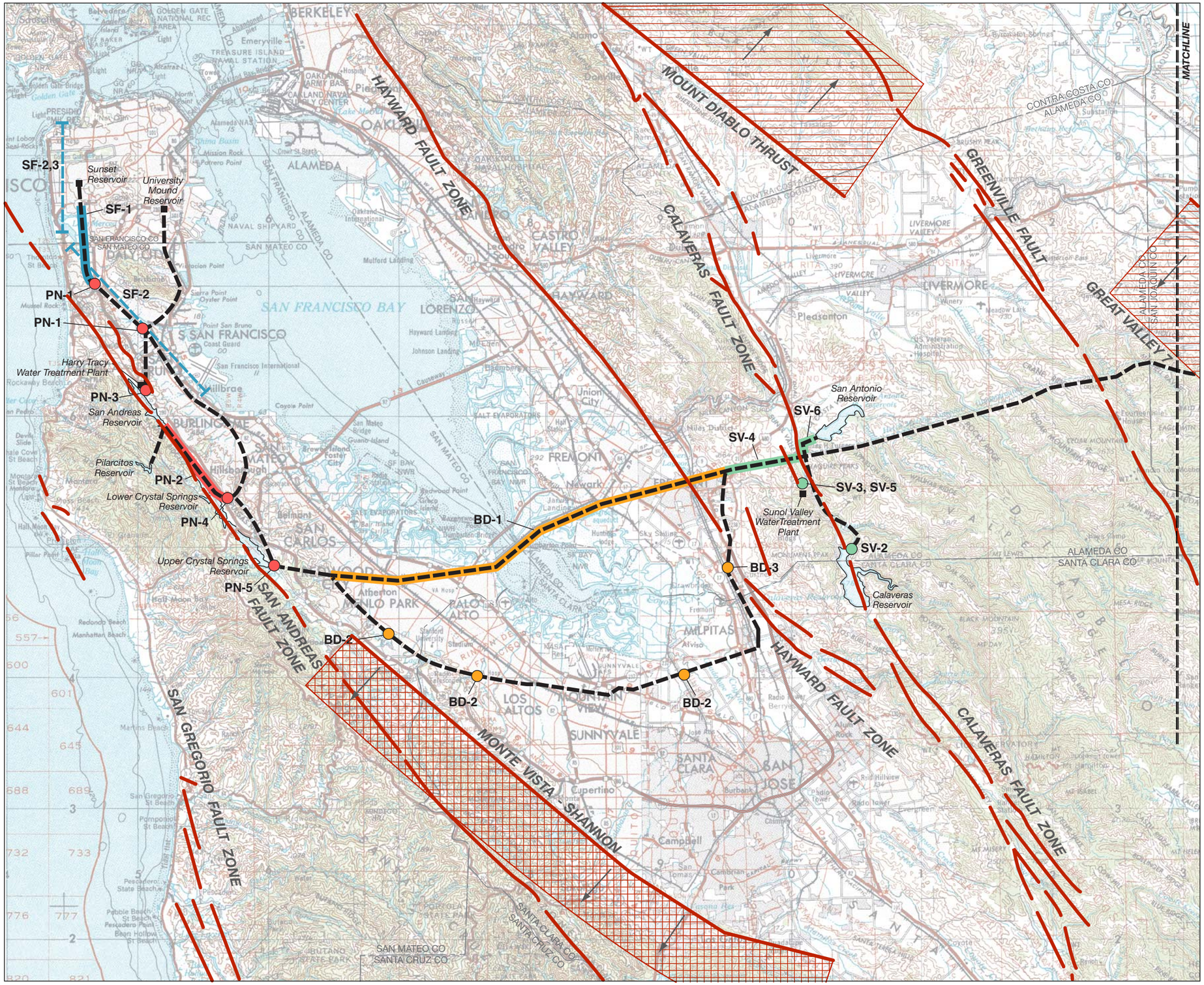
7 In Table 4.4-2, the estimated magnitude of the 1868 earthquake on the Hayward fault is 7.0; however, as presented in Table 4.4-1, the USGS estimates the maximum earthquake magnitude on this fault at 6.7. This discrepancy is likely due to inaccuracies in estimating earthquake magnitudes prior to use of the sophisticated earthquake measurement equipment in existence today.

8 Acceleration of gravity (g) = 980 centimeters per second squared. 1.0 g of acceleration is a rate of increase in speed equivalent to a car traveling 328 feet from rest in 4.5 seconds.



MAJOR FAULTS IN THE VICINITY OF THE SFPUC REGIONAL WATER SYSTEM

- Active Fault
- Pre-Quaternary Fault considered Potentially Active
- Blind Thrust Fault (fault does not intersect the surface, heavy solid line represents projection of the upper edge of the fault to the surface and rectangle represents the projection of the fault plane to the surface. Arrow points in the dip direction.)
- Reverse Thrust Fault (fault does not intersect the surface, heavy solid line represents projection of the upper edge of the fault to the surface and rectangle represents the projection of the fault plane to the surface. Arrow points in the dip direction.)
- Existing System Corridor
- Existing System Facility
- Proposed Facility Corridor
- Proposed Facility Site
- Proposed Facility, General Location

Note: See Figure 4.1-2 for full Project Names

SOURCE: ESA+Orion JV, 2006. Fault information based on: California Geological Survey (CGS), /Probabilistic Seismic Hazard Assessment For The State Of //California//, Appendix A: Fault Source Parameters/, revised in 2002, from CDMG Open File-Report 96-08, accessed at http://www.consrv.ca.gov/CGS/rghm/psha/ofr9608/, 2002.

SFPUC Water System Improvement Program . 203287

Figure 4.4-1a
Major Faults in the Vicinity of the SFPUC Regional Water System

MAJOR FAULTS IN THE VICINITY OF THE SFPUC REGIONAL WATER SYSTEM

- Active Fault
- Pre-Quaternary Fault considered Potentially Active
- Blind Thrust Fault (fault does not intersect the surface, heavy solid line represents projection of the upper edge of the fault to the surface and rectangle represents the projection of the fault plane to the surface. Arrow points in the dip direction.)
- Reverse Thrust Fault (fault does not intersect the surface, heavy solid line represents projection of the upper edge of the fault to the surface and rectangle represents the projection of the fault plane to the surface. Arrow points in the dip direction.)
- Existing System Corridor
- Existing System Facility
- Proposed Facility Corridor
- Proposed Facility Site
- Proposed Facility, General Location

Note: See Figure 4.1-2 for full Project Names

0 5
Miles

SOURCE: ESA+Orion JV, 2006. Fault information based on: California Geological Survey (CGS), /Probabilistic Seismic Hazard Assessment For The State Of //California//, Appendix A: Fault Source Parameters/, revised in 2002, from CDMG Open File-Report 96-08, accessed at http://www.consrv.ca.gov/CGS/rghm/psha/ofr9608/, 2002.

SFPUC Water System Improvement Program . 203287

Figure 4.4-1b
Major Faults in the Vicinity of the SFPUC Regional Water System

TABLE 4.4-1
SIGNIFICANT ACTIVE AND POTENTIALLY ACTIVE FAULTS

Fault Name	Estimated Maximum Earthquake Magnitude[a,b]	Approximate Fault Segment Length (miles)[b]	Average Recurrence Interval (years)[c]	Fault Type and Dip Direction[b]	Approximate Slip Rate (mm/yr)[b,d]
San Andreas (Peninsula)	7.2	53	229	Right-Lateral Strike-Slip, 90 degrees	17.0
San Andreas (North Coast South)	7.4	118	223	Right-Lateral Strike-Slip, 90 degrees	24.0
San Gregorio (North)	7.2	68	392	Right-Lateral Strike-Slip, 90 degrees	7.0
Monte Vista–Shannon	6.7	28	2,400[c]	Blind Thrust, 60 degrees west	0.4
Hayward (Northern)	6.5	22	155	Right-Lateral Strike-Slip, 90 degrees	9.0
Hayward (Southern)	6.7	33	161	Right-Lateral Strike-Slip, 90 degrees	9.0
Rodgers Creek	7.0	38	205	Right-Lateral Strike-Slip, 90 degrees	9.0
Calaveras (Northern)	6.8	28	187	Right-Lateral Strike-Slip, 90 degrees	6.0
Calaveras (Central)	6.2	37	54	Right-Lateral Strike-Slip, 90 degrees	15.0
Mount Diablo	6.7	15	389	Reverse Thrust, 38 degrees northeast	2.0
Greenville (North)	6.7	17	644	Right-Lateral Strike-Slip, 90 degrees	2.0
Greenville (South)	6.6	15	623	Right-Lateral Strike-Slip, 90 degrees	2.0
Great Valley 7	6.7	28	560[c]	Reverse Thrust, 15 degrees west	1.5
Great Valley 8	6.6	25	540[c]	Reverse Thrust, 15 degrees west	1.5
Foothills Fault System	6.5	223	12,500[c]	Normal Right-Lateral Oblique, 75 degrees east	0.05

[a] The maximum earthquake magnitude is the strongest earthquake that appears capable of occurring under the presently known tectonic framework, using the Richter scale.
[b] Fault parameters from CGS, 2002, and USGS, 2003.
[c] Recurrence Intervals from USGS, 2003.
[d] References to fault slip rates are traditionally presented in millimeters per year.

Fault rupture almost always follows preexisting faults, which are zones of weakness. Rupture may occur suddenly during an earthquake or slowly in the form of fault creep. Sudden displacements are more damaging to structures because they are accompanied by shaking. Fault creep is the slow rupture of the earth's crust. The Hayward fault where it crosses highly developed areas in Contra Costa and Alameda Counties exhibits fault creep, which offsets and deforms curbs, streets, buildings, and other structures that lie on the fault trace.

TABLE 4.4-2
SIGNIFICANT HISTORICAL EARTHQUAKES

Date	Earthquake Magnitude[a]	Name, Location, or Region Affected	Associated Fault	Comments[b]
June 1838	Assumed between 6.8 and 7.4	San Francisco Area	San Andreas	This earthquake is associated with probable rupture of the San Andreas fault from Santa Clara to San Francisco (approximately 37 miles). Walls were cracked at Mission Dolores and in Monterey.
October 8, 1865	6.5	Santa Cruz Mountains	San Andreas	Caused severe damage in New Almaden, Petaluma, San Francisco, San Jose, Santa Clara, and Santa Cruz resulting in $500,000 in property damage. Ground cracks, heaving, and subsidence were noted in several areas.
October 21, 1868	7.0	Hayward	Hayward	Felt throughout northern California and Nevada. Resulted in 30 deaths and $300,000 in property damage. Occurred on the Hayward fault with rupture from Berkeley to Fremont. Caused severe damage in the East Bay and San Francisco.
June 20, 1897	6.2	Gilroy	Calaveras	Felt from Woodland to San Luis Obispo. Resulted in building collapse in the Santa Clara Valley. Fissures were noted on the Calaveras fault southeast of Gilroy.
April 18, 1906	7.8	San Francisco Earthquake, San Francisco	San Andreas	This earthquake and the resulting fires caused approximately 3,000 deaths and $524 million in damage ($24 million from the earthquake alone). Destruction from this earthquake occurred at distances of up to 350 miles from the epicenter.
July 1, 1911	6.4	Morgan Hill	Calaveras	Located on the Calaveras fault, caused substantial damage in Gilroy and the Santa Clara Valley. Felt as far away as Reno, Nevada.
January 24, 1980	5.8	North of Livermore Valley	Greenville	Occurred on the Greenville fault with surface rupture of approximately nine miles. Resulted in numerous injuries and $11.5 million in property damage (primarily at Lawrence Livermore Laboratory).
April 24, 1984	6.2	Morgan Hill Earthquake, Morgan Hill	Calaveras	Earthquake was felt from San Francisco to Bakersfield and was located near the epicenter of the 1911 earthquake in Morgan Hill. Resulted in injuries and approximately $8 million in property damage.
October 17, 1989	6.9	Loma Prieta Earthquake, Santa Cruz Mountains	San Andreas	Largest earthquake to occur on the San Andreas fault since 1906. Resulted in 63 deaths, over 3,000 injuries, and an estimated $6 billion in property damage. Severe damage occurred from San Francisco to Monterey and in the East Bay, and included damage and destruction of buildings, roads, bridges, and freeways.

[a] Earthquake magnitudes and locations before 1932 are estimated based on reports of damage and felt effects (Toppozada et al., 1978, 1981, and 1982). Magnitudes reported using the Richter scale.
[b] Earthquake damage information primarily compiled from NEIC, 2007, and Berkeley Seismological Laboratory, 2007. Estimates of property damage values are in dollars valued to the year of damage.

TABLE 4.4-3
MODIFIED MERCALLI SCALE FOR EARTHQUAKE INTENSITY

Intensity Value	Intensity Description	Approximate Earthquake Magnitude (Richter)	Average Peak Acceleration
I	Not felt except by a very few persons under especially favorable circumstances.	1.0–3.0	<0.015 g
II	Felt only by a few persons at rest, especially on upper floors on buildings. Delicately suspended objects may swing.	3.0–3.9	
III	Felt noticeably indoors, especially on upper floors of buildings, but many people do not recognize it as an earthquake. Standing motor cars may rock slightly, vibration similar to a passing truck. Duration estimated.		
IV	During the day felt indoors by many, outdoors by few. At night, some awakened. Dishes, windows, doors disturbed; walls make cracking sound. Sensation like heavy truck striking building. Standing motor cars rocked noticeably.	4.0–4.9	0.015–0.03 g
V	Felt by nearly everyone, many awakened. Some dishes and windows broken; a few instances of cracked plaster; unstable objects overturned. Disturbances of trees, poles may be noticed. Pendulum clocks may stop.		0.03–0.08 g
VI	Felt by all, many frightened and run outdoors. Some heavy furniture moved; and fallen plaster or damaged chimneys. Damage slight.	5.0–5.9	0.08–0.15 g
VII	Everybody runs outdoors. Damage negligible in buildings of good design and construction; slight to moderate in well-built ordinary structures; considerable in poorly built or badly designed structures; some chimneys broken. Noticed by persons driving motor cars.		0.15–0.25 g
VIII	Damage slight in specially designed structures; considerable in ordinary substantial buildings, with partial collapse; great in poorly built structures. Panel walls thrown out of frame structures. Fall of chimneys, factory stacks, columns, monuments, walls. Heavy furniture overturned. Sand and mud ejected in small amounts. Changes in well water. Persons driving motor cars disturbed.	6.0–6.9	0.25–0.45 g
IX	Damage considerable in specially designed structures; well-designed frame structures thrown out of plumb; great in substantial buildings, with partial collapse. Buildings shifted off foundations. Ground cracked conspicuously. Underground pipes broken.	7.0 and higher	0.45–0.60 g
X	Some well-built wooden structures destroyed; most masonry and frame structures destroyed with foundations; ground badly cracked. Rails bent. Landslides considerable from riverbanks and steep slopes. Shifted sand and mud. Water splashed (slopped) over banks.		0.60–0.80 g
XI	Few, if any, masonry structures remain standing. Bridges destroyed. Broad fissures in ground. Underground pipelines completely out of service. Earth slumps and land slips in soft ground. Rails bent greatly.		0.80–0.90 g
XII	Damage total. Practically all works of construction are damaged greatly or destroyed. Waves seen on ground surface. Lines of sight and level are distorted. Objects are thrown upward into the air.		>0.90 g

SOURCE: Bolt, 1988.

Although future earthquakes could occur anywhere along the length of the faults listed in Table 4.4-1, only regional strike-slip earthquakes of magnitude 6.0 or greater are likely to be associated with surface fault rupture and offset (CGS, 1996). It is also important to note that earthquake activity and fault rupture due to unmapped subsurface fault traces is a possibility that is not predictable.

Liquefaction

Liquefaction is a phenomenon in which saturated granular sediments temporarily lose their shear strength during periods of earthquake-induced, strong groundshaking. The susceptibility of a site to liquefaction is a function of the depth, density, and water content of the granular sediments and the magnitude of earthquakes likely to affect the site. Saturated, unconsolidated silts, sands, silty sands, and gravels within 50 feet of the ground surface are most susceptible to liquefaction. Liquefaction-related phenomena include vertical settlement from densification, lateral spreading, ground oscillation, flow failures, loss of bearing strength, subsidence, and buoyancy effects.

Holocene-age alluvial sediments are especially prone to liquefaction. Older alluvial sediments deposited during the Pleistocene epoch are generally not liquefiable because they are more consolidated. Artificial fills, especially those placed on the San Francisco Bay margins prior to about 1950, are also highly prone to liquefaction.

Lateral Spreading

Of the liquefaction hazards, lateral spreading generally causes the most damage. This is a phenomenon where large blocks of intact, nonliquefied soil move downslope on a liquefied substrate of large aerial extent (Youd et al., 1978). The mass moves toward an unconfined area, such as a descending slope or stream-cut bluff, and can occur on slope gradients as gentle as 1 degree. Drainages and swales between hill slopes are generally filled by alluvium,[9] colluvium,[10] landslide debris, and slope wash. Unconsolidated deposits often develop soils along steep and shallow slopes in these areas.

Earthquake-Induced Settlement

Settlement of the ground surface can be accelerated and accentuated by earthquakes. During an earthquake, settlement can occur as a result of the relatively rapid rearrangement, compaction, and settling of subsurface materials (particularly loose, noncompacted, and variable sandy sediments). Settlement can occur both uniformly and differentially (i.e., where adjoining areas settle at different rates). Areas are susceptible to differential settlement if underlain by compressible sediments, such as poorly engineered artificial fill or bay mud.

Seismic Slope Instability/Ground Cracking

Earthquake motions can also induce substantial stresses in slopes, causing earthquake-induced landslides or ground cracking when the slope fails. Earthquake-induced landslides can occur in

[9] Alluvium consists of unconsolidated mixtures of gravel, sand, clay, and silt typically deposited by streams.
[10] Colluvium is a loose deposit of rock debris accumulated through the action of gravity at the base of a cliff or slope.

areas with steep slopes that are susceptible to strong ground motion during an earthquake. The 1989 Loma Prieta earthquake triggered thousands of landslides over an area of 770 square miles.

San Joaquin Valley (San Joaquin Region)

Physiography

WSIP facilities in the San Joaquin Valley lie within and on the margins of California's Great Valley Geomorphic Province. The San Joaquin Valley is an elongated, asymmetrical structural trough approximately 250 miles long and averaging 35 miles wide (Davis et al., 1959). The valley lies between the Coast Ranges Geomorphic Province to the west and the Sierra Nevada Range Geomorphic Province to the east. Traversing from southwest to northeast, the WSIP facilities span from the eastern end of the Coast Ranges, across the San Joaquin Valley floor, and onto the western foothills of the Sierra Nevada. Ground surface elevations along the western portion of this region range from a peak of approximately 825 feet at the existing Thomas Shaft facility in the Coast Ranges (where Lawrence Livermore, SJ-2, would be located) to an approximate elevation of 325 feet near the base of these mountains at Tesla Portal (where Advanced Disinfection, SJ-1, and Tesla Portal Disinfection, SJ-5, would be located) to a low elevation of approximately 30 feet along the existing San Joaquin Pipeline alignments (where SJPL System, SJ-3, and SJPL Rehabilitation, SJ-4, would be located). Along the eastern segment of the existing San Joaquin Pipeline system, elevations reach a peak of approximately 825 feet in the Sierra foothills at Oakdale Portal (USGS, 1989, 1994).

Geology

WSIP facilities in the San Joaquin Valley region span a nearly flat alluvial plain that forms the San Joaquin Valley within the Great Valley Geomorphic Province. The Great Valley is a large, northwest-trending structural trough that has been filled with several thousand feet of sedimentary and volcanic rocks.

In the program area, the sedimentary and volcanic sequence typically consists of marine sedimentary rocks that range in age from Jurassic to Cretaceous, overlain by Cenozoic to Quaternary continental deposits. The marine sedimentary rocks in the region are comprised of undifferentiated Upper Cretaceous sedimentary rocks, and sandstones and shales of the Panoche and Marino Formations.

The continental rocks comprise moderately consolidated sedimentary rock and volcanic deposits that outcrop in the foothills along the flanks of the Central Valley, and poorly consolidated alluvial deposits containing gravel, sand, silt, and clay that are present on the valley floor. The moderately consolidated sedimentary and volcanic deposits typically occupy the eastern margin of the Great Valley and consist of andesitic mudflow breccia[11] of the Mehrten Formation, and rhyolitic tuff[12] and sedimentary rocks of the Valley Springs Formation (Wagner et al., 1990).

[11] Breccia is a coarse-grained rock composed of angular broken rock fragments in a fine-grained matrix. Andesitic mudflow breccia is formed by a mudflow composed primarily of volcanic rock fragments of andesitic composition.

[12] Tuff is a rock composed of compacted volcanic ash varying in size from fine sand to coarse gravel. Rhyolitic tuff is comprised of ash similar in composition to granite.

Shallow alluvial deposits (Quaternary) that span the valley floor in the program area include alluvial fan deposits along the eastern margin of the Coast Ranges, and floodplain and riverbank deposits of the Dos Palos, Modesto, Riverbank, and Turlock Lake Formations (Wagner et al., 1990).

Beneath the Coast Ranges and the western side of the Central Valley, the sedimentary rocks are underlain by a basement complex of Mesozoic-age metamorphic rocks of the Franciscan Complex (Wagner et al., 1990). Beneath the Sierra foothills and the eastern side of the Central Valley, the sedimentary and volcanic sequence rocks are underlain by a basement complex of Mesozoic-age granitic and metamorphic rocks, including the Salt Springs and Merced Falls Slates and the Gopher Ridge Volcanics (Wagner et al., 1990). The structure of these basement rocks beneath the sedimentary deposits on the floor of the San Joaquin Valley region is poorly known (Wagner et al., 1990).

Seismicity

The San Joaquin Valley region of California is relatively seismically inactive compared to the west-neighboring San Francisco Bay and South Bay regions. Although no faults are known to displace the sediments underlying WSIP facilities in the Central Valley, earthquakes on any of the active faults in the greater Bay Area could produce groundshaking and associated seismic hazards at WSIP facilities in the region. For example, the great earthquake of 1906 on the San Andreas fault caused Level IV to VI intensity (Modified Mercalli Scale) across the San Joaquin Valley where WSIP facilities currently exist (USGS, 2007). The nearest fault to WSIP facilities in the San Joaquin Valley capable of producing strong groundshaking is the Great Valley 7 fault, which the SJPL System (SJ-3) and SJPL Rehabilitation (SJ-4) projects cross at the western margin of the region. The Advanced Disinfection (SJ-1) and Tesla Portal Disinfection (SJ-5) projects at Tesla Portal and the Lawrence Livermore project (SJ-2) at Thomas Shaft are also located over this thrust fault. Historical earthquakes on the Great Valley faults include an M 6.5 in 1983 (Segment 6), an M 6.5 in 1892 (Segment 4), and an M 6.0 in 1866 (Segment 7) (USGS, 1996).

South Bay (Sunol Valley and Bay Division Regions)

Physiography

WSIP facilities in the South Bay lie within the Coast Ranges Geomorphic Province. Significant physiographic features in the South Bay include San Francisco Bay and the broad alluvial fans (or flatlands) that were formed between the mountain ranges and the bay. The surrounding mountain ranges that bound the South Bay are the Santa Cruz Mountains on the south and west and the Diablo Range to the east.

The San Antonio and Calaveras Reservoirs are located in long, narrow valleys within the Diablo Range. The reservoirs occupy the La Costa Valley and the Calaveras Valley, respectively. Floor elevations in the La Costa Valley range from approximately 320 feet at the dam on the east side of the valley to 560 feet on the west side. Ground surface elevations along the WSIP facilities range from about 300 feet at the northeasterly base of the Santa Cruz Mountains to sea level

across the San Francisco Bay margin, then to an elevation of up to approximately 1,000 feet through the Diablo Range.

Geology

WSIP facilities in the South Bay are located within the Bay Division and Sunol Valley Regions. Facilities within the Bay Division Region cross sediments of San Francisco Bay and alluvial soils of the Santa Clara Valley. Facilities at the western end of the Bay Division Region also cross into bedrock at the northeastern flank of the Santa Cruz Mountains. Facilities within the Sunol Valley Region primarily traverse bedrock materials of the Diablo Range. Some facilities lie within the valley floors, such as in the Sunol Valley, Calaveras Valley, and La Costa Valley, where alluvial soils overlie the bedrock.

San Francisco Bay, a dominant feature in the South Bay, occupies a Late Pliocene structural depression that has been flooded several times in response to Pleistocene glacial cycles. Sediment deposition within the basin now occupied by the bay has been strongly influenced by ocean-level fluctuations. During periods of glacial advance, sea levels were lower, leaving the basin dry and subject to alluvial deposition, stream channel erosion, and aeolian (wind-related) processes. During periods of glacial retreat, sea levels rose, flooding the basin and resulting in fluvial deposition of fine-grained sediments at the bottom of the bay. The upper sediments within and along the margins of the bay include younger bay mud that has been deposited during and after the melting of the Wisconsin continental glaciers. The younger bay mud in the South Bay is up to approximately 60 feet thick (CDMG, 1969). Underlying the younger bay mud are sequences of alluvial and bay deposits consisting of sand, gravel, clay, and silt associated with previous ocean-level fluctuations. Bedrock underlying San Francisco Bay is predominantly of Jurassic and Cretaceous age and grouped within the Franciscan Complex. Bedrock depths range from about 200 feet near the northern bay crossing of the WSIP facilities to well over 1,000 feet toward the south. Historical development around the bay margins has included placement of artificial fill materials bayward of the natural shoreline, significantly altering the shoreline and reducing the size of the bay.

Flatlands, created by alluvial deposition of locally derived sediments, are found between the bay margins and the surrounding hills. Alluvial soils in the flatlands were deposited during the Quaternary period (during the last 1.8 million years). Alluvial soils range widely from fine-grained clay and silt on the broader, more gently sloping portions of the Santa Clara Valley to coarse-grained sand and gravel along the active or buried historical stream channels and at higher elevations along the range fronts. The upper tens of feet of soil within the Santa Clara Valley tend to be interstratified clay, silt, sand, and gravel as a result of the depositional history of the area. Alluvial soils extend to great depths in the Santa Clara Valley, with bedrock surfaces measuring well over 1,000 feet deep.

Sunol Valley Region

The WSIP facilities within the Sunol Valley Region are predominantly located within bedrock units of the Diablo Range, including marine sedimentary rocks comprised of sandstone, shell breccia, shale, chert, and pebble conglomerates. The marine sedimentary rocks are locally known

as Neroly Formation, Briones Formation, Claremont (Monterey) Formation, Temblor Sandstone, and Irvington Gravels (Santa Clara Formation). These predominantly Tertiary-age formations overlie Mesozoic basement rocks consisting of Creatceous marine sedimentary rocks, primarily of the Niles Canyon and Panoche Formations west of the Hayward fault, and of the Franciscan Complex east of the fault. Alluvial deposits consisting of unconsolidated silt, clay, sand, and gravel overlie the bedrock in the valley areas.

Franciscan serpentinite,[13] an ultramafic[14] rock, and Franciscan mélange,[15] both of which may contain chrysotile (a form of naturally occurring asbestos[16]), occur at Calaveras Dam (SV-2). No serpentinite is mapped near the Alameda Creek Fishery (SV-1), 40-mgd Treated Water (SV-3), or Treated Water Reservoir (SV-4) projects at the Sunol Valley Water Treatment Plant (WTP), or near the New Irvington Tunnel (SV-4) or SABUP (SV-6) projects.

Bay Division Region

WSIP facilities within the Bay Division Region near the northeastern flank of the Santa Cruz Mountains are primarily located on sedimentary and meta-sedimentary bedrock units. The facilities cross units of Plio-Pliestocene-age Santa Clara Formation, marine sedimentary rocks of Eocene age, and Franciscan Complex sandstone.

The Santa Clara Formation is a fluvially deposited, unconsolidated to lightly consolidated unit of bedded conglomerate, sandstone, siltstone, and claystone. These deposits contain significant amounts of montmorillonite clay,[17] which renders the bedrock and the residual soils derived from the bedrock expansive. The next older formations were deposited in a marine environment during the Eocene epoch of the Tertiary period and are comprised of sandstone and mudstone. These formations are underlain by the Franciscan Complex, which is also exposed at the ground surface at the furthest northwest reaches of the South Bay.

The Franciscan Complex is of Jurassic and Cretaceous age and consists of mafic[18] and ultramafic basement rocks and sedimentary rocks that were deposited in a deep ocean environment and subsequently transported to the western margin of the North American Plate by tectonic forces. In the Bay Division Region, the Franciscan Complex is mapped only on the west side of the bay and is predominantly comprised of sandstone. However, geophysical testing in support of the BDPL Reliability Upgrade project (BD-1) indicates the presence of a buried ridge of Franciscan Complex rock, consisting of highly weathered and intensely fractured serpentinite, sandstone, and shale, approximately 1,000 feet west of the Newark Shaft. Serpentinite contains naturally

[13] Serpentinite is a rock consisting of one or more serpentine minerals. Serpentine is a naturally occurring group of minerals that can be formed when ultramafic rocks are metamorphosed during uplift to the earth's surface. This rock type is commonly associated with ultramafic rock along faults. Small amounts of chrysotile asbestos, a fibrous form of serpentine minerals, are common in serpentinite.
[14] Ultramafic rocks are formed in high-temperature environments well below the surface of the earth.
[15] Mélange is a mixture of rock materials of differing sizes and types generally contained within a sheared matrix.
[16] Asbestos is a term used for several types of naturally occurring fibrous materials found in many parts of California.
[17] Montmorillonite clay is an expansive type of clay that undergoes large changes in volume with changes in water content.
[18] Mafic rocks are igneous rocks containing a group of dark-colored minerals, composed chiefly of magnesium and iron.

occurring asbestos in the form of chrysotile, which could be encountered during tunneling for the BDPL Reliability Upgrade project.

Seismicity

The South Bay is a very seismically active area. The active faults within and adjacent to the region are the Hayward, Calaveras, San Andreas, and Monte–Vista Shannon faults. The Hayward and Calaveras faults cross or are adjacent to WSIP facilities, and the San Andreas and Monte Vista–Shannon faults are in close proximity to other facilities in the South Bay.

San Francisco Peninsula (San Francisco and Peninsula Regions)

Physiography

The San Francisco Peninsula is located in the central portion of the Coast Ranges Geomorphic Province of California. The mountains and hills of the San Francisco Peninsula are separated from the parallel range of the East Bay Hills by San Francisco Bay. WSIP projects located on the San Francisco Peninsula traverse the northern and eastern foothills of the Santa Cruz Mountains, the San Andreas Fault Zone, and flatlands adjacent to San Francisco Bay.

The elevations of facilities in this region range from approximately 30 feet along Crystal Springs Pipeline No. 2 near the bay to 525 feet at the Harry Tracy WTP in the hills adjacent to the San Andreas Fault Zone.

Geology

The San Francisco Peninsula region lies directly east of the San Andreas fault and is underlain by basement rock composed of tectonically mixed rock of Cretaceous to Jurassic age known as the Franciscan Complex. On the San Francisco Peninsula, the Franciscan Complex is locally capped by Tertiary, Quaternary, and Recent marine and nonmarine sedimentary deposits. The geologic units expected to be encountered during construction of the facility improvement projects include artificial fill, bay mud, colluvium, alluvium, stream channel deposits, and alluvial fans. Bedrock units in this region are the Colma Formation, Santa Clara Formation, Merced Formation, Whiskey Hill Formation, and Franciscan Complex, which consist of greenstone, sandstone, serpentinite, mélange, and chert.

The geologic units exposed at the surface consist primarily of artificial fill, alluvium, colluvium, and stream channel deposits of Holocene and Quaternary age; marine sandstone, siltstone, and claystone of Pliocene and Pleistocene age; and Cretaceous- and Tertiary-age sandstone, shale, chert, greenstone, and serpentinite units of the Franciscan Complex and the Whiskey Hill Formation (Brabb et al., 1998).

Plio-Pleistocene sandstone, siltstone, and claystone of the Merced Formation overlies Franciscan rocks over large areas, particularly near the Baden and San Pedro Valve Lots (PN-1) and SAPL 3 Installation (SF-1) projects. Holocene bay mud is not exposed at the surface but underlies the

artificial fill along the San Francisco Bay margin, and is expected to be encountered in excavations in the program area.

In the Peninsula Region, most of the proposed WSIP projects are underlain by significant amounts of Franciscan ultramafic bedrock (primarily serpentinite) and mélange. These units contain naturally occurring asbestos in the form of chrysotile, which could be encountered during excavation for the CS/SA Transmission (PN-2) and Lower Crystal Springs Dam (PN-4) projects.

Seismicity

The major active faults in the Peninsula Region and San Francisco Extended Regions are part of the San Andreas Fault System—a complex system of right-lateral, strike-slip faults that includes the San Andreas, San Gregorio, Hayward, and Calaveras faults. These faults have produced measurable historic ground motion and movement. The Peninsula segment of the San Andreas Fault is nearest to all of the projects in this region and the CS/SA Transmission project (PN-4) could potentially cross this fault. The CGS estimates that the Peninsula segment of the San Andreas Fault is capable of producing an earthquake of maximum moment magnitude 7.2, with a recurrence interval on the order of 200 years (Cao et al., 2003). None of the other faults cross a WSIP project.

Regulatory Framework

Alquist-Priolo Earthquake Fault Zoning Act

Surface rupture is the most easily avoided seismic hazard. The Alquist-Priolo Earthquake Fault Zoning Act was passed in 1972 to mitigate the hazard of surface faulting to structures for human occupancy. In accordance with this act, the state geologist established regulatory zones, called "earthquake fault zones," around the surface traces of active faults and published maps showing these zones. Within these zones, buildings for human occupancy cannot be constructed across the surface trace of active faults. Each earthquake fault zone extends approximately 200 to 500 feet on either side of the mapped fault trace, because many active faults are complex and consist of more than one branch. There is the potential for ground surface rupture along any of the branches.

Title 14 of the California Code of Regulations, Section 3601(e), defines buildings intended for human occupancy as those that would be inhabited for more than 2,000 hours per year. None of the WSIP projects that would be constructed within an Alquist-Priolo Earthquake Fault Zone meet this criterion.[19] Therefore, this act does not apply to the WSIP projects.

[19] The Advanced Disinfection project (SJ-1) and Recycled Water Projects (SF-3) could include construction of facilities for human occupancy, and the HTWTP Long-Term project (PN-5) would include improvements at a facility for human occupancy, but none of these projects would be constructed within an Alquist-Priolo Earthquake Fault Zone.

Seismic Hazards Mapping Act

The Seismic Hazards Mapping Act was passed in 1990 following the Loma Prieta earthquake to reduce threats to public health and safety and to minimize property damage caused by earthquakes. The act directs the Department of Conservation to identify and map areas prone to the earthquake hazards of liquefaction, earthquake-induced landslides, and amplified groundshaking. For structures intended for human occupancy, the act requires site-specific geotechnical investigations to identify potential seismic hazards and formulate mitigation measures prior to permitting most developments designed for human occupancy within the Zones of Required Investigation. Only two of the WSIP projects would involve buildings for human occupancy within a Zone of Required Investigation (HTWTP Long-Term, PN-3, and Recycled Water Projects, SF-3).[20] However, the seismic hazard maps are useful tools for identifying areas with the potential for liquefaction and earthquake-induced landslides.

As of January 2006, 110 official seismic hazard zone maps showing areas prone to liquefaction and landslides had been published in California, and more are scheduled in the future. Most of the mapping has been performed in Southern California and the San Francisco Bay Area. Twenty-two official maps for the San Francisco Bay Area have been released, with preparation of 19 additional maps for San Mateo, Santa Clara, Alameda, and Contra Costa Counties planned or in progress. The CGS has no current plans to map San Joaquin County.

Surface Mining and Reclamation Act

In accordance with the Surface Mining and Reclamation Act of 1975, the state has established a mineral land classification system to help identify and protect mineral resources in areas that are subject to urban expansion or other irreversible land uses that would preclude mineral extraction. Protected mineral resources include construction materials, industrial and chemical mineral materials, metallic and rare minerals, and nonfluid mineral fuels. The act directs the state geologist to classify (identify and map) the nonfuel mineral resources of the state to show where economically significant mineral deposits occur and where they are likely to occur based on the best available scientific data. Nonfuel mineral resources include: metals such as gold, silver, iron, and copper; industrial minerals such as boron compounds, rare-earth elements, clays, limestone, gypsum, salt, and dimension stone; and construction aggregate, which includes sand, gravel, and crushed stone. Many areas of the state have been mapped using the California Mineral Land Classification System to identify areas with known mineral resources. This system provides guidance for identifying Mineral Resource Zones (MRZs) based on these four general categories:

- *MRZ-1*. Areas where adequate information indicates that no significant mineral deposits are present, or where it is judged that little likelihood exists for their presence.

- *MRZ-2*. Areas where adequate information indicates that significant mineral deposits are present, or where it is judged that a high likelihood exists for their presence.

[20] The Advanced Disinfection project (SJ-1) and Recycled Water Projects (SF-3) could include construction of facilities for human occupancy, but only the Recycled Water Projects would potentially be located in a Zone of Required Investigation. Although HTWTP Long-Term would include improvements to a facility for human occupancy, seismic hazards mapping has not been conducted in San Mateo County, and the improvements would not be subject to the Seismic Hazards Mapping Act unless mapping has been completed at the time of construction.

- *MRZ-3*. Areas containing mineral deposits, the significance of which cannot be evaluated.
- *MRZ-4*. Areas where available information is inadequate for assignment to any other zone.

Pipeline and other public engineering projects are not subject to Surface Mining and Reclamation Act regulation.

California Building Code

The 2001 California Building Code (CBC) is based on the 1997 Uniform Building Code, with the addition of more extensive structural seismic provisions. The CBC is contained in the California Code of Regulations, Title 24, or the California Building Standards Code, and is a compilation of three types of building standards from three different origins:

- Building standards that have been adopted by state agencies without change from building standards contained in national model codes
- Building standards that have been adopted and adapted from the national model code standards to meet California conditions
- Building standards, authorized by the California legislature, that constitute extensive additions not covered by the model codes that have been adopted to address particular California concerns

Title 24, Part 2, Volume 2, Chapter 16 of the California Code of Regulations contains definitions of seismic sources and the procedure used to calculate seismic forces on structures. As the proposed WSIP projects lie within Uniform Building Code Seismic Zones 3 and 4, provisions for design would follow the requirements of Chapter 16.

SFPUC General Seismic Design Requirements

The SFPUC's *General Seismic Design Requirements* (SFPUC, 2006) set forth consistent criteria for the seismic design and retrofit of all facilities and components of the regional water system. In accordance with these design requirements, every WSIP project must have project-specific design criteria based on the seismic environment and importance of the facility in achieving water service delivery goals in the event of a major earthquake.[21] The design criteria are based on the referenced codes, standards, and industry publications, but would exceed these requirements for facilities that are located in a severe seismic environment and are needed to achieve water service delivery goals. Covered facilities include offices, operating centers, water treatment plants, water storage structures, pumping plants, pipelines, tunnels, and related equipment. Dams and associated components under the jurisdiction of the California Division of Safety of Dams (DSOD) and/or the Federal Energy Regulatory Commission (FERC) may be subject to additional design criteria and seismic evaluation methodology. For this type of project, the DSOD and/or FERC would be consulted to determine appropriate criteria and methodology.

[21] In the *General Seismic Design Requirements*, the term "major earthquake" is defined as an earthquake of Richter magnitude 7.8 or larger on the San Andreas fault, 7.1 or larger on the Hayward fault, or 6.8 or larger on the Calaveras fault.

Under these design requirements, each facility is evaluated for its necessity in meeting the water service delivery goals and assigned a seismic performance class for the purposes of determining appropriate seismic design criteria. Facilities needed to achieve a basic level of service within 24 hours of a major earthquake are assigned a seismic performance class of Critical. This class includes structures and components of the storage, distribution, treatment, and control system, with either no redundancy or with redundancy that have common-cause failure modes (such as the same fault crossing) and for which the failure would result in an unacceptable service level. Facilities needed for emergency response, such as emergency operations centers and emergency repair response centers, are classified as Critical. Facilities needed to achieve the specified level of service within 30 days of a major earthquake are classified as Important. This class includes structures and components of the storage, distribution, treatment, and control systems with some level of redundancy or for which failure would not result in an unacceptable level of service. Other facilities, such as administrative centers, repair shops, service centers, and similar support facilities, are classified as Standard. These facilities are not needed to achieve the water service delivery goals of the WSIP and might not be repaired following a major earthquake for economic reasons. Many of the planned WSIP projects are classified as Critical.

4.4.2 Impacts

Significance Criteria

The CCSF has not formally adopted significance standards for impacts related to geology, soils, and seismicity, but generally considers that implementation of the proposed program would have a significant impact if it were to:

- Expose people or structures to potential substantial adverse effects, including the risk of loss, injury, or death involving:
  - Rupture of a known earthquake fault, as delineated on the most recent Alquist-Priolo Earthquake Fault Zoning Map issued by the state geologist for the area or based on other substantial evidence of a known fault (refer to Division of Mines and Geology Special Publication 42),
  - Strong seismic groundshaking,
  - Seismic-related ground failure, including liquefaction,
  - Landslides (Evaluated in this section)
- Result in substantial soil erosion or the loss of topsoil (Evaluated in this section)
- Be located on a geologic or soil unit that is unstable, or that would become unstable as a result of the project, and potentially result in onsite or offsite landslide, lateral spreading, subsidence, liquefaction, or collapse (Evaluated in this section)
- Be located on expansive or corrosive soil, creating substantial risks to life or property (Evaluated in this section)
- Have soils incapable of adequately supporting the use of septic tanks or alternative wastewater disposal systems where sewers are not available for the disposal of wastewater (Not evaluated in this section, see Appendix B)

- Substantially change the topography or any unique geologic or physical features of the site (Evaluated in this section)

Implementation of the proposed program would have a significant impact related to mineral resources if it were to:

- Result in the loss of availability of a known mineral resource that would be of value to the region and the residents of the state (Not evaluated in this section, see Appendix B)

- Result in the loss of availability of a locally important mineral resource recovery site delineated in a local general plan, specific plan, or other land use plan (Not evaluated in this section, see Appendix B)

- Encourage activities which result in the use of large amounts of fuel, water, or energy, or use these in a wasteful manner (Evaluated in Section 4.15, Energy Resources)

Approach to Analysis

The WSIP includes water system improvement projects that would ensure the SFPUC can maintain an adequate water supply in the event of a major earthquake, with the goals of restoring basic service within 24 hours of a major earthquake and meeting average-day demand within 30 days. To meet these goals, projects are included that: (1) strengthen and improve the seismic resistance of many of the water system components, and (2) provide system redundancy so that water service can be maintained should a component of the system fail. Each of these projects would be constructed in accordance with the SFPUC's *General Seismic Design Requirements* (described above in the Setting), which require a site-specific investigation and development of project-specific design criteria based on the seismic performance class of the facility and site-specific geologic and seismic hazards, including fault rupture, ground motions generated by earthquakes (groundshaking), slope instability, liquefaction, and loss of soil strength. Implementation of these design requirements would ensure that water service delivery goals are achieved in the event of a major earthquake. Collectively, this is a beneficial impact of the WSIP, as discussed in Section 4.16, Collective WSIP Impacts. Potential seismic hazards related to the operation, siting, and design of the WSIP projects are considered less than significant for each WSIP project, given compliance with the *General Seismic Design Requirements*. This section also analyzes geology, soils, and seismicity impacts that could occur during construction, and impacts associated with locating projects in areas of expansive or corrosive soils.

Although all WSIP projects in the Sunol Valley Region (located in the Alameda Creek watershed) and the CS/SA Transmission (PN-2), Lower Crystal Springs Dam (PN-4), and Pulgas Balancing Reservoir (PN-5) projects (located in the Peninsula watershed) would be required to comply with the following Alameda and Peninsula Watershed Management Plan (WMP) policies and actions, compliance with the *General Seismic Design Requirements* would incorporate the intent of these policies and actions, and they are not further discussed below:

- *Policy S7*: Require adequate seismic and static geohazards engineering studies for proposed facilities, infrastructure, and utilities easements within the watershed.

- *Policy S8*: Require that utility pipelines within the watershed meet current seismic standards and comply with applicable hazardous materials regulations.

- *Action des2.2*: Prior to the approval of construction of any new facility or structure, within the watershed but outside of an Alquist-Priolo Earthquake Fault Zone, require appropriate geotechnical evaluations to assure that the structure can withstand the effects of a seismic event. If the facility or structure is intended for human occupancy and sited over active fault traces, design and construction should comply with the policies and provisions of the Alquist-Priolo Earthquake Fault Zoning Act.

Impact Summary by Region

Table 4.4-4 provides a summary of the geology, soils, and seismicity impacts associated with implementation of the WSIP.

Construction Impacts

Impact 4.4-1: Slope instability during construction.

Destabilization of natural or constructed slopes could occur as a result of construction activities due to excavation and/or grading operations. Excavations for new and replacement pipelines, building foundations, tunnel portals, and temporary access roads and work areas could result in slope instability, potentially triggering slope failures that could result in landslides, slumps, soil creep, or debris flows. Slope failures are more likely to occur in areas with a history of previous failure and in weak geologic units exposed on unfavorable slopes, such as areas mapped by the USGS (1997) as having "many landslides" or areas of weak, fault-sheared rock. Such slope failures could damage WSIP or other nearby facilities and properties.

For projects located in areas with a low potential for landslides, this impact would be less than significant, but the site-specific information analyzed in accordance with SFPUC Construction Measure #2 (seismic and geotechnical studies) and during separate, project-level CEQA review could either confirm the program-level determination of less than significant or provide a basis to revise this determination.

For projects in areas with an identified landslide hazard, it could be necessary to conduct a quantified landslide analysis (Measure 4.4-1) and implement the recommendations of the investigation to reduce impacts to a less-than-significant level, although the need for mitigation would be determined during separate, project-level CEQA review of each WSIP project. All Sunol Valley and Peninsula Region projects located in the Peninsula watershed would also be required to comply with the following WMP policies related to slope instability:

- *Policy S5*: Minimize damage from potential mass movement hazards by avoiding construction or other disturbances in known dormant landslides and on slopes greater than 30 percent, without proper engineering.

- *Policy S6*: Conduct (for CCSF-owned) and require (for easements) inspection of facilities and utilities near active landslide areas and fault traces following earthquakes and slope failures to assess their stability and integrity, and complete repairs or further monitoring as needed to prevent geohazards.

TABLE 4.4-4
POTENTIAL IMPACTS AND SIGNIFICANCE – GEOLOGY, SOILS, AND SEISMICITY

Projects	Project Number	Impact 4.4-1: Slope instability during construction	Impact 4.4-2: Erosion during construction	Impact 4.4-3: Substantial alteration of topography	Impact 4.4-4: Squeezing ground and subsidence during tunneling	Impact 4.4-5: Surface fault rupture	Impact 4.4-6: Seismically induced groundshaking	Impact 4.4-7: Seismically induced ground failure, including liquefaction and settlement	Impact 4.4-8: Seismically induced landslides or other slope failures	Impact 4.4-9: Expansive or corrosive soils
San Joaquin Region										
Advanced Disinfection	SJ-1	LS	LS	LS	N/A	LS	LS	LS	LS	PSM
Lawrence Livermore Supply Improvements	SJ-2	PSM	LS	LS	N/A	LS	LS	LS	LS	PSM
San Joaquin Pipeline System	SJ-3	N/A	LS	LS	N/A	LS	LS	LS	N/A	PSM
Rehabilitation of Existing San Joaquin Pipelines	SJ-4	N/A	LS	LS	N/A	LS	LS	LS	N/A	PSM
Tesla Portal Disinfection Station	SF-5	LS	LS	LS	N/A	LS	LS	LS	LS	PSM
Sunol Valley Region										
Alameda Creek Fishery Enhancement	SV-1	PSM	LS	LS	N/A	LS	LS	LS	LS	PSM
Calaveras Dam Replacement	SV-2	PSM	LS	LS	N/A	LS	LS	LS	LS	PSM
Additional 40-mgd Treated Water Supply	SV-3	PSM	LS	LS	N/A	LS	LS	LS	LS	PSM
New Irvington Tunnel	SV-4	PSM	LS	LS	PSM	LS	LS	LS	LS	PSM
SVWTP – Treated Water Reservoirs	SV-5	PSM	LS	LS	N/A	LS	LS	LS	LS	PSM
San Antonio Backup Pipeline	SV-6	PSM	LS	LS	N/A	LS	LS	LS	LS	PSM
Bay Division Region										
Bay Division Pipeline Reliability Upgrade	BD-1	LS	LS	LS	PSM	LS	LS	LS	LS	PSM
BDPL Nos. 3 and 4 Crossovers	BD-2	N/A	LS	LS	N/A	LS	LS	LS	N/A	PSM
Seismic Upgrade of BDPL Nos. 3 and 4 at Hayward Fault	BD-3	N/A	LS	LS	N/A	LS	LS	LS	N/A	PSM
Peninsula Region										
Baden and San Pedro Valve Lots Improvements	PN-1	LS	LS	LS	N/A	LS	LS	LS	LS	PSM
Crystal Springs/San Andreas Transmission Upgrade	PN-2	LS	LS	LS	N/A	LS	LS	LS	LS	PSM
HTWTP Long-Term Improvements	PN-3	PSM	LS	LS	N/A	LS	LS	LS	LS	PSM
Lower Crystal Springs Dam Improvements	PN-4	LS	LS	LS	N/A	LS	LS	LS	LS	PSM
Pulgas Balancing Reservoir Rehabilitation	PN-5	PSM	LS	LS	N/A	LS	LS	LS	LS	PSM
San Francisco Region										
San Andreas Pipeline No. 3 Installation	SF-1	LS	LS	LS	N/A	LS	LS	LS	LS	PSM
Groundwater Projects	SF-2	PSM	LS	LS	N/A	LS	LS	LS	LS	PSM
Recycled Water Projects	SF-3	PSM	LS	LS	N/A	LS	LS	LS	LS	PSM

LS = Less than Significant impact, no mitigation required
PSM= Potentially Significant impact, can be mitigated to less than significant
N/A = Not Applicable

San Joaquin Region

Impact 4.4-1: Slope instability during construction		
Advanced Disinfection	SJ-1	LS
Lawrence Livermore	SJ-2	PSM
SJPL System	SJ-3	N/A
SJPL Rehabilitation	SJ-4	N/A
Tesla Portal Disinfection	SJ-5	LS

The USGS has not mapped the landslide distribution in the San Joaquin Region. The Lawrence Livermore project (SJ-2) is located in landslide-prone Franciscan Complex units on moderate to steep slopes of the Diablo Range. Excavation and grading for construction at this site could potentially trigger landslides that could cause damage to the facility or nearby properties. Because this project is located in an area of potential landslide susceptibility, impacts related to construction-triggered landslides are considered *potentially significant,* but would be reduced to a less-than-significant level with implementation of SFPUC Construction Measure #2 (seismic and geotechnical studies) and preparation of a quantified landslide analysis (Measure 4.4-1).

The Advanced Disinfection (SJ-1) and Tesla Portal Disinfection (SJ-5) projects are located on gentle hills underlain by Plio-Pleistocene-age, nonmarine sedimentary deposits with a low potential for landslides. If any slope failures did occur due to substantial excavation into the slope, it is expected that they would be minor surficial failures and not likely to cause damage. Therefore, impacts related to construction-triggered landslides would be *less than significant* for these projects.

The remaining San Joaquin Region projects (SJPL System, SJ-3, and SJPL Rehabilitation, SJ-4) would not be located on substantial slopes; therefore, the potential for construction-triggered landslides would be low, and this impact would *not apply* to these projects.

Sunol Valley Region

Impact 4.4-1: Slope instability during construction		
Alameda Creek Fishery	SV-1	PSM
Calaveras Dam	SV-2	PSM
40-mgd Treated Water	SV-3	PSM
New Irvington Tunnel	SV-4	PSM
Treated Water Reservoirs	SV-5	PSM
SABUP	SV-6	PSM

All of the Sunol Valley Region projects (Alameda Creek Fishery, SV-1; Calaveras Dam, SV-2; 40-mgd Treated Water, SV-3; New Irvington Tunnel, SV-4; Treated Water Reservoirs, SV-5; and SABUP, SV-6) are located at least partially on and/or adjacent to gentle to moderately steep slopes of the Alameda Creek drainage and Diablo Range foothills, in areas mapped as "mostly landslides" (USGS, 1997). These areas are primarily underlain by sheared Miocene and Cretaceous sedimentary bedrock and sheared Franciscan Complex. Existing landslides are also mapped adjacent to the Calaveras Dam site (SV-2). Because these projects are located in an area of potential landslide susceptibility, impacts related to construction-triggered landslides are considered *potentially significant*. However, with implementation of SFPUC Construction Measure #2 (seismic and geotechnical studies) and preparation of a quantified landslide analysis (Measure 4.4-1), impacts related to slope stability would be reduced to a less-than-significant level. Compliance with policies related to slope instability (S5 and S6) of the Alameda WMP, described above, would also be required.

Bay Division Region

Impact 4.4-1: Slope instability during construction		
BDPL Reliability Upgrade	BD-1	LS
BDPL 3 and 4 Crossovers	BD-2	N/A
BDPL 3 and 4 Seismic Upgrade at Hayward Fault	BD-3	N/A

All proposed WSIP projects in the Bay Division Region (BDPL Reliability Upgrade, BD-1; BDPL 3 and 4 Crossovers, BD-2; and BDPL 3 and 4 Seismic Upgrade at Hayward Fault, BD-3) would be located on flat and gently sloping terrain adjacent to San Francisco Bay in areas designated as "flat land," but with areas mapped as "few landslides" on both ends of the BDPL Reliability Upgrade alignment (USGS, 1997). Therefore, this impact would *not apply* to the BDPL 3 and 4 Crossovers and BDPL 3 and 4 Seismic Upgrade at Hayward Fault projects. Although both ends of the BDPL Reliability Upgrade pipeline alignment would be located in areas mapped as "few landslides," impacts related to construction-triggered landslides would be *less than significant* because any slope failures that did occur due to substantial excavation into the slopes are expected to be minor surficial failures and not likely to cause damage.

Peninsula Region

Impact 4.4-1: Slope instability during construction		
Baden and San Pedro Valve Lots	PN-1	LS
CS/SA Transmission	PN-2	LS
HTWTP Long-Term	PN-3	PSM
Lower Crystal Springs Dam	PN-4	LS
Pulgas Balancing Reservoir	PN-5	PSM

The HTWTP Long-Term (PN-3) and Pulgas Balancing Reservoir (PN-5) project sites would be located on or adjacent to sloping terrain, where there are small areas designated as "mostly landslides" and several existing landslides are mapped along the edges of the Harry Tracy WTP (GTC, 2005). Because these projects are located in an area of potential landslide susceptibility, impacts related to construction-triggered landslides are considered *potentially significant,* but would be reduced to a less-than-significant level with implementation of SFPUC Construction Measure #2 (seismic and geotechnical studies) and preparation of a quantified landslide analysis (Measure 4.4-1). Compliance with policies related to slope instability (S5 and S6) of the Peninsula WMP, described above, would also be required for the Pulgas Balancing Reservoir project.

The Baden and San Pedro Valve Lots (PN-1), CS/SA Transmission (PN-2), and Lower Crystal Springs Dam (PN-4) projects are located on the flat-to-sloping terrain of the foothills and San Andreas Fault Zone, in areas primarily designated as "few landslides" (USGS, 1997). Therefore, this impact would be *less than significant* for these projects.

San Francisco Region

Impact 4.4-1: Slope instability during construction		
SAPL 3 Installation	SF-1	LS
Groundwater Projects	SF-2	PSM
Recycled Water Projects	SF-3	PSM

The Local Groundwater Projects (SF-2) would be constructed in the vicinity of the San Francisco Zoo, in the Sunset District, and in Golden Gate Park. Because the CGS has not mapped areas of landslide susceptibility at these sites, the potential for construction-related landslides is low for this project. However, construction-triggered landslides could occur during the construction of the Regional Groundwater Projects

(SF-2); the associated wells would not likely be constructed in a landslide-prone area, but the pipelines could cross areas of potential landslide susceptibility in San Mateo County. In addition, the Recycled Water Projects (SF-3) could include construction of a storage tank in Lincoln Park where the CGS has mapped a zone of landslide susceptibility. Therefore, impacts related to construction-triggered landslides are considered *potentially significant* for both projects, but would be reduced to a less-than-significant level with implementation of SFPUC Construction Measure #2 (seismic and geotechnical studies) and preparation of a quantified landslide analysis (Measure 4.4-1).

The SAPL 3 Installation project (SF-1) is proposed on flat and gently sloping terrain adjacent to San Francisco Bay and the surrounding hills in areas designated as "flat land" and "few landslides" (USGS, 1997). Therefore, impacts related to construction-triggered landslides would be *less than significant* for this project.

Impact 4.4-2: Erosion during construction.

Construction activities such as backfilling, grading, and compaction can remove stabilizing vegetation and expose areas of loose soil that, if not properly stabilized during construction, can be subject to soil loss and erosion by wind and stormwater runoff. Newly constructed and compacted engineered slopes can also undergo substantial erosion through dispersed sheet-flow runoff, and more concentrated runoff can cause the formation of small erosional channels and larger gullies, each compromising the integrity of the slope and resulting in significant soil loss.

All Regions

Impact 4.4-2: Erosion during construction		
Advanced Disinfection	SJ-1	LS
Lawrence Livermore	SJ-2	LS
SJPL System	SJ-3	LS
SJPL Rehabilitation	SJ-4	LS
Tesla Portal Disinfection	SJ-5	LS
Alameda Creek Fishery	SV-1	LS
Calaveras Dam	SV-2	LS
40-mgd Treated Water	SV-3	LS
New Irvington Tunnel	SV-4	LS
Treated Water Reservoirs	SV-5	LS
SABUP	SV-6	LS
BDPL Reliability Upgrade	BD-1	LS
BDPL 3 and 4 Crossovers	BD-2	LS
BDPL 3 and 4 Seismic Upgrade at Hayward Fault	BD-3	LS
Baden and San Pedro Valve Lots	PN-1	LS
CS/SA Transmission	PN-2	LS
HTWTP Long-Term	PN-3	LS
Lower Crystal Springs Dam	PN-4	LS
Pulgas Balancing Reservoir	PN-5	LS
SAPL 3 Installation	SF-1	LS
Groundwater Projects	SF-2	LS
Recycled Water Projects	SF-3	LS

All WSIP facilities requiring grading or excavation could be subject to soil loss and erosion by wind and stormwater runoff. Although erosion can be a common construction-related occurrence, especially during wintertime construction projects, all WSIP projects would be required to implement SFPUC Construction Measure #3 (onsite air and water quality measures during construction), which requires the implementation of erosion control measures, as described in Impact 4.5-1 (see Section 4.5, Hydrology and Water Quality). This measure would require preparation of a stormwater pollution prevention plan for projects disturbing more than one acre of land outside of San Francisco; preparation of an erosion control plan in accordance with Article 4.1 of the

San Francisco Public Works Code for projects within San Francisco; and implementation of erosion and sedimentation controls tailored to the site and project for projects outside of San Francisco that disturb less than one acre of land. As summarized in Impact 4.5-1, projects located in the Alameda and Peninsula watersheds would also be required to comply with the erosion control actions of the Alameda and Peninsula WMPs. With implementation of these required measures, impacts related to erosion during construction would be *less than significant* for all WSIP projects.

Impact 4.4-3: Substantial alteration of topography.

Substantial alteration of topography (defined as changes in the character of the slope and gradient due to grading, excavation, or cut and fill) could result in unstable slopes or increased wind or water erosion due to resultant drainage pattern changes and/or slope changes. These potential geologic impacts are discussed above under Impacts 4.4-1 and 4.4-2.

San Joaquin, Bay Division, Peninsula, and San Francisco Regions

Impact 4.4-3: Substantial alteration of topography		
Advanced Disinfection	SJ-1	LS
Lawrence Livermore	SJ-2	LS
SJPL System	SJ-3	LS
SJPL Rehabilitation	SJ-4	LS
Tesla Portal Disinfection	SJ-5	LS
BDPL Reliability Upgrade	BD-1	LS
BDPL 3 and 4 Crossovers	BD-2	LS
BDPL 3 and 4 Seismic Upgrade at Hayward Fault	BD-3	LS
Baden and San Pedro Valve Lots	PN-1	LS
CS/SA Transmission	PN-2	LS
HTWTP Long-Term	PN-3	LS
Lower Crystal Springs Dam	PN-4	LS
Pulgas Balancing Reservoir	PN-5	LS
SAPL 3 Installation	SF-1	LS
Groundwater Projects	SF-2	LS
Recycled Water Projects	SF-3	LS

Although projects in the San Joaquin, Bay Division, Peninsula, and San Francisco Regions would require some excavation or grading, most of these projects are located in previously disturbed areas, or the grading or excavation associated with the projects is not expected to significantly alter the topography. Furthermore, SFPUC Construction Measure #10 (project site) would require construction contractors to return the WSIP project sites to the general condition that existed before construction, which would include regrading the sites and revegetating disturbed areas. Therefore, impacts related to the substantial alteration of topography would be *less than significant* for projects in these regions.

Sunol Valley Region

Impact 4.4-3: Substantial alteration of topography		
Alameda Creek Fishery	SV-1	LS
Calaveras Dam	SV-2	LS
40-mgd Treated Water	SV-3	LS
New Irvington Tunnel	SV-4	LS
Treated Water Reservoirs	SV-5	LS
SABUP	SV-6	LS

In the Sunol Valley Region, the excavation of borrow pits and grading of hills for the new spillway, required for construction of the Calaveras Dam project (SV-2), as well as improvements at the Irvington Portal under the New Irvington Tunnel project (SV-4) would substantially alter topography and could result in increased wind or water erosion. However,

this impact would be *less than significant* with implementation of SFPUC Construction Measure #3 (onsite air and water quality measures during construction), which requires erosion control measures and preparation of a stormwater pollution prevention plan, and SFPUC Construction Measure #10 (project site), which requires the construction contractor to restore project sites to the general condition that existed before construction, and which would include regrading the site and revegetating disturbed areas. For the Calaveras Dam project (SV-2), implementation of the following Alameda WMP action would further reduce impacts related to the alteration of topography to a less-than-significant level:

- *Action des5*: Prior to approval of new construction activities or renovation/alteration of existing facilities, structures, or roads, ensure that the following design guidelines are met:

  A. Where grading is necessary, slopes and landforms shall be contoured to mimic the surrounding environment as much as possible.

  B. Design and site new roads and trails to minimize grading and the visibility of cut banks and fill slopes.

The other Sunol Valley Region projects (Alameda Creek Fishery, SV-1; 40-mgd Treated Water, SV-3; Treated Water Reservoirs, SV-5; and SABUP, SV-6) would require some excavation or grading. However, many of these projects are located in previously disturbed areas, or the grading or excavation associated with these projects would not appreciably alter the topography. Furthermore, SFPUC Construction Measure #10 (project site) would require construction contractors to return the WSIP project sites to the general condition that existed before construction, which would include regrading the sites and revegetating disturbed areas. Therefore, impacts related to the substantial alteration of topography would be *less than significant* for these projects.

Impact 4.4-4: Squeezing ground and subsidence during tunneling.

The effects of squeezing ground could occur during tunnel construction and the ground surface overlying the proposed tunnels could subside due to tunnel excavation, damaging interior supports and resulting in potential health and safety hazards. Squeezing ground is a common construction challenge for tunnel projects, especially in sheared materials such as those expected during the excavation of proposed WSIP tunnels. Although the effects of squeezing ground can damage a tunnel's interior support structure and sometimes cause injury to workers, standard engineering design would reduce the potential for this phenomenon to compromise the structural integrity of the tunnel structure or cause tunneling delays. Design might include reinforcing the tunnel excavation with steel rib-type supports; blocking in areas of crushed and sheared material; installing immediate face, roof, and sidewall support for stability in areas of crushed and squeezing ground; and using shotcrete to strengthen sidewalls and faces when the tunnel excavation is not advanced within about a day.

Additionally, with subsurface excavation projects such as tunneling, there is a potential that the ground surface could subside in response to the removal of subsurface materials. Subsidence occurs when the earth materials above the tunnel lose the capacity to support the overlying weight as the tunneling progresses. Subsidence can damage overlying structures such as homes and other buildings, as well as infrastructure such as roadways and utilities, and can also endanger the health and safety of construction workers. However, the tunnel interior would be reinforced by support elements to maintain the tunnel opening and minimize subsidence during tunneling.

San Joaquin Region, Peninsula, and San Francisco Regions

Impact 4.4-4: Squeezing ground and subsidence during tunneling		
Advanced Disinfection	SJ-1	N/A
Lawrence Livermore	SJ-2	N/A
SJPL System	SJ-3	N/A
SJPL Rehabilitation	SJ-4	N/A
Tesla Portal Disinfection	SJ-5	N/A
Baden and San Pedro Valve Lots	PN-1	N/A
CS/SA Transmission	PN-2	N/A
HTWTP Long-Term	PN-3	N/A
Lower Crystal Springs Dam	PN-4	N/A
Pulgas Balancing Reservoir	PN-5	N/A
SAPL 3 Installation	SF-1	N/A
Groundwater Projects	SF-2	N/A
Recycled Water Projects	SF-3	N/A

Impacts related to squeezing ground and subsidence would *not apply* to any projects in the San Joaquin, Peninsula, or San Francisco Regions because none of the projects in these regions would involve tunneling.

Sunol Valley Region

Impact 4.4-4: Squeezing ground and subsidence during tunneling		
Alameda Creek Fishery	SV-1	N/A
Calaveras Dam	SV-2	N/A
40-mgd Treated Water	SV-3	N/A
New Irvington Tunnel	SV-4	PSM
Treated Water Reservoirs	SV-5	N/A
SABUP	SV-6	N/A

Although squeezing ground could become an issue during construction of the New Irvington Tunnel project (SV-4), tunnel damage would not likely occur, because standard engineering design would reduce the potential for this phenomenon to compromise the structural integrity of the tunnel structure or cause tunneling delays. However, subsidence could become an issue during the construction of this project; therefore, impacts related to subsidence during tunneling would be *potentially significant,* but would be reduced to a less-than-significant level by use of internal supports during tunneling, as described above, and implementation of a subsidence monitoring program (Measure 4.4-4) to detect potential ground movement well before major subsidence occurs. Corrective action, such as increased tunnel support, would be implemented if measured displacement reached a designated minimum trigger amount. This impact would be evaluated in greater detail as part of separate, project-level CEQA review for this project, and specific triggers for corrective action would be addressed during that review.

None of the other Sunol Valley Region projects (Alameda Creek Fishery, SV-1; Calaveras Dam, SV-2; 40-mgd Treated Water, SV-3; Treated Water Reservoirs, SV-5; or SABUP, SV-6) would

involve tunneling. Therefore, impacts related to squeezing ground and subsidence would *not apply* to these projects.

Bay Division Region

Impact 4.4-4: Squeezing ground and subsidence during tunneling		
BDPL Reliability Upgrade	BD-1	PSM
BDPL 3 and 4 Crossovers	BD-2	N/A
BDPL 3 and 4 Seismic Upgrade at Hayward Fault	BD-3	N/A

Although squeezing ground could become an issue during construction of the BDPL Reliability Upgrade project (BD-1), tunnel damage would not likely occur, because standard engineering design would reduce the potential for this phenomenon to compromise the structural integrity of the tunnel structure or cause tunneling delays. However, subsidence could become an issue during the construction of this project; therefore, impacts related to subsidence during tunneling would be *potentially significant*, but would be reduced to a less-than-significant level by use of internal supports during tunneling, as described above, and implementation of a subsidence monitoring program (Measure 4.4-4) to detect potential ground movement well before major subsidence occurs. Corrective action, such as increased tunnel support, would be implemented if measured displacement reached a designated minimum trigger amount. This impact would be evaluated in greater detail as part of separate, project-level CEQA review for this project, and specific triggers for corrective action would be addressed during that review.

None of the other Bay Division Region projects (BDPL 3 and 4 Crossovers, BD-2 and BDPL 3 and 4 Seismic Upgrade at Hayward Fault, BD-3) would involve tunneling. Therefore, impacts related to squeezing ground and subsidence would *not apply* to these projects.

Operations, Siting, and Design Impacts

Seismic Hazard Impacts

Impact 4.4-5: Surface fault rupture.

Although construction of the WSIP facilities would not alter the seismic environment or increase the risk of fault rupture, there is the potential for proposed improvements to be damaged by surface fault ruptures. Ground rupture most commonly occurs along preexisting faults, which are zones of weakness, and can occur slowly as fault creep (the slow rupture of the earth's crust along a fault) or more suddenly as earthquakes. The rate of movement along a fault can range from approximately 0.1 to 25 millimeters per year (mm/yr). This gradual movement can displace the ground surface and structures (such as buildings, roads, or fences) built over the trace of the fault, causing structural damage but generally not injury to people. Sudden movement resulting from an earthquake is more damaging than fault creep because it generally includes greater and more sudden displacement of the ground surface and is accompanied by groundshaking.

Because the SFPUC water system carries water from the Sierra Nevada to the San Francisco Bay Area, the crossing of several regional faults is unavoidable. Many of the WSIP facility projects include seismic upgrades and redundant features at fault crossings (as discussed by region below), which would enable the SFPUC to meet the water service delivery goals of the WSIP. These facilities would be designed to withstand fault rupture or maintain water service in accordance with the *General Seismic Design Requirements*.

The Alquist-Priolo Earthquake Fault Zoning Act prohibits construction of a structure for human occupancy within 50 feet of the trace of a known active fault. None of the WSIP facilities proposed for human occupancy are located within an Alquist-Priolo Earthquake Fault Zone.

The Sunol Valley and Peninsula Region projects located in the Peninsula watershed would also be required to comply with the following WMP policies related to fault rupture:

- *Policy S4*: Minimize damage from future seismic hazards by avoiding construction of facilities in active fault zones and traces, where feasible.
- *Policy S6*: Conduct (for CCSF-owned) and require (for easements) inspection of facilities and utilities near active landslide areas and fault traces following earthquakes and slope failures to assess their stability and integrity, and complete repairs or further monitoring as needed to prevent geohazards.

San Joaquin Region

Impact 4.4-5: Surface fault rupture		
Advanced Disinfection	SJ-1	LS
Lawrence Livermore	SJ-2	LS
SJPL System	SJ-3	LS
SJPL Rehabilitation	SJ-4	LS
Tesla Portal Disinfection	SJ-5	LS

Although the Advanced Disinfection (SJ-1), Lawrence Livermore (SJ-2), and Tesla Portal Disinfection (SJ-5) projects and the west end of the SJPL System (SJ-3) and SJPL Rehabilitation (SJ-4) projects would be constructed over the Great Valley 7 blind-thrust fault, there is no surface fault rupture associated with this thrust fault. There are no Alquist-Priolo Earthquake Fault Zones mapped in the San Joaquin Region. Therefore, the potential for fault rupture in this region is considered low, and impacts related to fault rupture would be *less than significant* for all San Joaquin Region projects.

Sunol Valley Region

Impact 4.4-5 Surface fault rupture		
Alameda Creek Fishery	SV-1	LS
Calaveras Dam	SV-2	LS
40-mgd Treated Water	SV-3	LS
New Irvington Tunnel	SV-4	LS
Treated Water Reservoirs	SV-5	LS
SABUP	SV-6	LS

Several of the WSIP facilities within the Sunol Valley Region lie within or cross the Calaveras Fault Zone. The Calaveras Fault Zone is expressed as numerous strands that form a zone tens of feet to more than 1,500 feet in width. North of Calaveras Reservoir, the fault is characterized by sparse seismicity, but would probably rupture to the surface in moderate to large earthquakes (Bryant and Cluett, 2000).

The Alameda Creek Fishery (SV-1), 40-mgd Treated Water (SV-3), Treated Water Reservoirs (SV-5), and SABUP (SV-6) projects would each include construction of structures within the Alquist-Priolo Earthquake Fault Zone for the Calaveras fault (CGS, 2000). However, the SABUP project would provide a redundant pipeline to the existing San Antonio Pipeline, and new discharge facilities would allow discharge to San Antonio Creek during an emergency outage. These projects would be designed and constructed in accordance with the *General Seismic Design Requirements*, which would ensure that water service delivery goals are met after an earthquake, and impacts related to fault rupture would be *less than significant*.

Although the Alquist-Priolo Earthquake Fault Zone extends beneath Calaveras Reservoir, the dam is located outside of the zone. The Calaveras Dam (SV-2) and New Irvington Tunnel (SV-4) projects would not cross or be located within 50 feet of an active fault trace. Therefore, impacts related to fault rupture would be *less than significant* for these projects.

Implementation Alameda WMP policies related to fault rupture (S4 and S6), described above, would also be required for all Sunol Valley Region projects.

Bay Division Region

Impact 4.4-5: Surface fault rupture		
BDPL Reliability Upgrade	BD-1	LS
BDPL 3 and 4 Crossovers	BD-2	LS
BDPL 3 and 4 Seismic Upgrade at Hayward Fault	BD-3	LS

Both Bay Division Pipelines Nos. 1 and 2 and Pipelines Nos. 3 and 4 cross the southern segment of the Hayward fault. Most of the fault exhibits fault creep between 3 and 6 mm/yr, although the historical creep rate has been as high as 9 mm/yr near the southern part of the southern segment of the Hayward fault (Bryant and Cluett, 2000). In 1868, a substantially damaging earthquake of M 7.0 occurred on this segment of the Hayward fault, with a rupture length of approximately 32 miles.

The BDPL Reliability Upgrade project (BD-1) crosses the Hayward fault and would include construction of new seismically improved pipeline between the Irvington and Pulgas Portals, and the BDPL 3 and 4 Seismic Upgrade at Hayward Fault project (BD-3) would include construction of upgraded, seismically resistant sections of the Bay Division Pipelines Nos. 3 and 4 where they cross the Hayward fault (CGS, 2000). Because these projects would be designed and constructed in accordance with the *General Seismic Design Requirements*, impacts related to fault rupture would be *less than significant* for these projects.

The crossovers that would be constructed under the BDPL 3 and 4 Crossovers project (BD-2) would not be located within an Alquist-Priolo Earthquake Fault Zone. Therefore, impacts related to fault rupture would be *less than significant* for this project.

Peninsula Region

Impact 4.4-5: Surface fault rupture		
Baden and San Pedro Valve Lots	PN-1	LS
CS/SA Transmission	PN-2	LS
HTWTP Long-Term	PN-3	LS
Lower Crystal Springs Dam	PN-4	LS
Pulgas Balancing Reservoir	PN-5	LS

The active trace of the San Andreas fault and the associated Alquist-Priolo Earthquake Fault Zone cross the San Andreas Reservoir and Dam. In this area, the San Andreas Fault Zone is expressed as several overlapping and parallel strands that form a linear valley, ranging from several hundred feet to approximately one-half mile wide. The San Andreas fault passes under the eastern abutment of the dam and, although there was an 8-foot shearing movement along the rift during the 1906 earthquake, there was no damage to the dam (SFPUC, 2007). Two studies conducted to evaluate the rupture potential and seismic safety at the San Andreas Dam (ESA, 1980 and 1983) found no faulting in the west abutment or valley immediately downstream of the dam during the last 5,000 years. The studies concluded that fault rupture in the dam vicinity over the past 7,500 years has been confined within a fairly narrow zone (100 to 150 feet wide) in an area east of and within the eastern abutment of the dam, and that, in the unlikely event of rupture through the dam, the clayey fill and native materials within and underlying the dam would be able to withstand some offset without catastrophic failure of the dam.

The CS/SA Transmission project (PN-2) includes seismic improvements to facilities that convey water from Crystal Springs Reservoir to the Harry Tracy WTP, including the Crystal Springs Pump Station, Crystal Springs/San Andreas Pipeline, and pipelines that convey raw water to the Harry Tracy WTP pump station. This project could be located almost entirely within the Alquist-Priolo Earthquake Fault Zone for the San Andreas fault (CGS, 2000), and the Crystal Springs/San Andreas Pipeline to be improved or replaced under this project would parallel the fault; however, the project would be designed and constructed in accordance with the *General Seismic Design Requirements*, and impacts related to fault rupture would thus be *less than significant.* Implementation of Peninsula WMP policies related to fault rupture (S4 and S6), described above, would also be required.

The HTWTP Long-Term (PN-3), Lower Crystal Springs Dam (PN-4), and Pulgas Balancing Reservoir (PN-5) projects as well as the Pulgas Pump Station to be improved under the Baden and San Pedro Valve Lots project (PN-1) are located in close proximity to the Alquist-Priolo Earthquake Fault Zone for the San Andreas fault. However, because they are outside of the zone, it is not expected that these projects would be affected by fault rupture. Other improvements under the Baden and San Pedro Valve Lots project would not be located within 50 feet of or in proximity to an active fault trace. Therefore, impacts related to fault rupture would be *less than significant* for these projects. Implementation of Peninsula WMP policies related to fault rupture (S4 and S6), described above, would be required for the Lower Crystal Springs Dam and Pulgas Balancing Reservoir projects.

San Francisco Region

Impact 4.4-5: Surface fault rupture		
SAPL 3 Installation	SF-1	LS
Groundwater Projects	SF-2	LS
Recycled Water Projects	SF-3	LS

There are no active faults or Alquist-Priolo Earthquake Fault Zones mapped in the city of San Francisco where the Local Groundwater Projects (SF-2) and Recycled Water Projects (SF-3) would be constructed. Although the SAPL Installation project (SF-1) includes pipeline installation south of San Francisco and in the city itself, the pipeline would not cross an Alquist-Priolo Earthquake Fault Zone. The Regional Groundwater Projects in San Mateo County would be constructed to the east of the Alquist-Priolo Earthquake Fault Zone for the San Andreas fault. Therefore, the potential for fault rupture is considered low, and impacts related to fault rupture would be *less than significant* for the three projects in this region.

Impact 4.4-6: Seismically induced groundshaking.

Groundshaking is the most widespread effect of earthquakes and poses a greater seismic threat than local ground rupture. Depending on the level of groundshaking, an earthquake could damage buildings, pipelines, valves, control facilities, tunnels, and pump stations, resulting in a disruption of water service and/or endangering the health and welfare of people. Damage to treatment facilities could affect the ability of the SFPUC to provide treated water to its customers, and damage to storage facilities could reduce the amount of storage available in the regional water system. Such damage could require short-term, temporary service interruptions for inspections and repairs, and long-term repairs could also be required. However, facilities constructed under the WSIP would meet current seismic standards in accordance with the *General Seismic Design Requirements*, thereby improving their ability to withstand seismic damage due to groundshaking.

San Joaquin Region

Impact 4.4-6: Seismically induced groundshaking		
Advanced Disinfection	SJ-1	LS
Lawrence Livermore	SJ-2	LS
SJPL System	SJ-3	LS
SJPL Rehabilitation	SJ-4	LS
Tesla Portal Disinfection	SJ-5	LS

Although there are few active or potentially active faults within the San Joaquin Region, several faults in the greater Northern California region are capable of producing groundshaking in the region. Most notable of these faults are the San Andreas, Hayward, San Gregorio, Calaveras, and Great Valley faults. The western portion of this region (at the eastern margin of the Diablo Range) is closest to these faults. The following WSIP projects or facilities would be located in this area: Advanced Disinfection (SJ-1), Lawrence Livermore (SJ-2), the western pipeline segments of the SJPL System (SJ-3) and SJPL Rehabilitation (SJ-4), and Tesla Portal Disinfection (SJ-5). Because of the type of rock beneath them, these facilities could be subject to groundshaking magnitudes ranging from 20 to 50 percent of gravity (0.2 to 0.5 g). However, due to its distance from these regional seismic sources, the eastern pipeline segment of the SJPL System and SJPL Rehabilitation projects are expected to experience lower groundshaking magnitudes, ranging from 10 to 20 percent of

gravity (0.1 to 0.2 g). These approximate values are presented in this document for general review and estimation of potential seismic groundshaking and are not intended for the purpose of project design. All WSIP projects would be designed and constructed in accordance with the *General Seismic Design Requirements*. Therefore, impacts related to groundshaking would be *less than significant* for all San Joaquin Region projects.

Sunol Valley, Bay Division, Peninsula, and San Francisco Regions

Impact 4.4-6: Seismically induced groundshaking.		
Alameda Creek Fishery	SV-1	LS
Calaveras Dam	SV-2	LS
40-mgd Treated Water	SV-3	LS
New Irvington Tunnel	SV-4	LS
Treated Water Reservoirs	SV-5	LS
SABUP	SV-6	LS
BDPL Reliability Upgrade	BD-1	LS
BDPL 3 and 4 Crossovers	BD-2	LS
BDPL 3 and 4 Seismic Upgrade at Hayward Fault	BD-3	LS
Baden and San Pedro Valve Lots	PN-1	LS
CS/SA Transmission	PN-2	LS
HTWTP Long-Term	PN-3	LS
Lower Crystal Springs Dam	PN-4	LS
Pulgas Balancing Reservoir	PN-5	LS
SAPL 3 Installation	SF-1	LS
Groundwater Projects	SF-2	LS
Recycled Water Projects	SF-3	LS

Active and potentially active faults capable of producing strong groundshaking are located within and near each of the Sunol Valley, Bay Division, Peninsula, and San Francisco Regions. Most notable of these faults are the San Andreas, Hayward, San Gregorio, Calaveras, and Greenville faults. WSIP facilities in any of these regions could experience strong groundshaking from a seismic event on one of these faults. Anticipated groundshaking magnitudes in each region are summarized in **Table 4.4-5** and range from approximately 50 to 70 percent of gravity (0.5 g to 0.7 g). These approximate values are presented in this document for general review and estimation of potential seismic groundshaking in each region and are not intended for the purpose of project design.

TABLE 4.4-5
APPROXIMATE GROUND MOTIONS EXPECTED IN EACH REGION
(10% probability of being exceeded in 50 years)

Region	Range of Approximate Peak Ground Acceleration (g)[a,b]
Sunol Valley	0.72 – 0.73
Bay Division	0.50 – 0.71
Peninsula	0.68 – 0.72
San Francisco	0.55 – 0.69

[a] Ground motions are expressed as a fraction of the acceleration due to gravity (g) and have a 10% probability of being exceeded in 50 years.
[b] Ground motion values are the same for firm rock (conditions on the boundary between site categories B and C, as defined by the building code), soft rock (site category C), and alluvium (site category D).

SOURCE: CGS, 2007.

All WSIP projects would be designed and constructed in accordance with the *General Seismic Design Requirements.* Therefore, impacts related to ground shaking would be *less than significant* for all WSIP projects in the Sunol Valley, Bay Division, Peninsula, and San Francisco Regions.

Impact 4.4-7: Seismically induced ground failure, including liquefaction and settlement.

Liquefaction-related phenomena can include lateral spreading, ground oscillation, loss of bearing strength, subsidence, and buoyancy effects, all of which can damage to structures. During the loss of bearing capacity, large deformations can occur within the soil mass. Damage from liquefaction and lateral spreading is generally most severe when liquefaction occurs within 15 to 20 feet of the ground surface. The WSIP projects most likely to suffer damage from liquefaction-related phenomena are foundations for structures, vaults, and pipelines.

Seismically induced settlement can occur in areas underlain by compressible sediments. Stream channel deposits and recent valley alluvium are generally the most susceptible to earthquake-induced settlement. Additionally, artificial fills, especially fills placed before 1965 and those placed on top of bay mud, are highly susceptible to mobilization and densification, resulting in earthquake-induced subsidence.

For this analysis, areas susceptible to liquefaction were identified based on mapping conducted by the CGS and USGS. As required by the Seismic Hazards Mapping Act, the CGS has mapped areas of liquefaction potential within portions of the program area, and additional mapping is underway or planned. The USGS has issued a GIS map and report that includes liquefaction susceptibility mapping for the San Francisco Bay Area (USGS, 2000). For this mapping, the USGS has assigned liquefaction susceptibility designations of very low, low, moderate, high, and very high based on the geologic unit (type and age of deposit) and depth to groundwater.

Because the regional water system carries water from the Sierra Nevada to the San Francisco Bay Area, the crossing of many areas of moderate to very high liquefaction susceptibility is unavoidable. However, many of the WSIP facility projects include improvements to the water system within these areas (as discussed below by region), which would enable the SFPUC to meet the water service delivery goals of the WSIP, and these facilities would be designed to withstand liquefaction and settlement or maintain water service in accordance with the *General Seismic Design Requirements*.

Pipelines and Related Facilities. Where pipelines are buried in soil overlying deeper liquefiable soil layers, liquefaction of the deeper layers can result in substantial lateral spreading of the upper competent soil layer. Lateral spreading can extend several hundred feet from a slope, and displacements of tens of feet can occur if soil conditions are especially favorable for liquefaction and if earthquake shaking is of sufficient duration. Lateral spreading was responsible for most of the pipeline failures in San Francisco during the 1989 Loma Prieta earthquake.

During an earthquake, underground utilities tend to fail at the interface between a softer unit and a stiffer unit due to the settlement that occurs within the softer unit, a phenomenon known as differential settlement. The unconsolidated sediments underlying water crossings are typical examples of such conditions. During the Loma Prieta earthquake, differential settlement due to groundshaking resulted in water pipeline ruptures in the Marina District of San Francisco. Differential settlement is of most concern, as it can cause the uneven movement of pipelines, resulting in substantial damage to pipelines, including cracks and breakage.

Other Facilities. Liquefaction can result in a loss of bearing capacity, subsidence, and lateral spreading, all of which can cause serious building foundation failures, and naturally buoyant structures such as underground storage tanks can also be raised above ground. In response to seismically induced settlement, buildings and other structures can settle and tilt. Differential settlement is of most concern because it can cause uneven movement of foundations, resulting in significant damage to structures.

San Joaquin Region

Impact 4.4-7: Seismically induced ground failure, including liquefaction and settlement		
Advanced Disinfection	SJ-1	LS
Lawrence Livermore	SJ-2	LS
SJPL System	SJ-3	LS
SJPL Rehabilitation	SJ-4	LS
Tesla Portal Disinfection	SJ-5	LS

Seismic hazard maps have not been prepared for the San Joaquin Valley, and the CGS does not indicate plans for completing maps for this region. However, some areas are potentially liquefiable, including near-surface soils comprised of sandy and gravelly alluvial deposits and areas of shallow groundwater along the eastern margin of the Coast Ranges, where the following WSIP projects or facilities would be located: Advanced Disinfection (SJ-1), Lawrence Livermore (SJ-2), Tesla Portal Disinfection (SJ-5), and the western pipeline segments of the SJPL System (SJ-3) and SJPL Rehabilitation (SJ-4) projects. However, the SJPL System project would include construction of a fourth pipeline parallel to the existing pipelines as well as two crossover facilities, and the SJPL Rehabilitation project includes a conditions assessment and rehabilitation of the existing San Joaquin Pipelines where improvements are needed. Rehabilitation of the pipelines to current seismic design criteria would improve the reliability of the San Joaquin Pipelines and reduce the potential for failure in the event of liquefaction or settlement. Because each of these projects would be designed and constructed in accordance with the *General Seismic Design Requirements*, impacts related to liquefaction and other seismically induced ground failures are considered *less than significant* for all San Joaquin Region projects.

Sunol Valley Region

Impact 4.4-7: Seismically induced ground failure, including liquefaction and settlement		
Alameda Creek Fishery	SV-1	LS
Calaveras Dam	SV-2	LS
40-mgd Treated Water	SV-3	LS
New Irvington Tunnel	SV-4	LS
Treated Water Reservoirs	SV-5	LS
SABUP	SV-6	LS

Of the six WSIP projects in the Sunol Valley Region, a seismic hazard map has been prepared only for an area covering the western portion of the New Irvington Tunnel (SV-4, shown on the Niles quadrangle); based on this mapping, the western portion of the New Irvington Tunnel does not pass beneath any zones of potential liquefaction. The CGS plans to prepare a seismic hazard map for the La Costa Valley quadrangle, where many of the Sunol Valley projects would be constructed.

The USGS liquefaction susceptibility mapping delineates areas of moderate to very high liquefaction potential in the Sunol Valley Region. The highest liquefaction potential is in areas of Quaternary deposition on the valley floor and along the drainage of Alameda Creek. The

Alameda Creek Fishery project (SV-1) and the pipeline component of the 40-mgd Treated Water project (SV-3) would be located in areas with moderate to very high liquefaction susceptibility. A portion of the SABUP project (SV-6) would also be located in areas with moderate to very high liquefaction susceptibility. However, this project would provide a redundant pipeline to the existing San Antonio Pipeline, and new discharge facilities would allow discharge to San Antonio Creek during an emergency outage. Because these projects would be designed and constructed to withstand liquefaction and settlement in accordance with the *General Seismic Design Requirements*, impacts related to liquefaction and other seismically induced ground failures are considered *less than significant* for these projects.

The Calaveras Dam (SV-2), New Irvington Tunnel (SV-4), and Treated Water Reservoirs (SV-5) projects are located in areas designated as having low to very low susceptibility to liquefaction; therefore, potential impacts related to liquefaction and other seismically induced ground failures would be *less than significant* for these projects.

Bay Division Region

Impact 4.4-7: Seismically induced ground failure, including liquefaction and settlement		
BDPL Reliability Upgrade	BD-1	LS
BDPL 3 and 4 Crossovers	BD-2	LS
BDPL 3 and 4 Seismic Upgrade at Hayward Fault	BD-3	LS

The Niles and Newark seismic hazard maps cover the segment of the BDPL Reliability Upgrade project (BD-1) to the east of the bay, and maps are planned or under preparation for the segment of this project to the west of the bay. Based on existing seismic hazard mapping, most of the eastern segment of the BDPL Reliability Upgrade traverses a zone of potential liquefaction. USGS mapping also indicates that the eastern segment of the pipeline traverses areas of moderate to very high liquefaction susceptibility.

The existing Bay Division Pipelines Nos. 3 and 4 traverse a broad area mapped by the CGS as having liquefaction potential, and by the USGS as having moderate to very high liquefaction susceptibility. These liquefaction-susceptible areas are located along the San Francisco Bay margins, where recent deposition has created a thick stratum of Holocene-age alluvium (greater than 60 feet in some areas). Significant bay filling has also created more liquefaction-prone areas of artificial fill. The BDPL 3 and 4 Crossovers (BD-2) and BDPL 3 and 4 Seismic Upgrade at Hayward Fault (BD-3) projects would be constructed on these existing pipeline segments in an area of liquefaction potential.

The BDPL Reliability Upgrade project (BD-1) would include construction of new seismically improved pipeline between the Irvington and Pulgas Portals; the BDPL 3 and 4 Crossovers (BD-2) would increase the reliability of water service delivery by reducing the amount of pipeline that would need to be taken out of service at one time; and the BDPL 3 and 4 Seismic Upgrade at Hayward Fault project (BD-3) would include construction of upgraded, seismically resistant sections of the Bay Division Pipelines Nos. 3 and 4 where they cross the Hayward fault. Because these projects would be designed and constructed to withstand liquefaction and settlement in accordance with the *General Seismic Design Requirements*, impacts related to liquefaction and

other seismically induced ground failures are considered *less than significant* for all Bay Division Region projects.

Peninsula Region

Impact 4.4-7: Seismically induced ground failure, including liquefaction and settlement		
Baden and San Pedro Valve Lots	PN-1	LS
CS/SA Transmission	PN-2	LS
HTWTP Long-Term	PN-3	LS
Lower Crystal Springs Dam	PN-4	LS
Pulgas Balancing Reservoir	PN-5	LS

The CGS plans, but has yet to prepare, seismic hazard maps delineating areas of potential liquefaction for the Peninsula Region to the south of San Francisco. USGS mapping delineates areas of moderate liquefaction potential at the south end of Lower Crystal Springs Reservoir, where the Pulgas Balancing Reservoir project (PN-5) would be constructed, and between the Lower and Upper Crystal Springs Reservoirs, where the Crystal Springs/San Andreas Pipeline would be repaired or replaced under the CS/SA Transmission project (PN-2). However, whether repaired or replaced, this pipeline would improve the reliability of water conveyance from Crystal Springs Reservoir to the Harry Tracy WTP. Because these projects would be designed and constructed to withstand liquefaction and settlement in accordance with the *General Seismic Design Requirements*, impacts related to liquefaction and other seismically induced ground failures are considered *less than significant* for these projects.

Other WSIP facilities in this region are located in areas underlain by Pleistocene and older bedrock units that have low to very low liquefaction susceptibility as mapped by the USGS. Therefore, the potential for liquefaction at the remaining facilities in this region is low, and impacts related to liquefaction other seismically induced ground failures would be *less than significant* for the Baden and San Pedro Valve Lots (PN-1), HTWTP Long-Term (PN-3), and Lower Crystal Springs Dam (PN-4) projects.

San Francisco Region

Impact 4.4-7: Seismically induced ground failure, including liquefaction and settlement		
SAPL 3 Installation	SF-1	LS
Groundwater Projects	SF-2	LS
Recycled Water Projects	SF-3	LS

Based on CGS seismic hazard mapping, the SAPL 3 Installation project (SF-1) could cross several small areas of potential liquefaction in the vicinity of Lake Merced. However, the project would repair and replace portions of the existing Crystal Springs Pipeline No. 2 to improve the seismic reliability of the water system. Final locations have not been selected, but the Local Groundwater Projects (SF-2) and Recycled Water Projects (SF-3) could be constructed in areas of potential liquefaction mapped by the CGS in the vicinity of Lake Merced and along the coastline in the Sunset District and Golden Gate Park to the north. The CGS plans, but has yet to prepare, seismic hazard maps for the Peninsula Region to the south of San Francisco, where the Regional Groundwater Projects (SF-2) would be constructed. However, these projects would be designed and constructed to withstand liquefaction in accordance with the *General Seismic Design Requirements*, and impacts related to liquefaction and other seismically induced ground failures would be *less than significant* for all San Francisco Region projects.

In addition, if the Recycled Water Projects (SF-3) are located in a CGS zone of potential liquefaction, construction of the treatment plant under this project would be required to comply with Seismic Hazards Mapping Act requirements (described in the Setting), because the plant would likely be staffed for more than 2,000 hours per year. The applicability of this act would be determined during separate, project-level CEQA environmental review of this project.

Impact 4.4-8: Seismically induced landslides or other slope failures.

Impact 4.4-8: Seismically induced landslides or other slope failures		
Advanced Disinfection	SJ-1	LS
Lawrence Livermore	SJ-2	LS
SJPL System	SJ-3	N/A
SJPL Rehabilitation	SJ-4	N/A
Tesla Portal Disinfection	SJ-5	LS
Alameda Creek Fishery	SV-1	LS
Calaveras Dam	SV-2	LS
40-mgd Treated Water	SV-3	LS
New Irvington Tunnel	SV-4	LS
Treated Water Reservoirs	SV-5	LS
SABUP	SV-6	LS
BDPL Reliability Upgrade	BD-1	LS
BDPL 3 and 4 Crossovers	BD-2	N/A
BDPL 3 and 4 Seismic Upgrade at Hayward Fault	BD-3	N/A
Baden and San Pedro Valve Lots	PN-1	LS
CS/SA Transmission	PN-2	LS
HTWTP Long-Term	PN-3	LS
Lower Crystal Springs Dam	PN-4	LS
Pulgas Balancing Reservoir	PN-5	LS
SAPL 3 Installation	SF-1	LS
Groundwater Projects	SF-2	LS
Recycled Water Projects	SF-3	LS

As discussed in Impact 4.4-1, many WSIP projects would be located in areas mapped as "many landslides" (USGS, 1997). Therefore, the potential exists for seismically induced ground failure in the form of landsliding or ground-cracking at these sites. Slope instability (including landslides, earth flows, and debris flows) could undermine foundations, cause distortion and distress to overlying structures, and displace or destroy project components. However, all WSIP projects would be designed and constructed to withstand or avoid seismically induced landslides in accordance with the *General Seismic Design Requirements.* Therefore, impacts related to seismically induced landslides or other slope failures would be *less than significant* for all WSIP projects located in an area susceptible to landslides. Implementation of Alameda WMP Policies 55 and 56 described in Impact 4.4-1 would also be required for projects located in the Alameda and Peninsula watersheds. Similar to Impact 4.4-1, this impact would *not apply* to projects located outside of areas susceptible to landslides.

None of the WSIP facilities intended for human occupancy are located in areas mapped by the CGS as having the potential for seismically induced landslides, and these facilities would thus not be subject to the Seismic Hazards Mapping Act. If seismic hazard mapping is completed in San Mateo County by the time of construction, improvements at the Harry Tracy WTP under the HTWTP Long-Term project (PN-3) could be subject to Seismic Hazards Mapping Act requirements (described in the Setting).

Geologic Hazard Impacts

Impact 4.4-9: Expansive or corrosive soils.

Problematic soils, including corrosive and expansive soils, can cause damage to structures and buried utilities and can also increase required maintenance. Depending on the degree of corrosivity of the subsurface soils, building materials such as concrete, reinforcing steel in concrete structures, and bare-metal structures exposed to these soils can deteriorate, eventually leading to structural failures. Expansion and contraction of expansive soils in response to changes in moisture content can lead to differential and cyclical movements that can cause damage and/or distress to structures and equipment.

Some of the natural soil types identified within the WSIP project areas are known to be corrosive or expansive. Under the CBC, the expansive characteristics of a soil would be determined according to Uniform Building Code Standard 18-2, and the soil classified according to CBC Table 18A-1-B. For projects located on soil with an expansion index greater than 20, a geotechnical investigation could be required. If the soil expansion index varies with depth, the variation would be included in the engineering analysis of the effects of expansive soils on the structure. The report for the geotechnical investigation would provide a recommended foundation type, design criteria (including bearing capacity), and provisions to protect against the effects of expansive soils. The geotechnical report would also identify the total and differential settlement that could occur.

Examples of measures that could be taken to correct for expansive soils include removing unsuitable subgrade soils and replacing them with engineered fill, supporting structures on deep-pile foundation systems, densifying compactable subgrade soils with in-situ techniques, and placing moisture barriers above and around expansive subgrade soils to help prevent variations in soil moisture content. Examples of measures that could be taken to correct for corrosive soils include installing cathodic protection systems to protect buried metal utilities, using coated or nonmetallic (i.e., concrete or PVC) pipes not susceptible to corrosion, and constructing foundations using sulfate-resistant concrete.

All WSIP projects are located in an area of potentially corrosive or expansive soil, as discussed below; therefore, this impact is considered potentially significant for all projects. However, the site-specific information analyzed in accordance with SFPUC Construction Measure #2 (seismic and geotechnical studies) and during separate, project-level CEQA review would either confirm the program-level determination or provide a basis to revise this determination.

San Joaquin Region

Impact 4.4-9: Expansive or corrosive soils		
Advanced Disinfection	SJ-1	PSM
Lawrence Livermore	SJ-2	PSM
SJPL System	SJ-3	PSM
SJPL Rehabilitation	SJ-4	PSM
Tesla Portal Disinfection	SJ-5	PSM

Based on the STATSGO Map (described in the setting), the distribution of soil units in the San Joaquin Region is highly variable. **Table 4.4 6** summarizes the characteristics of the major soil types that could be encountered during construction of the new pipeline

TABLE 4.4-6
MAJOR SOIL TYPES FOR SAN JOAQUIN REGION PROJECTS

Unit ID	Soil Association	Description	Shrink/Swell Potential	Risk of Corrosion	
				Concrete	Uncoated Steel
CA402	Auburn–Whiterock–Rock Outcrop	Soils consist of silt loam and loam.[a] Shallow soils formed on amphibolite schists and other metasedimentary rock types.	Low to High	Low to Moderate	Moderate to High
CA431	Pentz–Peters–Pardee	Predominantly shallow soils formed in material weathered from andesitic tuffaceous sediments, some soils formed in mixed alluvium. Soils consist of clay, fine sandy loam, and gravelly to cobbly loam.	Low, with some areas of Moderate to High	Low to Moderate	Moderate to High
CA469	Capay–El Sloyo–Vernalis	Very deep soils consisting of clay, clay loam, and silty clay loam that form on fine-grained alluvial fans and flats.	Moderate to High	Low to Moderate	High
CA470	Carbona–Capay–Calla	Soils consist of clays and clay loams. Deep soils formed in fine alluvial fans and terraces.	Moderate to High	Low to Moderate	High
CA484	Vernalis–San Emigdio–Garretson	Soils consist of clay loam, loam, sandy loam, gravelly loam, and gravelly sandy loam. Very deep soils that form on alluvial fans and floodplains.	Low to Moderate	Low	Moderate to High
CA485	Capay–Zacharias–Stomar	Very deep soils formed in fine-grained alluvium consisting of clay and clay loam.	Low to High	Low to Moderate	Moderate to High

[a] Loam soil composed of sand, silt, clay, and organic matter in evenly mixed particles of various sizes.

SOURCES: NRCS, 1994 and 2007.

segments and disinfection facilities. Some soil types exhibit a high shrink/swell potential and some exhibit a high risk of corrosion to uncoated steel. Therefore, impacts related to expansive and corrosive soils would be *potentially significant* for all San Joaquin Region projects (Advanced Disinfection, SJ-1; Lawrence Livermore, SJ-2; SJPL System, SJ-3; SJPL Rehabilitation, SJ-4; and Tesla Portal Disinfection, SJ-5). However, implementation of SFPUC Construction Measure #2 (seismic and geotechnical studies) and characterization of the extent of expansive and corrosive soils (Measure 4.4-9), including conformance with CBC requirements, would reduce this impact to a less-than-significant level.

Sunol Valley Region

Impact 4.4-9: Expansive or corrosive soils		
Alameda Creek Fishery	SV-1	PSM
Calaveras Dam	SV-2	PSM
40-mgd Treated Water	SV-3	PSM
New Irvington Tunnel	SV-4	PSM
Treated Water Reservoirs	SV-5	PSM
SABUP	SV-6	PSM

Soils in the Sunol Valley Region consist of one soil association, the Millsholm–Los Osos–Los Gatos Association. **Table 4.4-7** summarizes the characteristics of this soil type. The major soil type in this region exhibits a moderate shrink/swell potential and a high risk of corrosion to uncoated steel. Therefore, impacts related to expansive and corrosive soils are *potentially significant* for the Sunol Valley Region projects (Alameda Creek Fishery, SV-1; Calaveras Dam, SV-2; 40-mgd Treated Water, SV-3; New Irvington Tunnel, SV-4; Treated Water Reservoirs, SV-5; and SABUP, SV-6), but would be reduced to a less-than-significant level with implementation of SFPUC Construction Measure #2 (seismic and geotechnical studies) and characterization of the extent of expansive and corrosive soils (Measure 4.4-9), including conformance with CBC requirements.

TABLE 4.4-7
MAJOR SOIL TYPES FOR SUNOL VALLEY REGION PROJECTS

Unit ID	Soil Association	Description	Shrink/Swell Potential	Risk of Corrosion	
				Concrete	Uncoated Steel
CA423	Millsholm–Los Osos–Los Gatos	Moderately deep to shallow soils formed in material weathered from sandstone and shale consisting of clay, clay loam, loam,[a] and sandy loam.	Low, some areas of Moderate	Low to Moderate	Moderate to High

[a] Loam soil composed of sand, silt, clay, and organic matter in evenly mixed particles of various sizes.

SOURCES: NRCS, 1994 and 2007.

Bay Division Region

Impact 4.4-9: Expansive or corrosive soils		
BDPL Reliability Upgrade	BD-1	PSM
BDPL 3 and 4 Crossovers	BD-2	PSM
BDPL 3 and 4 Seismic Upgrade at Hayward Fault	BD-3	PSM

The distribution of soil types in this region is also highly variable, with soils of varying expansive and corrosive properties. **Table 4.4-8** summarizes the characteristics of the major soil types that could be encountered during construction of the new pipeline and new pipeline interties, valve structures, and crossover facilities. Some soil types exhibit a high shrink/swell potential and some exhibit a high risk of corrosion to uncoated steel. Therefore, impacts related to expansive and corrosive soils are *potentially significant* for the all projects in this region (BDPL Reliability Upgrade, BD-1; BDPL 3 and 4 Crossovers, BD-2; and BDPL 3 and 4 Seismic Upgrade at Hayward Fault, BD-3), but would be reduced to a less-than-significant level with implementation of SFPUC Construction Measure #2 (seismic and geotechnical studies) and characterization of the extent of expansive and corrosive soils (Measure 4.4-9), including conformance with CBC requirements.

TABLE 4.4-8
MAJOR SOIL TYPES FOR BAY DIVISION REGION PROJECTS

Unit ID	Soil Association	Description	Shrink/Swell Potential	Risk of Corrosion	
				Concrete	Uncoated Steel
CA202	Reyes–Novato–Tamba	Deep soils formed in alluvium next to bays and in marshes consisting of silty clay, clay, and mucky clay.	Moderate to High	Low to High	High
CA240	Clear Lake–Pescadero–Cropley	Deep to very deep soils formed in fine-grained alluvium. Soil types include clay, silty clay, and silty clay loam.[a]	Low to High	Low to Moderate	Moderate to High
CA242	Danville–Botella–Urban Land[b]	Very deep soils formed in alluvial fans and terraces consisting of clay, sandy clay loam, silty clay loam, sandy clay, and clay loam.	Moderate to High	Low to Moderate	Moderate to High
CA592	Urban Land–Xerorthents[c]–Accelerator	Deep soil formed in material weathered from soft sandstone and siltstone. Consists of loam, clay, and gravelly clay loam.	Low to High	Low to Moderate	Moderate to High
CA593	Accelerator–Fagan–Urban Land	Deep soil formed in material weathered from soft sandstone and siltstone. Consists of loam, clay loam, clay, and gravelly clay loam.	Low to High	Low to Moderate	Moderate
CA595/596	Associations including varying amounts of Urban Land, Xerorthents, and Botella	Very deep soils formed in alluvium from sedimentary rocks consisting of silty clay loam, sandy clay, and clay loam.	Moderate to High	Moderate to High	Moderate to High

[a] Loam soil composed of sand, silt, clay, and organic matter in evenly mixed particles of various sizes.
[b] Urban Land – areas of urbanized land where soil units have been modified by urban uses or engineered materials.
[c] Xerorthents type is used to describe the highly variable, disturbed urban flatlands.

SOURCES: NRCS, 1994 and 2007.

Peninsula Region

Impact 4.4-9: Expansive or corrosive soils		
Baden and San Pedro Valve Lots	PN-1	PSM
CS/SA Transmission	PN-2	PSM
HTWTP Long-Term	PN-3	PSM
Lower Crystal Springs Dam	PN-4	PSM
Pulgas Balancing Reservoir	PN-5	PSM

The distribution of soil types in this region is highly variable, with soils of varying expansive and corrosive properties. **Table 4.4-9** summarizes the characteristics of the major soil types that could be encountered during construction of the facility improvements, replacement pipelines, and other new structures. Some soil types exhibit a high shrink/swell potential and some exhibit a high risk of corrosion to uncoated steel. Therefore, impacts related to expansive and corrosive soils are *potentially significant* for each of the Peninsula Region projects (Baden and San Pedro Valve Lots, PN-1; CS/SA Transmission, PN-2; HTWTP Long-Term, PN-3; Lower Crystal Springs Dam, PN-4; and Pulgas Balancing Reservoir, PN-5), but would be reduced to a less-than-significant level with implementation of SFPUC Construction Measure #2 (seismic and geotechnical studies) and characterization of the extent of expansive and corrosive soils (Measure 4.4-9), including conformance with CBC requirements.

TABLE 4.4-9
MAJOR SOIL TYPES FOR PENINSULA REGION PROJECTS

Unit ID	Soil Association	Description	Shrink/Swell Potential	Risk of Corrosion	
				Concrete	Uncoated Steel
CA588	Alambique–McGarvey–Zeni	Moderately deep soils formed in material weathered from sandstone, consists of gravelly loam, clay loam, and loam.[a]	Low to Moderate	Low to Moderate	Moderate to High
CA591	Fagan–Obispo–Urban Land[b]	Deep soils in material weathered from sandstone consisting of clay and clay loam, and shallow soils in material weathered from serpentinite consisting of clay.	Low to Moderate	Low to High	Moderate to High
CA592	Urban Land–Xerorthents[c]–Accelerator	Deep soil formed in material weathered from soft sandstone and siltstone. Consists of loam, clay, and gravelly clay loam.	Low to High	Low to Moderate	Moderate to High
CA595	Urban Land–Xerorthents–Botella	Very deep soils formed in alluvium from sedimentary rocks consisting of silty clay loam, sandy clay, and clay loam.	Moderate to High	Moderate to High	Moderate to High
CA599	Urban Land–Xerorthents–Sirdrak	Sirdrak soils are very deep soils formed in eolian sands consisting of grayish to yellowish brown sand.	Low	Moderate	Moderate

[a] Loam soil composed of sand, silt, clay, and organic matter in evenly mixed particles of various sizes.
[B] Urban Land – areas of urbanized land where soil units have been modified by urban uses or engineered materials.
[C] Xerorthents type is used to describe the highly variable, disturbed urban flatlands.

SOURCES: NRCS, 1994 and 2007.

San Francisco Region

Impact 4.4-9: Expansive or corrosive soils		
SAPL 3 Installation	SF-1	PSM
Groundwater Projects	SF-2	PSM
Recycled Water Projects	SF-3	PSM

The distribution of soil types in this region is highly variable, with soils of varying expansive and corrosive properties. **Table 4.4-10** summarizes the characteristics of the major soil types that could be encountered during construction of the new pipelines and related facilities/structures. Some soil types exhibit a high shrink/swell potential and some exhibit a high risk of corrosion to uncoated steel. Therefore, impacts related to expansive and corrosive soils are *potentially significant* for each of the San Francisco Region projects (SAPL 3 Installation, SF-1; Groundwater Projects, SF-2; and Recycled Water Projects, SF-3), but would be reduced to a less-than-significant level with implementation of SFPUC Construction Measure #2 (seismic and geotechnical studies) and characterization of the extent of expansive and corrosive soils (Measure 4.4-9), including conformance with CBC requirements.

TABLE 4.4-10
MAJOR SOIL TYPES FOR SAN FRANCISCO REGION PROJECTS

Unit ID	Soil Association	Description	Shrink/Swell Potential	Risk of Corrosion	
				Concrete	Uncoated Steel
CA590	Barnabe–Candlestick–Buriburi	Shallow to moderately deep soil formed in material weathered from sandstone. Consists of gravelly loam, very gravelly loam, sandy loam, and loam.[a]	Low to Moderate	Moderate	Moderate
CA591	Fagan–Obispo–Urban Land[b]	Deep soils in material weathered from sandstone consisting of clay and clay loam, and shallow soils in material weathered from serpentinite consisting of clay.	Low to Moderate	Low to High	Moderate to High
CA592	Urban Land–Xerorthents[c]–Accelerator	Deep soil formed in material weathered from soft sandstone and siltstone. Consists of loam, clay, and gravelly clay loam.	Low to High	Low to Moderate	Moderate to High
CA595	Urban Land–Xerorthents–Botella	Very deep soils formed in alluvium from sedimentary rocks consisting of silty clay loam, sandy clay, and clay loam.	Moderate to High	Moderate to High	Moderate to High
CA599	Urban Land–Xerorthents–Sirdrak	Sirdrak soils are very deep soils formed in eolian sands consisting of grayish to yellowish brown sand.	Low	Moderate	Moderate

[a] Loam soil composed of sand, silt, clay, and organic matter in evenly mixed particles of various sizes.
[b] Urban Land – areas of urbanized land where soil units have been modified by urban uses or engineered materials.
[c] Xerorthents type is used to describe the highly variable, disturbed urban flatlands.

SOURCES: NRCS, 1994 and 2007.

4.4.3 References – Geology, Soils, and Seismicity

Berkeley Seismological Laboratory, available online at http://seismo.berkeley.edu/eqw/, accessed June 2007.

Bolt, Bruce A., *Earthquakes*, W.H. Freeman and Company, New York, 1988.

Brabb, E.E., R.W.Graymer, and D.L. Jones, *Geology of the onshore part of San Mateo County, California: A Digital Database*, Open File Report 98-137, available online at http://pubs.usgs.gov/of/1998/of98-137/, 1998.

Brown, I.R., T.L. Brekke, and G.E. Korbin, *Behavior of the Bay Area Rapid Transit Tunnels through the Hayward Fault*, U.S. Department of Transportation Report No. UMTA-CA-06-0120-81-1, 1981.

Bryant, W.A., and S.E. Cluett (compilers), *Fault number 55b, Hayward Fault Zone, Southern Hayward Fault Section*, in Quaternary Fault and Fold Database of the United States, U.S. Geological Survey website, available online at http://earthquakes.usgs.gov/regional/qfaults, 2000, accessed June 11 2007.

California Division of Mines and Geology (CDMG), *Geologic and Engineering Aspects of San Francisco Bay Fill*, CDMG Special Report 97, Harold B. Goldman, editor, 1969.

California Geological Survey (CGS), *Probabilistic Seismic Hazard Assessment for the State of California,* CDMG Open File Report 96-08, 1996.

California Geological Survey (CGS), *Fault Rupture Hazard Zones in California*, CDMG Special Publication #42, 1999.

California Geological Survey, *Digital Images of Official Maps of Alquist-Priolo Earthquake Fault Zones of California*, maps reviewed on disk include La Costa Valley, Niles, Newark, Calaveras Reservoir, Milpitas, Mountain View, Palo Alto and Woodside Quadrangles, Scale 1:24,000, CD 2000-04 – Central Coastal Region, 2000.

California Geological Survey (CGS), *Probabilistic Seismic Hazard Assessment For The State Of California, Appendix A: Fault Source Parameters*, revised in 2002, from CDMG Open File-Report 96-08, available online at http://www.consrv.ca.gov/CGS/rghm/psha/ofr9608/, 2002.

California Geological Survey (CGS), Probabilistic Seismic Hazards Mapping (PSHM) Ground Motion web site, available online at http://www.consrv.ca.gov/cgs/rghm/pshamap, accessed June 2007.

Cao, T., W.A. Bryant, W.A., B. Rowshandel, D. Branum, and C.J. Wills, The revised 2002 California probabilistic seismic hazards maps: California Geological Survey, available online at www.conservation.ca.gov/cgs/rghm/psha, 2003.

Davis, G.H., J.H. Green, F.H. Olmstead, and D.W. Brown, *Groundwater Conditions and Storage Capacity in the San Joaquin Valley, California,* USGS Water Supply Paper 1469, 1959.

Earth Science Associates (ESA), *Fault Rupture Evaluation, San Andreas Dam*, prepared for the San Francisco Water Department, January 1980.

Earth Science Associates (ESA), *Phase II Seismic Safety Investigation of San Andreas Dam*, prepared for the City and County of San Francisco Public Utilities Commission, February 1983.

Fenton, C.H., and C.S. Hitchcock, 2001, Recent geomorphic and paleoseismic investigations of thrust faults in Santa Clara Valley, California, in H. Ferriz and R. Anderson (eds.), *Engineering Geology Practice in Northern California: California Division of Mines and Geology Bulletin 210*.

Geotechnical Consultants, Inc. (GTC), *Geologic Study and Hazards Assessment (Draft), Harry Tracy Water Treatment Plant, Millbrae, California*, 2005.

National Earthquake Information Center (NEIC), official website, available online at http://earthquake.usgs.gov/regional/neic/, accessed June 2007.

Natural Resources Conservation Service (NRCS), State Soil Geographic (STATSGO) GIS Database for California, 1994.

Natural Resources Conservation Service (NRCS), Official Soils Series Descriptions website, available online at http://soils.usda.gov/technical/classification/osd/index.html, accessed May 2007.

Nilsen, T.H., and B.L. Turner, *Influence of rainfall and ancient landslide deposits on recent landslides (1950-71) in urban areas of Contra Costa County, California*, U.S. Geological Survey Bulletin 1388, 1975.

Norris, R.M., and R.W. Webb, *Geology of California*, 1st Edition, John Wiley & Sons, Inc., 1976.

San Francisco Public Utilities Commission (SFPUC), *General Seismic Requirements for Design of New Facilities and Upgrade of Existing Facilities.* August 15, 2006

San Francisco Public Utilities Commission (SFPUC), official website, available online at http://sfwater.org/, accessed June 2007.

Toppozada, T. R., D. L. Parke, and C. T. Higgins, *Seismicity of California 1900–1931*, California Division of Mines and Geology Special Report 135. 1978.

Toppozada, T.R., C.R. Real, and D.L. Parke, *Preparation of Isoseismal Maps and Summaries of Reported Effects for pre-1900 California Earthquakes,* California Division of Mines and Geology Open File Report 81-11. 1981.

Toppozada, T. R. and D. L. Parke, *Areas Damaged by California Earthquakes, 1900–1949,* California Division of Mines and Geology Open File Report 82-17, 1982.

U.S. Geological Survey (USGS), Stockton California – 1:100,000 Scale Metric Topographic Map, 30 X 60 Quadrangle, 1989.

U.S. Geological Survey (USGS), Oakdale California – 1:100,000 Scale Metric Topographic Map, 30 X 60 Quadrangle, 1994.

U.S. Geological Survey (USGS), *Database of Potential Sources for Earthquakes Larger then Magnitude 6 in Northern California*, Open File Report 96-705, Working Group on Northern California Earthquake Potential, 1996.

U.S. Geological Survey (USGS), *Summary Distribution of Slides and Earth Flows in the San Francisco Bay Region, California,* GIS database for Open File Report 97-745 Part C, by C. M. Wentworth, S. E. Graham, R. J. Pike, G. S. Beukelman, D. W. Ramsey, and A. D. Barron, 1997.

U.S. Geological Survey (USGS), *Preliminary Maps of Quaternary Deposits and Liquefaction Susceptibility, Nine-County San Francisco Bay Region, California: A Digital Database*, USGS Open File Report 00-444, 2000.

U.S. Geological Survey (USGS), *Earthquake Probabilities in the San Francisco Bay Region*, Working Group on California Earthquake Probabilities: 2002–2031, USGS Open File Report 03-214, 2003.

U.S. Geological Survey (USGS), Quaternary Fault and Fold Database of the United States, available online at http://earthquake.usgs.gov/regional/qfaults, accessed May 2007.

Wagner, D.L., E.J. Bortugno, and R.D. McJunkin, Geologic Map of the San Francisco-San Jose Quadrangle, CDMG Map, Scale 1:250,000, 1990.

Wentworth, C.M., General distribution of geologic materials in the San Francisco Bay region, California: a digital map database: U.S. Geological Survey Open file Report 97-744, database resolution 1:125,000, 1997.

Youd, T. L. and D. M. Perkins, "Mapping Liquefaction Induced Ground Failure Potential," *Proceedings of the American Society of Civil Engineers, Journal of the Geotechnical Engineering Division*, 1978.

4.5 Hydrology and Water Quality

4.5 Hydrology and Water Quality

4.5.1 Setting

WSIP facility improvement projects would be located in several major watersheds within and near the San Francisco Bay and San Joaquin River areas, and major project activities would occur in or adjacent to water bodies that support substantial beneficial uses for both wildlife and humans. Major water bodies in the WSIP program area are shown in **Figure 4.5-1**. This section discusses the major water bodies or watersheds that could be affected by the WSIP projects and identifies potential flooding issues in the vicinity of WSIP projects.

San Joaquin Region

The Tuolumne River, Stanislaus River, San Joaquin River, Delta-Mendota Canal, and California Aqueduct are the major water bodies within this region (Figure 4.5-1).

Tuolumne River

The Tuolumne River and watershed are described in Chapter 5, Section 5.3, Tuolumne River System and Downstream Water Bodies.

Stanislaus River

The Stanislaus River is a tributary to the San Joaquin River, which flows westward from the Sierra Nevada roughly parallel to and north of the Tuolumne River; the Hetch Hetchy Aqueduct runs between these two rivers. The North and Middle Forks of the Stanislaus River originate in Alpine County, while the South Fork originates in the Emigrant Wilderness north of Yosemite National Park. All three forks converge before the river enters New Melones Reservoir.

Delta-Mendota Canal

The Delta-Mendota Canal is a 120-mile-long component of the Central Valley Project, a system of irrigation and hydroelectric canals and dams. The Delta-Mendota Canal is used for irrigation water. The Tracy Pumping Plant is located at the northern end of the canal and diverts water to it from the Delta Cross Channel. The canal runs south along the western edge of the San Joaquin Valley and ends at the San Joaquin River near the town of Mendota, just west of Fresno. The Hetch Hetchy Aqueduct crosses over the canal west of Modesto. The Delta-Mendota Canal is operated by the Delta-Mendota Water Authority, which is responsible for maintaining the quality of the water discharged from the south end of the canal.

San Joaquin River

The San Joaquin River originates from Thousand Island Lake near Mount Ritter, high on the western slopes of the Sierra Nevada, in the Ansel Adams Wilderness near Mammoth Mountain. The San Joaquin River drains most of the area from the southern border of Yosemite National Park south to Kings Canyon National Park, making it the second largest river drainage in the

state. The river emerges from the foothills at the former town of Millerton; Friant Dam, located in Millerton since 1944, forms Millerton Lake. From the foothills, the river flows west to the trough of the Central Valley, where its major tributaries include the Stanislaus River, Tuolumne River, Merced River, Calaveras River, and Mokelumne River; it then flows north to the Sacramento–San Joaquin Delta and on to San Francisco Bay. The Hetch Hetchy Aqueduct crosses the river west of Modesto.

California Aqueduct

The California Aqueduct is a concrete-lined aqueduct that transports water from Northern California to Southern California. It is the main water transport structure of the State Water Project and, at nearly 450 miles in length, is the longest water channel in California. The aqueduct, built by the California Department of Water Resources, begins at the Sacramento River Delta and carries water south through the Central Valley, where it often parallels Interstate 5 (I-5). Here, the coastal branch splits off in a southwesterly direction to serve the central coast. The Hetch Hetchy Aqueduct crosses over the California Aqueduct west of Modesto. At Bakersfield, water is pumped up 2,000 feet to cross the Tehachapi Mountains.

Corral Hollow Watershed

Both the Advanced Disinfection (SJ-1) and the Tesla Portal Disinfection (SJ-5) facilities would be located at Tesla Portal, which is in the Corral Hollow Creek watershed on the eastern flank of the Coast Ranges in San Joaquin County. This watershed is within the overall Old River watershed but is hydraulically divided from the watershed by I-580, the California Aqueduct, and the Delta-Mendota Canal. Surface drainages in the Corral Hollow Creek watershed are not well defined due to limited precipitation. However, no surface runoff from the Tesla Portal site or the surrounding area contributes water to the aqueduct or canal or directly to Corral Hollow Creek.

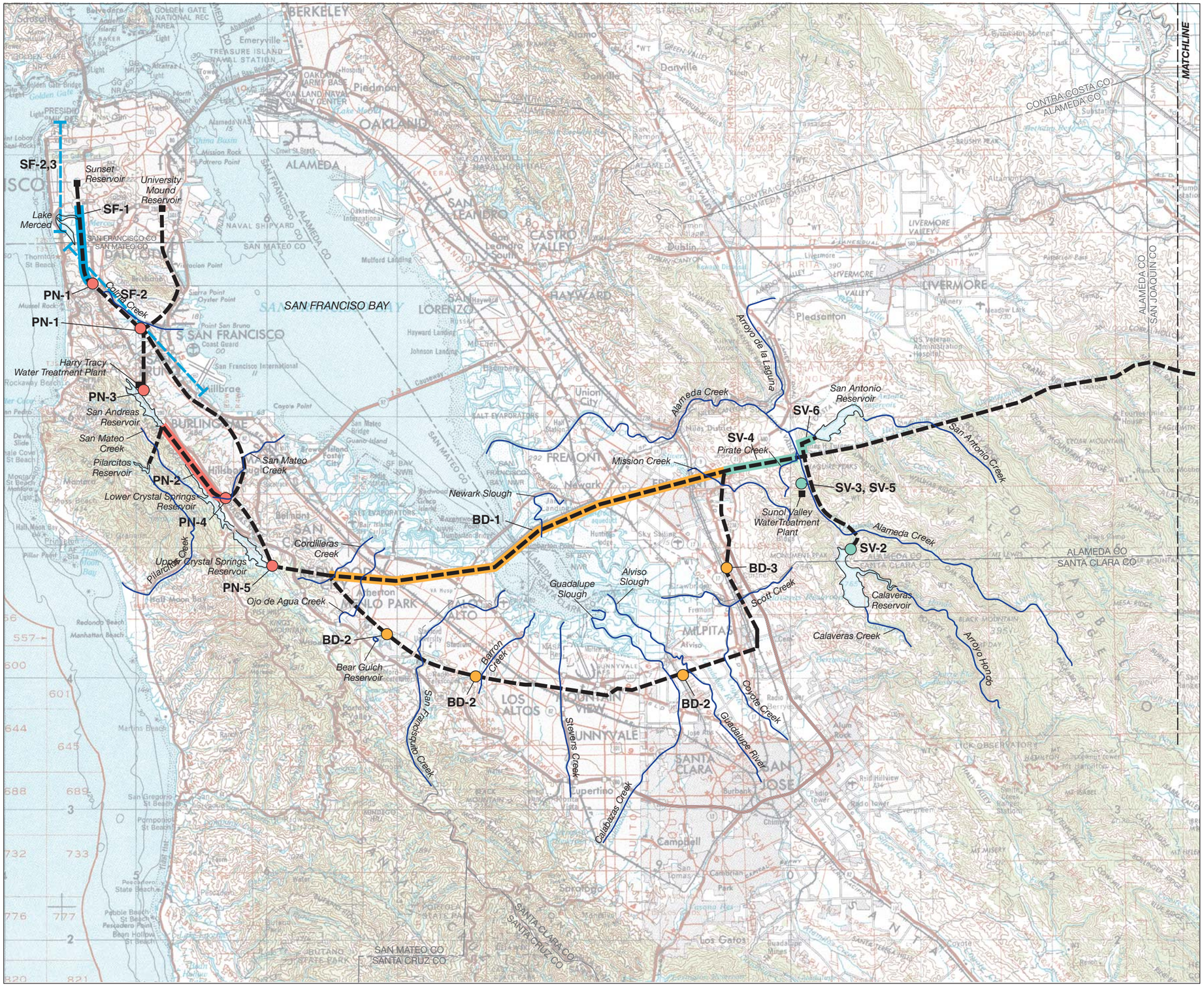
Flooding

The San Joaquin Pipeline system crosses a 3.6-mile-wide section of the 100-year flood zone of the San Joaquin River (FEMA, 2004). The pipeline system crosses no other 100-year flood zones in the San Joaquin Region.

Sunol Valley Region

Alameda Creek Watershed

All of the Sunol Valley Region projects are located in the Alameda Creek watershed on watershed lands owned by the City and County of San Francisco (CCSF) (see Figure 2.2 in Chapter 2). The Alameda Creek watershed is the largest drainage in the southern San Francisco Bay region, encompassing 633 square miles, and includes remote wildlands along upper Alameda Creek within the Sunol and Ohlone Regional Wilderness Preserves and SFPUC Alameda watershed lands. The watershed is comprised of the Livermore Drainage Unit and the Southern Alameda Creek Drainage Unit (SFPUC, 2001).



Existing System Corridor

Existing System Facility

Proposed Facility Corridor

Proposed Facility Site

Proposed Facility, General Location

Note: See Figure 4.1-2 for full Project Names

0 5

Miles

SOURCE: ESA + Orion JV, 2006

SFPUC Water System Improvement Program . 203287

Figure 4.5-1a
Major Streams and Rivers

Note: See Figure 4.1-2 for full Project Names

SOURCE: ESA + Orion; SFPUC, 2006

SFPUC Water System Improvement Program . 203287

Figure 4.5-1b
Major Streams and Rivers

All of the Sunol Valley Region projects are located in the Southern Alameda Creek Drainage Unit; this unit encompasses 175 square miles, of which approximately one-third, or approximately 36,000 acres, are owned by the CCSF. These landholdings are split between Alameda County (23,000 acres) and Santa Clara County (13,000 acres). Major water bodies located within the southern Alameda Creek watershed, and on CCSF-owned lands, include the Calaveras and San Antonio Reservoirs, Alameda Creek, Arroyo Hondo, Calaveras Creek, and San Antonio Creek (see Figure 4.5-1).

The SFPUC Alameda watershed lands include primary and secondary watershed lands. The 30,000 acres of primary watershed lands are tributary to the San Antonio and Calaveras Reservoirs and Alameda Creek. The 6,000 acres of secondary watershed lands are tributary to Alameda Creek below Calaveras Dam, San Antonio Dam, and the Alameda Creek Diversion Dam. The Calaveras Dam (SV-2), 40-mgd Treated Water (SV-3), and Treated Water Reservoirs (SV-5) projects and part of the Alameda Creek Fishery project (SV-1) are located in the CCSF-owned primary watershed lands, the most sensitive lands in terms of water quality protection. The New Irvington Tunnel (SV-4), and SABUP (SV-6) projects as well as the majority of the Alameda Creek Fishery project are located in the CCSF-owned secondary watershed lands.

Alameda Creek

Alameda Creek flows from its headwaters near Mount Hamilton northward through the Alameda watershed and the Sunol Valley, where it is joined by Arroyo de la Laguna. Alameda Creek then exits SFPUC lands through Niles Canyon and eventually drains to San Francisco Bay.

Calaveras Reservoir

Calaveras Reservoir is located at the southern end of the Alameda watershed; it is formed by Calaveras Dam, which is an earthen dam structure. The reservoir, originally constructed in 1913 and completed in 1925, collects and stores water from the local watershed, including drainage from Calaveras Creek and Arroyo Hondo, and has a tributary watershed area of approximately 98 square miles. The Alameda Creek Diversion Dam and Tunnel, constructed from 1925 to 1931 following completion of Calaveras Dam, divert flows and drainage from Alameda Creek to Calaveras Reservoir. Local runoff collected in Calaveras Reservoir is routed to the Sunol Valley Water Treatment Plant (WTP) by gravity flow through the Calaveras Pipeline.

Calaveras Reservoir is currently operating under restrictions imposed by the California Department of Water Resources, Division of Safety of Dams (DSOD) due to concern regarding the seismic stability of the dam. These restrictions allow the reservoir to be filled to about 40 percent of its maximum capacity; at this level, the reservoir has a surface area of 1.35 square miles and a storage capacity of 37,800 acre-feet.

San Antonio Reservoir

San Antonio Reservoir is formed by the James H. Turner Dam, an earthen dam completed in 1965. San Antonio Reservoir has a surface area of 1.3 square miles and a storage capacity of 50,300 acre-feet. The reservoir has a tributary watershed area of about 40 square miles and

impounds water from San Antonio Creek. In addition to storing local runoff, San Antonio Reservoir is used to store Calaveras Reservoir surplus water, Hetch Hetchy water, and has received water from the South Bay Aqueduct during an extended drought. Water from San Antonio Reservoir is conveyed through the San Antonio Pipeline to the Sunol Valley WTP.

Flooding

Alameda Creek flows through much of the Sunol Valley Region, and stream flow is largely regulated by operation of the Calaveras and San Antonio Reservoirs, owned by the CCSF, and the Del Valle Reservoir, owned and operated by the California Department of Water Resources. Within the WSIP study area, the Alameda Creek Fishery (SV-1) and SABUP (SV-6) projects are located in 100-year flood zones designated on flood insurance maps (FEMA, 2000b). There are no mapped 100-year flood zones upstream of these projects, where the remainder of the Sunol Valley Region projects would be located.

Groundwater Resources

None of the proposed WSIP projects would substantially affect groundwater resources of the Sunol Valley, as described in Section 5.4.4. However, the New Irvington Tunnel project (SV-4) would penetrate marine rocks of the Diablo Range, which is composed of interbedded permeable sandstone and relatively impermeable shale (Water Infrastructure Partners, 2005). While these rocks do not produce commercial quantities of groundwater, they do produce some local domestic or stock water supplies, primarily through springs and shallow dug wells. In the 1930s, there were 104 wells, springs, or piezometers in the vicinity of the Irvington Tunnel, many of which are no longer in use or have been abandoned. The quality of water from these rocks tends to be poor.

Bay Division Region

The Bay Division Region includes many watersheds defined by intermittent and perennial drainages. Pipeline and related projects in this region would be constructed across or near numerous creeks and other water bodies; the main water bodies are shown in Figure 4.5-1. On the east side of San Francisco Bay, the right-of-way of the existing Bay Division Pipelines Nos. 1 and 2, where the BDPL Reliability Upgrade project (BD-1) would be constructed, crosses the following major water bodies: Mission Creek, Agua Caliente Creek, and Newark Slough. On the west side of the bay, the right-of-way of the Bay Division Pipelines Nos. 1 and 2 crosses Ojo de Agua Creek and Cordilleras Creek. The pipeline right-of-way also crosses unnamed creeks, drainages, and flood control channels on both sides of the bay. Major creeks or water bodies crossed by or near the right-of-way for the existing Bay Division Pipelines Nos. 3 and 4, where the BDPL 3 and 4 Crossovers (BD-2) and BDPL 3 and 4 Seismic Upgrade at Hayward Fault (BD-3) would be constructed, include Barron Creek, Bear Gulch Reservoir, and the Guadalupe River.

Most of the creeks and flood control channels in each of the watersheds traversed by a Bay Division Region project discharge to sloughs in the tidal flats of South San Francisco Bay. Much of the land at the bay's shore has been altered to form evaporative salt ponds, with drainage routed around dikes to the various sloughs.

Flooding

Flooding in the Bay Division Region occurs primarily along the bay margins and along individual streams. An extensive network of flood control channels has been constructed throughout this region, and flood control improvements have been made to many of the streams to contain the 100-year and 500-year floods. In some areas, flood flows are contained by levees.

Peninsula Region

Major water bodies in this region are shown in Figure 4.5-1. The primary watershed in the Peninsula Region is within the CCSF-owned Peninsula watershed, including the San Mateo Creek watershed and the Pilarcitos Creek watershed. Peninsula Region projects located at least partially in the Peninsula watershed include the Baden and San Pedro Valve Lots (PN-1), CS/SA Transmission (PN-2), Lower Crystal Springs Dam (PN-4), and the Pulgas Balancing Reservoir (PN-5) projects. The Lower Crystal Springs Dam project would also be located in the San Mateo Creek watershed.

Peninsula Watershed

The Peninsula watershed encompasses 23,000 acres of the San Francisco Peninsula, which is owned by the CCSF (see Figure 2.3 in Chapter 2). The watershed is located in central San Mateo County and includes the San Andreas and Upper and Lower Crystal Springs Reservoirs, adjacent to I-280 and the Pilarcitos Reservoir to the northwest.

Crystal Springs Reservoir

While originally built as two separate reservoirs, Upper and Lower Crystal Springs Reservoirs are connected through a culvert beneath Highway 92, so there is free exchange between the two reservoirs. Upper Crystal Springs Dam is an earthen dam built in 1877. Lower Crystal Springs Dam, a concrete gravity dam built on San Mateo Creek in 1888, was raised a few feet in 1891 and again in 1911. The combined Crystal Springs Reservoir has a design capacity of 69,320 acre-feet and a catchment area of 22.5 square miles, with 13.5 and 9 square miles in the drainages of the upper and lower reservoirs, respectively. The water level in Crystal Springs Reservoir has been lowered in accordance with a DSOD mandate and cannot be raised to its original level unless Lower Crystal Springs Dam is renovated to safely contain the probable maximum flood. This mandate has reduced the available water storage to an interim operating capacity of 58,400 acre-feet.

San Andreas Reservoir

San Andreas Reservoir is an earth-fill dam originally constructed in 1870. The reservoir has a tributary area of 4.4 square miles and provides a total of 19,000 acre-feet of storage.

Pilarcitos Reservoir

Pilarcitos Reservoir is formed by an earthen dam that was constructed in 1864 and raised in 1871. Stone Dam, a masonry-arch dam built in 1871, is located two miles downstream of Pilarcitos Reservoir. Pilarcitos Reservoir has a tributary area of 6 square miles and provides a total of

3,100 acre-feet of storage. The upper watershed has the highest annual rainfall on the Peninsula (42 inches).

Flooding

Flooding in the Peninsula Region is primarily related to individual streams, and flood control improvements have been made to many of the streams to contain the 100-year and 500-year floods. None of the Peninsula Region projects are located within or cross a 100-year floodplain.

San Francisco Region

There are currently no natural surface water bodies or streams in San Francisco, with the exception of Lobos Creek (which flows through the Presidio), San Francisco Bay, which borders the east and north sides of the city, and the Pacific Ocean to the west. Historically, there were small creeks flowing to the bay, but most of the creeks were filled during development of the city. Lake Merced is the only major open water body in San Francisco (see Figure 4.5-1).

Freshwater drainage in San Francisco has been almost entirely diverted to the city's combined sewer and stormwater system, which collects and transports both sanitary sewage and stormwater runoff in the same set of pipes. The stormwater drainage is conveyed through the combined sewer system, treated, and eventually discharged through outfalls and overflow structures along the shoreline. Water treatment plants on both the east and west sides of the city provide full secondary treatment for all dry-weather flow, and storage and discharge structures provide the equivalent of primary treatment for wet-weather flows when the treatment capacity of the water treatment plants is reached. Flows from these structures are discharged through combined sewer discharge structures located along the city's bayside and ocean waterfronts. Wet-weather flows are intermittent throughout the rainy season, and combined sewer discharges vary in nature and duration depending largely on the intensity of individual rainstorms.

Lake Merced

Lake Merced, described in Section 5.6, Westside Basin Groundwater Resources, is comprised of four lake bodies (North Lake, East Lake, South Lake, and Impound lake). As the largest freshwater body in San Francisco, Lake Merced supports numerous recreational activities.

Flooding

San Francisco is not presently mapped by the Federal Emergency Management Agency (FEMA), but localized flooding does occur during periods of intense precipitation, especially in low-lying areas where storm drains become clogged with debris.

Regulatory Framework

Water Quality Regulations

The federal Clean Water Act and subsequent amendments, under the enforcement authority of the U.S. Environmental Protection Agency (U.S. EPA), was enacted "to restore and maintain the chemical, physical, and biological integrity of the Nation's waters." The Clean Water Act gave the U.S. EPA the authority to implement pollution control programs such as setting wastewater standards for industry. The act also set water quality standards for surface waters and established the National Pollutant Discharge Elimination System (NPDES) program to protect water quality. Under Section 402 of the act, discharge of pollutants to navigable waters is prohibited unless the discharge is in compliance with an NPDES permit. The U.S. EPA determined that California's water pollution control program has sufficient authority to manage the NPDES program under state law in a manner consistent with the Clean Water Act. Therefore, implementation and enforcement of the NPDES program is conducted through the California State Water Resources Control Board (SWRCB) and the nine Regional Water Quality Control Boards (RWQCBs). These agencies also implement the Waste Discharge Requirements (WDR) Program, which regulates discharges of waste to land under the California Water Code as well as discharges of waste into waters of the state that are outside federal jurisdiction, as defined under the Clean Water Act.

The RWQCBs regulate water quality under the Porter-Cologne Water Quality Control Act through the regulatory standards and objectives set forth in water quality control plans (referred to as Basin Plans) prepared for each region. The Basin Plans identify existing and potential beneficial uses and provide numerical and narrative water quality objectives to protect those uses. The San Francisco Bay RWQCB (Region #2) is responsible for protection of the beneficial uses of San Francisco Bay Area water resources, including water bodies in the Sunol Valley, Bay Division, Peninsula, and San Francisco Regions. The San Francisco Bay RWQCB adopted its Basin Plan in 1995, and most recently revised the plan in December 2006. The Central Valley RWQCB (Region#5) has regulatory authority over water bodies in the San Joaquin Region. The Central Valley RWQCB adopted its Basin Plan in 1998, and most recently revised the plan in October 2007.

Beneficial Uses

Beneficial uses serve as a basis for establishing water quality objectives and discharge prohibitions to attain the goal of achieving the highest water quality consistent with the maximum benefit to the people of the state. Beneficial uses are designated in Basin Plans for surface waters and groundwater basins, and in the case of the San Francisco Bay Basin, wetlands. **Table 4.5-1** lists the designated beneficial uses for those water bodies that could be affected by the WSIP. The beneficial uses of the water bodies generally apply to all tributaries.

Impaired Water Bodies and Total Maximum Daily Loads

In accordance with Section 303(d) of the Clean Water Act, state governments must present the U.S. EPA with a list of "impaired water bodies," defined as those water bodies that do not meet water quality standards, even after point sources of pollution have installed the minimum required levels of pollution control technology. The law requires the development of actions, known as

TABLE 4.5-1
DESIGNATED BENEFICIAL USES

Water Body	Designated Beneficial Uses
San Joaquin Region	
San Joaquin River	MUN (potential), AGR, IND, MIGR, REC-1, REC-2, WARM, SPWN, WILD
California Aqueduct	MUN, AGR, IND, REC-1, REC-2, WILD
Delta-Mendota Canal	MUN, AGR, REC-1, REC-2, WARM, WILD
Sunol Valley Region	
Alameda Creek	AGR, COLD, GWR, MIGR, REC-1, REC-2, SPWN, WARM, WILD
Arroyo Hondo	COLD, FRSH, MUN, REC-1, REC-2, SPWN, WARM, WILD
Calaveras Reservoir	COLD, MUN, REC-1 (limited), REC-2, SPWN, WARM, WILD
San Antonio Reservoir	COLD, MUN, REC-1 (limited), REC-2, SPWN, WARM, WILD
Niles Cone Groundwater	MUN, PROC, IND, AGR
Bay Division Region	
Guadalupe River	COLD, MIGR (potential), REC-1 (potential), REC-2, SPWN (potential), WARM, WILD
Santa Clara Valley Groundwater	MUN, PROC, IND, AGR (potential)
Peninsula Region	
San Mateo Creek	COLD (potential), FRSH, RARE, REC-1 (potential), REC-2 (potential), SPWN, WILD
Crystal Springs Reservoir	COLD, MUN, RARE, REC-2, SPWN, WARM, WILD
San Andreas Reservoir	COLD, MUN, RARE, REC-1 (limited), REC-2, SPWN, WARM, WILD
San Mateo Plain Groundwater	MUN, PROC, IND, AGR (potential)
San Francisco Region	
Lake Merced	COLD, MUN (potential), REC-1, REC-2, SPWN, WARM, WILD
Westside Groundwater	MUN, PROC (potential), IND (potential), AGR
San Francisco Bay	
San Francisco Bay, Lower	COMM, EST, IND, MIGR, NAV, RARE, REC-1, REC-2, SHELL, SPWN (potential), WILD
San Francisco Bay, South	COMM, EST, IND, MIGR, NAV, RARE, REC-1, REC-2, SHELL, SPWN (potential), WILD

Beneficial Uses Key:

MUN (Municipal and Domestic Supply); AGR (Agriculture); REC-1 (Body Contact Recreation); REC-2 (Noncontact Recreation); WARM (Warm Freshwater Habitat); COLD (Cold Freshwater Habitat); MIGR (Fish Migration); SPWN (Fish Spawning); WILD (Wildlife Habitat); NAV (Navigation); GWR (Groundwater Recharge); FRSH (Freshwater Replenishment); RARE (Preservation of Rare and Endangered Species); SHELL (Shellfish Harvesting); COMM (Ocean, Commercial, and Sport Fishing); EST (Estuarine Habitat); IND (Industrial Service Supply); PROC (Industrial Process).

Note: Beneficial uses for specific wetland sites affected by the WSIP facility improvement projects in the San Francisco Bay region will be determined as needed based on the process described in the San Francisco Bay Basin Plan.

total maximum daily loads (TMDLs), to improve water quality of impaired water bodies. The TMDL is the quantity of a pollutant that can be safely assimilated by a water body without violating water quality standards. The listing of a water body as impaired does not necessarily suggest that the water body cannot support the beneficial uses; rather, the intent is to identify the water body as requiring future development of a TMDL to maintain water quality and reduce the potential for future water quality degradation. NPDES permits for water discharges must take into account the pollutant from which a water body is listed as impaired. Specific requirements for the permits would be specified in the TMDL for that pollutant.

Table 4.5-2 lists the water bodies in the program area that could be affected by WSIP projects and are identified on the Section 303(d) list of impaired water bodies, indicates the planned date for TMDL completion (based on information provided by the SWRCB), and identifies the water bodies for which a TMDL has been approved.

TABLE 4.5-2
SECTION 303(D) LIST OF IMPAIRED WATER BODIES

Water Body	Pollutant	Potential Source	Status of TMDL Preparation and Approval[a]
San Joaquin Region			
San Joaquin River	Boron	Agriculture	Planned (2006)
	Chlorpyrifos	Agriculture	Approved (2005)
	DDT	Agriculture	Planned (2011)
	Diazinon	Agriculture	Approved (2005)
	Electrical conductivity	Agriculture	Planned (2006)
	Group A pesticides	Agriculture	Planned (2011)
	Mercury	Resource extraction	Planned (2020)
	Selenium	Source unknown	Approved (2002)
	Toxaphene	Source unknown	Planned (2019)
	Unknown toxicity	Agriculture	Planned (2019)
Delta Waterways (Stockton Deep Channel)	Organic enrichment/low Dissolved oxygen	Municipal point sources Urban Runoff/Storm Sewers	Approved (2005)
Sunol Valley Region			
Alameda Creek	Diazinon	Urban runoff/storm sewers	Planned (2005)
Bay Division Region			
Guadalupe River	Diazinon	Urban runoff/storm sewers	Planned (2005)
	Mercury	Mine tailings	Planned (2006)
Peninsula Region			
San Mateo Creek	Diazinon	Urban runoff/storm sewers	Planned (2005)
San Francisco Region			
Lake Merced	Low dissolved oxygen	Unknown	Planned (2019)
	pH	Unknown	Planned (2019)
San Francisco Bay (Lower and South)	Chlordane	Nonpoint source	Planned (2008)
	DDT	Nonpoint source	Planned (2008)
	Dieldrin	Nonpoint source	Planned (2008)
	Dioxin compounds	Atmospheric deposition	Planned (2019)
	Exotic species	Ballast water	Planned (2019)
	Furan compounds	Atmospheric deposition	Planned (2019)
	Mercury	Industrial point sources Municipal point sources Resource extraction Atmospheric deposition Natural sources Nonpoint source	Planned (2006)
	PCBs	Unknown nonpoint source	Planned (2006)
	PCBs (dioxin-like)	Unknown nonpoint source	Planned (2019)
	Selenium (south bay only)	Agriculture Domestic use of groundwater	Planned (2019)

[a] The date of planned TMDL completion is provided in the 303(d) lists from the SWRCB. Although the planned date of completion has been passed for many of the TMDL projects, approved TMDLs have not been completed as of February 2006.

SOURCE: SWRCB, 2006a and 2006b.

Construction in Waters of the State and of the United States

The Regional Water Quality Control Board (RWQCB) has regulatory authority over construction in waters of the United States and waters of the state, including activities in wetlands, under both the Clean Water Act and the State of California's Porter-Cologne Water Quality Control Act (California Water Code, Division 7). Under the Clean Water Act, the RWQCB has regulatory authority over actions in waters of the United States through the issuance of water quality certifications under Section 401 of the Clean Water Act, which are issued in conjunction with permits issued by the Army Corps of Engineers (Corps) under Section 404 of the Clean Water Act. When the RWQCB issues a Section 401 certification for a project, the project is also regulated under State Water Resources Control Board Order No. 2003-0017-DWQ, "General Waste Discharge Requirements for Dredge and Fill Discharges That Have Received State Water Quality Certification," which requires compliance with all conditions of the water quality certification. Activities in areas that are outside the jurisdiction of the Corps (e.g., isolated wetlands, vernal pools, or stream banks above the ordinary high water mark) are regulated by the RWQCB under the authority of the Porter-Cologne Act. Activities that lie outside of Corps jurisdiction may require the issuance of either individual or general waste discharge permits.

The California Department of Fish and Game (CDFG) has jurisdiction over any activity that could affect the bank or bed of any stream that has value to fish and wildlife. If any changes are proposed along a creek or waterway within its jurisdiction, a streambed alteration agreement would be required under California Fish and Game Code Sections 1601 and 1603. Refer to Section 4.6, Biological Resources, for additional information.

Section 401 of the Clean Water Act provides the SWRCB and the RWQCBs with the regulatory authority to waive, certify, or deny any proposed federally permitted activity that could result in a discharge to surface waters of the state. To waive or certify an activity, these agencies must find that the proposed discharge will comply with state water quality standards, including protection of beneficial uses and water quality objectives. If these agencies deny the proposed activity, the federal permit cannot be issued. This water quality certification is generally required for projects involving the discharge of dredged or fill material to wetlands or other water bodies, as described in Section 4.6, Biological Resources.

NPDES Waste Discharge Regulations

The NPDES program requires all facilities that discharge pollutants into waters of the United States to obtain a permit. The discharge permit provides two levels of control for the protection of water quality: technology-based limits and water-quality-based limits. Technology-based limits are based on the ability of dischargers in the same category to treat wastewater, while water-quality-based limits are required if technology-based limits are not sufficient to provide protection of the water body. Water-quality-based effluent limitations required to meet water quality criteria in the receiving water are based on criteria specified in the National Toxics Rule, the California Toxics Rule, and the Basin Plan. NPDES permits must also incorporate TMDL waste load allocations when they are developed.

In 1972, the NPDES regulations initially focused on municipal and industrial wastewater discharges, followed by stormwater discharge regulations, which became effective in November 1990. NPDES permits for wastewater and industrial discharges specify discharge prohibitions and effluent limitations and also include other provisions (such as monitoring and reporting programs) deemed necessary to protect water quality. In California, the SWRCB and the RWQCBs implement and enforce the NPDES program.

Municipal Stormwater Permits

Stormwater in San Joaquin, Stanislaus, Tuolumne, Alameda, Santa Clara, and San Mateo Counties is managed in accordance with an NPDES permit from the San Francisco Bay or Central Valley RWQCB. These permits contain a comprehensive plan to reduce the discharge of pollutants to the "maximum extent practicable" and mandate that participating municipalities implement an approved stormwater management plan. The stormwater programs incorporate best management practices (BMPs) that include construction controls (such as a model grading ordinance), legal and regulatory approaches (such as stormwater ordinances), public education

and industrial outreach (to encourage the reduction of pollutants at various sources), inspection activities, wet-weather monitoring, and special studies.

The RWQCBs added provision C.3 to municipal stormwater permits for Alameda, Santa Clara, and San Mateo Counties in 2003. In accordance with these updated requirements, new development and redevelopment projects are required to incorporate treatment measures and other appropriate source control and site design features to reduce the pollutant load in stormwater discharges and manage runoff flows. The required schedule for compliance is based on the size and type of project. Group 1 projects were required to comply with these requirements by February 15, 2005. This group includes previously undeveloped sites and redevelopment projects that involve the creation or replacement of one or more acre of impervious surfaces. Group 2 projects were required to comply with these requirements by August 15, 2006. These include new and redevelopment projects that involve the creation or replacement of 10,000 square feet or more of impervious surfaces.

The C.3 requirements are similar for all counties. However, local municipalities are phasing in these requirements, and specific procedures and application requirements may differ from one municipality to another. Reconstruction projects located within a public street or road right-of-way, such as some pipeline projects proposed as part of the WSIP, are exempt from the C.3 requirements where both sides of the right-of-way are developed.

San Francisco currently holds NPDES permits adopted by the RWQCB that cover the Oceanside Water Pollution Control Plant, the South East Water Pollution Control Plant, the North Point Wet Weather Facility, and all of the wet-weather facilities, including combined sewer discharges to the bay or ocean. The permits specify discharge prohibitions, dry-weather effluent limitations, wet-weather effluent performance criteria, receiving water limitations, sludge management practices, and monitoring and reporting requirements. The permits prohibit discharges from the combined sewer structures during dry weather, and require wet-weather discharges to comply with the nine minimum controls specified in the federal Combined Sewer Overflow Control Policy, including compliance with a specified number of combined sewer discharges.

Construction stormwater discharges from sites served by the combined sewer system are subject to the requirements of Article 4.1 of the San Francisco Public Works Code, which incorporates and implements the City's NPDES permit and the nine minimum controls described in the federal Combined Sewer Overflow Control Policy. The nine minimum controls include development and implementation of a pollution prevention program. At a minimum, the City requires that a project sponsor develop and implement an erosion and sediment control plan to reduce the impact of runoff from construction sites that are 0.5 acre or more in size. The City must review and approve the erosion and sediment control plan prior to implementation, and conducts periodic inspections to ensure compliance with the plan. Discharges during dewatering must also comply with Article 4.1, as supplemented by Order No. 158170.

Small areas within San Francisco, including Lake Merced, are served by separate stormwater systems that discharge without treatment of the stormwater. Discharges from these systems are regulated under the Statewide General Permit for Stormwater Discharges from Small Separate Storm Sewer Systems.

Regionwide General NPDES Permit for Discharges from Surface Water Treatment Facilities for Potable Supply

The San Francisco Bay RWQCB has issued the Regionwide General NPDES Permit for Discharges from Surface Water Treatment Facilities for Potable Supply (Order No. R2-2003-0062, NPDES General Permit No. CAG382001) to regulate the quality of discharges from water treatment plants to surface water (RWQCB, 2003). Covered discharges include filter backwash water discharge and storage/settling basin discharge; discharges from treatment unit overflow and broken waterlines within the treatment facility; leakage water; treatment unit dewatering/drainage water; treatment system flushing water during startup after facility shutdown; onsite water storage facility drainage; and excess raw water released from the treatment facility. The requirements of this general permit supersede other stormwater permitting requirements regulating discharges to the storm sewer system at a covered facility.

To obtain coverage under the general permit, the discharger must complete a notice of intent, including a description of all discharges that would be covered by the permit, water quality data for each discharge point, receiving water information, a site location map, a flow chart showing the general route taken by the effluent from intake to discharge, and a site-specific BMP plan. All dischargers must comply with the self-monitoring program required by the general permit, file annual reports in accordance with the standard provisions and reporting requirements for NPDES surface water discharge permits, and annually update the BMP plan.

If the discharger plans any modifications or maintenance at the facility that may result in a violation of effluent limitations or an alteration of discharge locations, the discharger is required to submit a schedule for approval by the RWQCB 30 days before the changes are made. The schedule must include a description of the modifications or maintenance, including the altered discharge characteristic or location(s) and its purpose; the period of the modification or maintenance; and steps taken to reduce, eliminate, and prevent occurrence of noncompliance.

General Order for Dewatering and Other Low Threat Discharges to Surface Waters

The Central Valley RWQCB has issued a General Order for Dewatering and Other Low Threat Discharges to Surface Waters (Order No. 5-00-175, NPDES No. CAG995001) to regulate the quality of discharges considered to have a low threat to water quality, including discharges from water supply systems (RWQCB, 2000). Similar to other NPDES permits, to obtain coverage under the general permit the discharger must complete a notice of intent. All dischargers must comply with specified effluent limitations and the self-monitoring program required by the general permit. Water suppliers with numerous discharge points may elect to prepare a pollution prevention plan and monitoring and reporting program rather than identify and monitor each discharge as required by the notice of intent and monitoring and reporting program.

Construction Stormwater NPDES Permit

The federal Clean Water Act prohibits discharges of stormwater from construction projects unless the discharge is in compliance with an NPDES permit. The SWRCB is the permitting authority in California and has adopted a Statewide General Permit for Stormwater Discharges Associated with Construction Activity (Construction General Permit) that encompasses one or more acres of

soil disturbance (SWRCB, 1999). Construction activity includes clearing, grading, excavation, stockpiling, and reconstruction of existing facilities involving removal or replacement.

In general, the NPDES stormwater permitting requirements for construction activities require that the landowner and/or contractor submit a notice of intent and develop and implement a storm water pollution prevention plan (SWPPP). The SWPPP includes a site map(s) showing the construction site perimeter, existing and proposed buildings, lots, roadways, stormwater collection and discharge points, general topography both before and after construction, and drainage patterns across the site. The SWPPP must also specify BMPs that will be used to protect stormwater runoff as well as the placement of those BMPs; a visual monitoring program; a chemical monitoring program for non-visible pollutants to be implemented if there is a failure of BMPs; and a sediment monitoring plan if the site discharges directly to a water body listed as an impaired water body for sediment. Measures for erosion and sediment control, construction waste handling and disposal, and post-construction erosion and sediment control must also be addressed, along with methods to eliminate or reduce non-stormwater discharges to receiving waters.

The SWRCB is in the process of reissuing the Construction General Permit and released a preliminary draft of the new permit on March 2, 2007 (SWRCB, 2007). When adopted, this permit will replace the 1999 Construction General Permit, and, as proposed, would require the permittee to implement additional minimum BMPs as well as specific analytical procedures to determine whether the BMPs implemented on a construction site are (1) preventing further impairment due to sediment in stormwaters discharged directly into waters listed as impaired for sediment or silt, and (2) preventing non-visible pollutants in stormwater discharges from construction sites from causing or contributing to exceedances of water quality objectives. In addition, all sites would be required to meet new development and redevelopment performance standards to minimize or mitigate hydromodification impacts. As proposed, the permit allows for a risk-based permitting approach and specifies water quality action levels, numeric effluent levels, and detailed management practices. Under the new permit, the SWPPP must be prepared by a qualified SWPPP developer; the SWPPP would be much more limited and would be meant to demonstrate compliance with the detailed permit requirements, with less discretion in how these requirements are met. The permit would also enable public review and hearings on permit applications.

Construction Stormwater NPDES Permit for Small Linear Projects

The SWRCB considers certain projects involving the installation of underground and overhead utilities, such as installation of infrastructure, as small linear underground/overhead projects (referred to as small LUPs). Construction activities required for these projects have a lower potential to affect water quality via runoff than traditional construction projects because the projects are typically shorter in duration and constructed within or around hard paved surfaces, thus resulting in minimal disturbed land area at the close of the construction day. To simplify the stormwater permitting process for these projects, the SWRCB has issued the Statewide LUP General Permit for small LUPs that disturb more than one acre but less than five acres of land (SWRCB, 2003a). The LUP General Permit covers projects associated with private or municipal development projects, such as those operated by the LUP owner or operator, to relocate facilities in advance of pending developments or redevelopments or to provide new facilities.

Under the LUP General Permit, the owner/operator must submit the required notices; prepare a SWPPP specifying BMPs to control and reduce discharges of pollutants associated with construction stormwater runoff into storm drains and receiving waters; eliminate or reduce non-stormwater discharges to the storm sewers and receiving waters; and monitor the construction site to ensure that all BMPs are implemented, maintained, and effective. Permit requirements, such as the notification requirements, minimum SWPPP elements, and the amount and degree of monitoring vary depending on the complexity of the small LUP.

Waste Discharge Requirements

All point-source discharges of waste to land that do not involve the discharge of pollutants to surface waters are regulated under the WDR program implemented by the RWQCBs, including groundwater produced during dewatering as well as clear water (discharges to surface water are regulated under the NDPES program described above). Under this program, a discharger must complete a report of waste discharge with the appropriate RWQCB in order to obtain waste discharge requirements. These requirements, adopted under the WDR Program, protect surface water by either prohibiting the discharge of a pollutant to waters of the U.S. or identifying requirements for discharge to surface waters that are not waters of the U.S. They protect groundwater by identifying requirements for waste containment, treatment, and control. The report of waste discharge must include: a description of the facility or activity responsible for the discharge; the location of the operation; a description of the discharge by type, quality, quantity, interval, and method of discharge; identification of the source water contributing or transporting the waste; a water flow and location map identifying all discharge points; and a statement noting whether an environmental document has been or must be prepared. Filing of a report of waste discharge requires a fee, standard forms, and supporting technical information. The RWQCB can waive filing of a report or adopt waste discharge requirements. General orders have been prepared for certain types of similar discharges.

Statewide General Waste Discharge Requirements for Discharges to Land with a Low Threat to Water Quality

The SWRCB has issued the Statewide General Waste Discharge Requirements for Discharges to Land with Low Threat to Water Quality (Order No. 2003-003-DWQ) (SWRCB, 2003b) to regulate discharges to land that are considered to have a low threat to water quality. Categories of covered discharges include wastes from the installation of borings and wells, clear water discharges, small dewatering projects, and miscellaneous discharges. In accordance with this permit, all dischargers must comply with all applicable Basin Plan provisions, including any prohibitions and water quality objectives governing the discharge. In addition, the discharge of waste may not cause the spread of groundwater contamination. Discharges must be made to land owned or controlled by the discharger, unless the discharger has a written lease or agreement with the landowner.

Similar to the NPDES program, dischargers seeking coverage under this permit must submit a notice of intent to comply with the terms and conditions of this general permit or a report of waste discharge, fees, a project map, evidence of CEQA compliance, and a discharger monitoring plan.

The plan must include a list of all pollutants believed to be present in the discharge, the approximate concentration of pollutants in the discharge, monitoring locations, monitoring frequencies, and a reporting schedule.

Discharges to land listed as a hazardous materials site are not eligible for coverage under this general permit. In addition, discharges that could have a significant impact on biological resources, cultural resources, aesthetics, or air quality, or that could significantly alter the existing drainage pattern of a discharge site or surroundings are not eligible for coverage. Other discharges not covered under this permit are those that would significantly physically divide an established community, significantly conflict with any applicable land use plan, policy, or regulation of an agency, or significantly conflict with any applicable habitat or community conservation plan.

Discharge of Chlorinated Water

Because chlorine is toxic to aquatic life in both freshwater and saltwater, the SWRCB considers that every discharger that uses chlorine has the potential to cause acute toxicity due to total residual chlorine (TRC) in freshwater and chlorine-produced oxidants (CPO) in saltwater. However, the approach to regulating residual chlorine in discharges varies between regions. To facilitate a consistent approach, the SWRCB has proposed the Total Residual Chlorine and Chlorine-Produced Oxidants Policy of California to establish TRC and CPO objectives that apply to all inland surface waters, enclosed bays, and estuaries throughout the state to protect aquatic life beneficial uses; establish consistent procedures that apply to non-stormwater NPDES permits to regulate TRC and CPO discharges; and establish a basis for equitable compliance determination to adequately enforce violations of the TRC and CPO effluent limitations in non-stormwater NPDES permits (SWRCB, 2006c). The policy will also establish monitoring and reporting requirements to demonstrate compliance with effluent limitations. If adopted, the requirements of this policy will supersede all other numeric TRC or CPO objectives and implementation provisions for TRC and CPO in existing Basin Plans.

Recycled Water

The California Water Code defines recycled water (alternatively called reclaimed water) as "water which, as a result of treatment of waste [water], is suitable for a direct beneficial use or a controlled use that would not otherwise occur." Recycled water is wastewater that has been highly purified through multiple stages of treatment to meet stringent and protective health and safety standards set by the California Department of Health Services (DHS). Federal laws provide regulation of recycled water through the Water Pollution Control Act of 1972 (also referred to as the Clean Water Act) and its related amendments. However, the State of California has primary responsibility for the development of regulations regarding the treatment and distribution of recycled water and operation of recycled water facilities. The following laws govern the use of recycled water in California:

- California Health and Safety Code (Division 104; Part 12)
- California Water Code (Division 7; Chapters 2, 6, 7, and 22)
- California Code of Regulations, Title 22 (Division 4; Chapters 1, 2, and 3)
- California Code of Regulations, Title 17 (Division 1; Chapter 5)

Recycled water laws are enforced by DHS and the San Francisco Bay RWQCB. In January 1996, the San Francisco Bay RWQCB adopted General Reuse Order 96-011 (RWQCB, 1996). This order applies to publicly owned wastewater and water agencies that are currently recycling water, or propose to do so in the future. The order authorizes domestic wastewater reuse by producers, distributors, and users throughout the region through a local agency administered program. An agency may apply for the order through the notice of intent process. General Order 96-011 replaces individual reuse orders for those agencies choosing to be included under General Order 96-011. The intent of the order is to streamline the permitting process and delegate the responsibility of administering water reuse programs to local agencies to the fullest extent possible.

In accordance with this order, the recycled water must meet DHS water quality reuse criteria, as specified in Sections 60301 through 60355 of Title 22 of the California Code of Regulations. These regulations provide specific treatment requirements as well as water quality criteria appropriate for the intended use of the recycled water. In addition, the order specifies prohibitions on the application of recycled water to ensure that this water does not enter a surface water body or otherwise degrade surface or groundwater quality. Recycled water that is treated to higher standards (i.e., advanced treatment) can be discharged to surface water bodies, including water bodies that allow body-contact water recreational activities (Section 60301.620).

An agency that produces recycled water must submit a notice of intent and technical report to both the RWQCB and DHS, including a description of the existing or proposed treatment, storage, and transmission facilities for water reuse; the types of applications for which the recycled water will be used; a description of the agency's water reuse permit program; a description of the reuse program administration specifying how the permitting system for regulating users will be implemented and how compliance with the DHS reuse criteria will be approved; and any additional site-specific information that is appropriate. The order becomes effective upon written approval of the notice of intent by the RWQCB.

The producer of recycled water must establish and enforce rules and regulations for recycled water uses that govern the design and construction of recycled water facilities and the reuse of recycled water in accordance with DHS reuse criteria. The producer must also develop a water reuse monitoring program in accordance with the self-monitoring requirements of the order, submit an annual monitoring report to the RWQCB, and conduct periodic inspections of the user's facilities and operations to monitor and assure compliance with the conditions of the producer's permit and Order 96-011.

In groundwater basins that are a significant source of drinking water, the RWQCB can require a salt management plan if there is a likely potential for salt buildup from irrigation with recycled water. In addition, the DHS is preparing Groundwater Recharge Reuse regulations for the use of recycled water for recharge of groundwater by surface spreading or subsurface injection (DHS, 2007), and a separate NPDES permit is required for use of recycled water for these purposes.

The CCSF's Reclaimed Water Ordinance, contained in Article 22 of the San Francisco Public Works Code, specifies that certain development projects of 40,000 square feet or more, and

irrigated areas of 10,000 square feet or more that are located within designated Reclaimed Water Use Areas must use recycled water for nonpotable uses unless an exemption is granted. The owner, operator, or manager of a development project or irrigation system must register with the SFPUC (part of which was formerly known as the San Francisco Water Department) and obtain a reclaimed water use certificate for the reclaimed water system, and the SFPUC may inspect any recycled water operations to ensure compliance with the Reclaimed Water Ordinance, including mandatory use of recycled water. Golden Gate Park, Lincoln Park, Lincoln Park Golf Course, San Francisco Zoo, Sunset Boulevard medians, San Francisco State University, and Harding Park, which would use recycled water under the Recycled Water Projects (SF-3), and Lake Merced, which could be supplemented with recycled water under the Local Groundwater Projects (SF-2), are all located in a Reclaimed Water Use Area.

Dam Safety Regulations

The California Water Code entrusts the regulatory Dam Safety Program to the DSOD, which regulates dams that are 25 feet or more in height or have an impounding capacity of 50 acre-feet or more.[1] The principal goal of this program is to avoid dam failure and thus prevent loss of life and destruction of property. DSOD staff makes periodic inspections of dams and reservoirs under DSOD jurisdiction for the purpose of determining their safety, and may require dam owners to perform work to safeguard life and property. Construction of any new dam or the repair or alteration of an existing dam requires DSOD approval.

The California Office of Emergency Services dam failure inundation mapping and emergency procedure program requires the preparation of inundation maps, provides for inundation map waivers, and establishes emergency procedures for the evacuation and control of populated areas below dams under the jurisdiction of the DSOD. Inundation maps are prepared by the dam owner and represent the best estimate of where water would flow if a dam failed completely and suddenly with a full reservoir; copies of the maps are sent to the city and county emergency service coordinators of affected local jurisdictions. Based on approved inundation maps or information obtained in preparation of a waiver, cities and counties with territory in the mapped inundation areas are required to adopt emergency procedures for the evacuation and control of populated areas below dams where death or personal injury could occur.

Alameda County Watercourse Protection Ordinance

Chapter 13.12 of the Alameda County General Ordinances is the Watercourse Protection Ordinance, which requires permits from the County Director of Public Works for the following activities in all unincorporated lands within Alameda County:

- Discharging into or connecting any pipe or channel to a watercourse
- Modifying the natural flow of water in a watercourse
- Development within a setback, as defined by the ordinance

[1] Small dams with a height of 6 feet or less or an impounding capacity of 15 acre-feet or less are not subject to DSOD regulations.

- Depositing or planting materials in or removing any material from a watercourse, including its banks, except as required for necessary maintenance

- Constructing, altering, enlarging, connecting to, changing, or removing any structure in a watercourse

- Placing any loose or unconsolidated material along the side of or within a watercourse or so close to the side as to cause a diversion of the flow, or to cause a probability of such material being carried away by stormwater passing through the watercourse

This ordinance does not apply to the primary watershed lands owned by the SFPUC, but does apply to private lands in the watershed.

4.5.2 Impacts

Significance Criteria

The CCSF has not formally adopted significance standards for impacts related to hydrology and water quality, but generally considers that implementation of the proposed program would have a significant hydrologic or water quality impact if it were to:

- Violate any water quality standards or waste discharge requirements (Evaluated in this section)

- Substantially deplete groundwater supplies or interfere substantially with groundwater recharge such that there would be a net deficit in aquifer volume or a lowering of the local groundwater table level (e.g., the production rate of preexisting nearby wells would drop to a level that would not support existing land uses or planned uses for which permits have been granted) (Evaluated in this section)

- Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, in a manner that would result in substantial erosion or siltation on or off the site (Evaluated in this section)

- Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, or substantially increase the rate or amount of surface runoff in a manner that would result in flooding on or off the site (Evaluated in this section)

- Create or contribute runoff water which would exceed the capacity of existing or planned stormwater drainage systems or provide substantial additional sources of polluted runoff (Evaluated in this section)

- Otherwise substantially degrade water quality (Evaluated in this section)

- Place housing within a 100-year flood hazard area as mapped on a federal Flood Hazard Boundary or Flood Insurance Rate Map or other authoritative flood hazard delineation map (Not evaluated in this section, see Appendix B)

- Place within a 100-year flood hazard area structures that would impede or redirect flood flows (Evaluated in this section)

- Expose people or structures to a significant risk of loss, injury, or death involving flooding, including flooding as a result of the failure of a levee or dam (Not evaluated in this section, see Appendix B)

- Expose people or structures to a significant risk of loss, injury, or death involving inundation by seiche, tsunami, or mudflow (Not evaluated in this section, see Appendix B)

Approach to Analysis

This program-level analysis of water quality impacts is based on a general characterization of the potential for water quality degradation and increased erosion, sedimentation, and runoff attributable to the construction and operation of WSIP facility improvement projects and legal requirements for managing these issues. Mitigation measures are provided as necessary to mitigate potential impacts that could be significant even with implementation of SFPUC construction measures and compliance with legal requirements. In general, implementation of the WSIP projects would not have direct long-term effects on the hydrology or water quality of regional and local surface waters. However, short-term construction impacts could result in erosion and sedimentation or discharge of construction-related pollutants to local water bodies, causing water quality effects. Operation of some projects could also result in the discharge of chlorinated or chloraminated water, treated stormwater, or recycled water to water bodies, causing potential water quality effects. Through compliance with existing regulations and established project procedures as well as implementation of mitigation measures specified in this section, these impacts would be less than significant.

Impact Summary by Region

Table 4.5-3 provides a summary of the WSIP facility-related impacts by region.

Construction Impacts

Impact 4.5-1: Degradation of water bodies as a result of erosion and sedimentation or a hazardous materials release during construction.

In the absence of proper controls, construction activities associated with implementation of the WSIP adjacent to and through creeks could degrade water quality. Activities involving soil disturbance, such as excavation, soil stockpiling, or grading, adjacent to or near creeks or storm drains could result in substantial erosion and sedimentation, particularly if construction were to occur during the rainy season. Where construction or trenching activities would occur along the creek banks or would cross a creek, the potential for effects to creeks would increase due to the proximity of construction activities and the limited space for the construction easement. Sedimentation to the creeks would degrade water quality and could also increase channel siltation, reduce the flood-carrying capacity, and affect associated habitats (see Section 4.6, Biological Resources, for a discussion of facility impacts on aquatic habitats). In addition, the temporary storage of diesel and use of construction equipment could accidentally release construction-related chemicals, such as oil, grease, and fuel, which could degrade water quality.

TABLE 4.5-3
POTENTIAL IMPACTS AND SIGNIFICANCE – HYDROLOGY AND WATER QUALITY

Projects	Project Number	4.5-1: Degradation of water bodies as a result of erosion and sedimentation or a hazardous materials release during construction	Impact 4.5-2: Depletion of groundwater resources	Impact 4.5-3a: Degradation of water quality due to construction dewatering discharges	Impact 4.5-3b: Degradation of water quality due to construction-related discharge of treated water	Impact 4.5-4: : Flooding and water quality impacts associated with impeding or redirecting flood flows	Impact 4.5-5: Degradation of water quality and increased flows due to discharges to surface water during operation	Impact 4.5-6: Degradation of water quality as a result of alteration of drainage patterns or an increase in impervious surfaces
San Joaquin Region								
Advanced Disinfection	SJ-1	LS	LS	LS	LS	N/A	N/A	LS
Lawrence Livermore Supply Improvements	SJ-2	LS	N/A	N/A	LS	N/A	N/A	PSM
San Joaquin Pipeline System	SJ-3	LS	LS	LS	LS	PSM	LS	LS
Rehabilitation of Existing San Joaquin Pipelines	SJ-4	LS	LS	LS	LS	PSM	N/A	LS
Tesla Portal Disinfection Station	SJ-5	LS	LS	LS	LS	N/A	N/A	LS
Sunol Valley Region								
Alameda Creek Fishery Enhancement	SV-1	LS	LS	LS	N/A	PSM	N/A	LS
Calaveras Dam Replacement	SV-2	LS	LS	LS	N/A	N/A	N/A	LS
Additional 40-mgd Treated Water Supply	SV-3	LS	N/A	N/A	LS	N/A	LS	LS
New Irvington Tunnel	SV-4	LS	PSM	LS	LS	PSM	N/A	LS
SVWTP – Treated Water Reservoirs	SV-5	LS	N/A	N/A	LS	N/A	LS	LS
San Antonio Backup Pipeline	SV-6	LS	LS	LS	LS	PSM	LS	LS
Bay Division Region								
Bay Division Pipeline Reliability Upgrade	BD-1	LS	LS	LS	LS	PSM	LS	LS
BDPL Nos. 3 and 4 Crossovers	BD-2	LS	LS	LS	LS	PSM	LS	LS
Seismic Upgrade of BDPL Nos. 3 and 4 at Hayward Fault	BD-3	LS	LS	LS	LS	N/A	N/A	LS
Peninsula Region								
Baden and San Pedro Valve Lots Improvements	PN-1	LS	LS	LS	N/A	N/A	N/A	LS
Crystal Springs/San Andreas Transmission Upgrade	PN-2	LS	LS	LS	N/A	N/A	LS	LS
HTWTP Long-Term Improvements	PN-3	LS	LS	LS	LS	N/A	LS	LS
Lower Crystal Springs Dam Improvements	PN-4	LS	LS	LS	N/A	N/A	N/A	LS
Pulgas Balancing Reservoir Rehabilitation	PN-5	LS	LS	LS	LS	N/A	LS	LS
San Francisco Region								
San Andreas Pipeline No. 3 Installation	SF-1	LS	LS	LS	LS	N/A	N/A	LS
Groundwater Projects	SF-2	LS	N/A	N/A	N/A	PSM	PSM	LS
Recycled Water Projects	SF-3	LS	LS	LS	N/A	N/A	LS	LS

LS = Less than Significant impact, no mitigation required
PSM= Potentially Significant impact, can be mitigated to less than significant
N/A = Not Applicable

All WSIP projects would be required to implement SFPUC Construction Measure #3 (onsite air and water quality measures during construction), which requires the implementation of erosion control measures. For projects located outside of San Francisco that disturb more than one acre of land, construction activities would have to comply with the applicable NPDES permit implemented by the RWQCB. For construction of WSIP pipeline projects involving disturbance of one to five acres of land, the requirements of the LUP General Permit would apply. For construction of WSIP projects involving disturbance of one or more acres of land and pipeline projects involving more than five acres of temporary land disturbance, the requirements of the NPDES Construction General Permit would apply.

In accordance with these permits, the SFPUC or its contractor(s) would submit the required notices, develop a SWPPP, and implement site-specific BMPs in accordance with the SWPPP to control and reduce discharges of sediments and pollutants associated with construction stormwater runoff into storm drains and any receiving waters. These practices would include a provision requiring the placement of drip pans underneath heavy equipment that is stored overnight to prevent leaks of hydraulic fluids, oil, grease, or fuels from reaching an adjacent waterway or stormwater collection system.

The SWPPP would also include protection measures for the temporary onsite storage of diesel fuels used during construction, including requirements for secondary containment and berming of the diesel storage area or any chemical storage areas to contain a potential release and to prevent any such release from reaching an adjacent waterway or stormwater collection system. Non-stormwater discharges to the storm sewers and receiving waters would be eliminated or reduced and monitoring would be conducted to ensure that all BMPs are implemented, maintained, and effective. The control measures would also be consistent with the appropriate local guidelines for stormwater control and policies and actions of the SFPUC's Alameda and Peninsula Watershed Management Plans (WMPs) for projects located in these watersheds.

For projects located within San Francisco, the construction contractor(s) would obtain approval from the SFPUC and would comply with all permit requirements for the control of construction-related stormwater. Subject to the requirements of Article 4.1 of the San Francisco Public Works Code, the contractor(s) would be required, at a minimum, to develop and implement an erosion and sediment control plan to reduce the impact of runoff from the construction site. The erosion and sediment control plan must be reviewed and approved by the SFPUC prior to implementation, and the SFPUC would conduct periodic inspections to ensure compliance with the erosion and sediment control plan.

For projects not subject to NPDES or Article 4.1 requirements, SFPUC Construction Measure #3 (onsite air and water quality measures during construction) would require preparation and implementation of an erosion control plan for each facility site. The plan would provide both interim and permanent erosion control measures and requirements for secondary containment and berming of the diesel storage area or any chemical storage areas to contain a potential release and to prevent any such release from reaching an adjacent waterway or stormwater collection system.

In addition, WSIP projects in the Sunol Valley Region would be located within the Alameda watershed (and subject to the Alameda WMP), while some of the WSIP projects in the Peninsula Region would be located within the Peninsula watershed (and subject to the Peninsula WMP). Since these WSIP projects would be required to implement all pertinent WMP policies and actions, this analysis assumes the following actions pertaining to erosion and sedimentation would be implemented as part of the WSIP projects. (In the actions listed below, if two numbers are listed, the first number refers to the Alameda plan, and the second number refers to the Peninsula plan):

- *Action aqu1*. Prior to undertaking or constructing any non-water dependent facility or watershed activity, conduct site-specific review in conjunction with the review process for proposed plans and projects to ensure that the facility or activity is not located within a High Water Quality Vulnerability Zone. If feasible, relocate the activity or facility to an alternative upland site. If no feasible site exists, follow BMPs as set forth in Appendix C-6 of the Watershed Management Plan and minimize stream crossings.

- *Action aqu5*. Rehabilitate shoreline areas using structural shoreline protection practices in areas where erosion and sedimentation cannot be adequately controlled by land use restrictions.

- *Action veg4*. Prior to the initiation of any construction project involving grading, a grading plan shall be prepared by the project proponent and approved by appropriate SFPUC staff. Revegetation of all graded areas shall be required to the maximum extent practicable.

- *Action veg7/veg 9*. When conducting operations, maintenance, and construction activities, follow erosion control BMPs to ensure protection of wetlands, streams, and shoreline areas. BMPs provided in Appendix C-6 of the watershed management plan to be employed in the vicinity of wetlands and riparian areas shall be coordinated with the requirements of the CDFG Streambed Alteration Agreement and Clean Water Act Section 404 permit from the Army Corps of Engineers.

- *Action veg13/veg 17*. Encourage other agencies with interest in watershed lands to minimize the disturbance of serpentine bedrock or soils to prevent the erosion of asbestos fibers into the water supply.

Pipelines and Infiltration Galleries. The installation of pipelines would generally require excavation of a trench ranging from 5 to 8 feet deep and 2 to 5 feet wide for smaller pipe diameters, to as large as 15 feet deep and 12 feet wide where trenches are shored in congested areas. In open areas where the trenches would be constructed with sloped sides, the trench could be as wide as 50 feet at the surface. Pipelines would cross creek channels using cut-and-cover or open-cut methods for seasonal creeks during the dry season only, or jack-and-bore or microtunneling methods for perennial creeks. Rehabilitation of the infiltration galleries that could be conducted for the Alameda Creek Fishery project (SV-1) could also require excavation of substantial amounts of soil adjacent to Alameda Creek.

In addition to the NPDES requirements described above, the SFPUC or its contractor(s) would be subject to an encroachment permit from the local flood control district or other appropriate local agency. They must also comply with CDFG and U.S. Army Corps of Engineers (Corps) requirements pertaining to wetlands or streambeds, including associated water quality protection requirements of the applicable RWQCB.

Tunnels. Erosion and sedimentation during tunnel construction (and the resulting potential to degrade water bodies) would primarily be an issue at tunnel entry and exit shafts or portals where construction staging occurs, including the handling and removal of excavated materials (shaft/portal and tunnel spoils), and would depend on the extent of land disturbance and proximity to nearby water bodies. Construction activities at the tunnel portals would be subject to the NPDES Construction General Permit if more than one acre of land would be disturbed. Although a tunnel may pass beneath one or more water bodies, tunneling beneath water bodies would not result in increased sedimentation or erosion.

Other Facilities. Where feasible, WSIP facilities would be sited to avoid construction across creeks or other water bodies. The area of land disturbance required for construction would vary by project, and the potential for water quality effects related to construction activities would depend on a project's proximity to nearby water bodies and the size of the disturbed area. The applicable NPDES or erosion control requirements for construction activities would depend on the size and location of the project.

San Joaquin Region

Impact 4.5-1: Degradation of water bodies as a result of erosion and sedimentation or a hazardous materials release during construction		
Advanced Disinfection	SJ-1	LS
Lawrence Livermore	SJ-2	LS
SJPL System	SJ-3	LS
SJPL Rehabilitation	SJ-4	LS
Tesla Portal Disinfection	SJ-5	LS

The Advanced Disinfection (SJ-1) and Tesla Portal Disinfection (SJ-5) projects would each disturb more than one acre of soil. These facilities are located adjacent to vegetated swales, and runoff from these sites would not directly enter a waterway. Pipeline construction associated with the SJPL System project (SJ-3) could disturb 400 or more acres of land and would cross the Delta-Mendota Aqueduct and California Aqueduct. The amount of land disturbance for the Lawrence Livermore (SJ-2) and SJPL Rehabilitation (SJ-4) projects has not been determined. However, with implementation of SFPUC Construction Measure #3 (onsite air and water quality measures during construction) and implementation of control measures in compliance with NPDES permit requirements for projects disturbing more than one acre of land, impacts related to the degradation of water bodies as a result of erosion and sedimentation during construction would be *less than significant* for all projects in this region. The SJPL System project would also be required to comply with encroachment permitting requirements and the requirements of other regulatory agencies, as described above.

Sunol Valley Region

Impact 4.5-1: Degradation of water bodies as a result of erosion and sedimentation or a hazardous materials release during construction		
Alameda Creek Fishery	SV-1	LS
Calaveras Dam	SV-2	LS
40-mgd Treated Water	SV-3	LS
New Irvington Tunnel	SV-4	LS
Treated Water Reservoirs	SV-5	LS
SABUP	SV-6	LS

Erosion and sedimentation from the Sunol Valley Region projects could affect water quality in Alameda Creek, Calaveras Creek, Arroyo Hondo, San Antonio Creek, and several unnamed drainages. The Calaveras Dam (SV-2), 40-mgd Treated Water (SV-3), New Irvington Tunnel (SV-4), and Treated Water Reservoirs (SV-5) projects would each disturb more than one acre of land, with the Calaveras Dam project disturbing over 600 acres and the New Irvington Tunnel project disturbing an estimated 120 acres. The area of disturbance has not been determined for the Alameda Creek Fishery (SV-1) and SABUP (SV-6) projects. However, with implementation of SFPUC Construction Measure #3 (onsite air and water quality measures during construction) and implementation of control measures in compliance with NPDES permit requirements for projects disturbing more than one acre of land, impacts related to the degradation of water bodies as a result of erosion and sedimentation during construction would be *less than significant* for all projects in this region. The Alameda Creek Fishery, 40-mgd Treated Water, and SABUP projects would also involve creek or stream crossings and would be required to implement control measures to comply with encroachment permitting requirements and the requirements of other regulatory agencies, as described above. Projects in this region would also be required to implement policies and actions of the Alameda WMP regarding erosion control, also described above.

Bay Division Region

Impact 4.5-1: Degradation of water bodies as a result of erosion and sedimentation or a hazardous materials release during construction		
BDPL Reliability Upgrade	BD-1	LS
BDPL 3 and 4 Crossovers	BD-2	LS
BDPL 3 and 4 Seismic Upgrade at Hayward Fault	BD-3	LS

Erosion and sedimentation from Bay Division Region projects could affect water quality in a number of water bodies. The BDPL Reliability Upgrade project (BD-1) would involve disturbance of more than 150 acres of land and would cross Newark Slough, Mission Creek, Agua Caliente Creek, Ojo de Agua Creek, and Cordilleras Creek as well as unnamed creeks, drainages, and flood control channels. The area of land disturbance has not been determined for the BDPL 3 and 4 Crossovers (BD-2) or BDPL 3 and 4 Seismic Upgrade at Hayward Fault (BD-3) projects. However, with implementation of SFPUC Construction Measure #3 (onsite air and water quality measures during construction) and implementation of control measures in compliance with NPDES permit requirements for projects disturbing more than one acre of land, impacts related to degradation of water bodies as a result of erosion and sedimentation during construction would be *less than significant* for all projects in this region. Implementation of additional control measures in compliance with encroachment permitting requirements and the requirements of other regulatory agencies, as described above, would also be required for the BDPL Reliability Upgrade project.

Peninsula Region

Impact 4.5-1: Degradation of water bodies as a result of erosion and sedimentation or a hazardous materials release during construction		
Baden and San Pedro Valve Lots	PN-1	LS
CS/SA Transmission	PN-2	LS
HTWTP Long-Term	PN-3	LS
Lower Crystal Springs Dam	PN-4	LS
Pulgas Balancing Reservoir	PN-5	LS

Construction of the Lower Crystal Springs Dam project (PN-4) would involve land disturbance of approximately six acres. The amount of land disturbance has not been determined for the CS/SA Transmission (PN-2), HTWTP Long-Term (PN-3), and Pulgas Balancing Reservoir (PN-5) projects. Valve lot improvements under the Baden and San Pedro Valve Lots project (PN-1) would likely involve land disturbance of less than one acre at each construction site. However, with implementation of SFPUC Construction Measure #3 (onsite air and water quality measures during construction) and implementation of control measures in compliance with NPDES permit requirements for projects disturbing more than one acre of land, impacts related to degradation of water bodies as a result of erosion and sedimentation during construction would be *less than significant* for all projects in this region.

The Lower Crystal Springs Dam project (PN-4) would involve work in San Mateo Creek, and the Pulgas Balancing Reservoir project (PN-5) would enlarge Pulgas Channel. Encroachment permits and implementation of control measures in compliance with the requirements of other regulatory agencies could also be required for the Lower Crystal Springs Dam and Pulgas Balancing Reservoir projects.

Because they are located in the Peninsula watershed, the CS/SA Transmission (PN-2), Lower Crystal Springs Dam (PN-4), and Pulgas Balancing Reservoir (PN-5) projects as well as portions of the Baden and San Pedro Valve Lots project (PN-1) would also be required to implement policies and actions of the Peninsula WMP regarding erosion control, as described above.

San Francisco Region

Impact 4.5-1: Degradation of water bodies as a result of erosion and sedimentation or a hazardous materials release during construction		
SAPL 3 Installation	SF-1	LS
Groundwater Projects	SF-2	LS
Recycled Water Projects	SF-3	LS

As discussed in the Setting, most creeks within San Francisco were contained in underground culverts during urbanization of the city; most of the city is served by a combined sewer system that collects both sanitary sewage and stormwater and transports this combined flow to wastewater treatment plants. Discharges to the combined sewer system are treated and discharged to the bay or ocean in compliance with the City's NPDES permit and must be in conformance with requirements of the Clean Water Act, Combined Sewer Overflow Control Policy, and the associated state requirements in San Francisco's Basin Plan.

The SAPL 3 Installation project (SF-1) would be located partially within San Francisco and San Mateo Counties. The portions of this project located in San Francisco are served by the combined sewer system. The portions of the pipelines located in San Mateo County would be

served by a separate sewer. However, with implementation of SFPUC Construction Measure #3 (onsite air and water quality measures during construction), implementation of control measures in compliance with NPDES permit requirements for those portions of the project disturbing more than one acre of land outside of San Francisco, and implementation of control measures in compliance with Article 4.1 of the San Francisco Public Works Code for those portions of the project within San Francisco, impacts related to the degradation of water bodies as a result of erosion and sedimentation during construction would be *less than significant* for the SAPL 3 Installation project.

Final locations for the Groundwater Projects (SF-2) have not been selected, but the local projects would be located in San Francisco and the regional projects would be located in San Mateo County. Final locations for the Recycled Water Projects (SF-3) have not been determined, but these projects would generally be located in San Francisco. With implementation of SFPUC Construction Measure #3 (onsite air and water quality measures during construction), implementation of control measures in compliance with NPDES permit requirements for projects disturbing more than one acre of land outside of San Francisco, and implementation of control measures in compliance with Article 4.1 of the San Francisco Public Works Code for projects within San Francisco, impacts related to the degradation of water bodies as a result of erosion and sedimentation during construction would be *less than significant* for these two projects.

Impact 4.5-2: Depletion of groundwater resources.

Construction Dewatering. Dewatering for construction of most facilities (except for tunnels, as discussed below) could temporarily affect groundwater levels in the shallow groundwater zones where WSIP facilities are located. As a result, water levels in shallow wells located near construction sites could be lowered temporarily. However, groundwater extracted from shallow sources tends to be of poor quality and unsuitable for human consumption; as a result, there would not likely be many domestic wells tapping the shallow groundwater zone near WSIP project facilities. Furthermore, any effects related to lowering the water table would be temporary. Therefore, groundwater dewatering would not be expected to substantially deplete shallow groundwater resources, and impacts related to the depletion of shallow groundwater resources are considered less than significant for all WSIP projects that would require dewatering.

Tunnels. Groundwater for domestic and other uses is commonly obtained from deeper groundwater-bearing zones that contain water of sufficient quality for the intended use. Groundwater dewatering, required for tunnel projects could affect water levels in the deeper groundwater-bearing zones by stopping or reducing the flow to springs or lowering groundwater levels in nearby wells, thus reducing the capacity of the wells or rendering them inoperable in the short or long term.

The use of a water-tight lining system and backfilling of the annular space between the pipe and the tunnel shaft would reduce the rate of groundwater infiltration and related groundwater

dewatering requirements along much of the tunnel alignment. However, greater amounts of groundwater dewatering could be required for shaft or portal construction. After tunnel construction, the shafts or portals would be backfilled, and there would be no long-term groundwater infiltration into the shafts, portals, or tunnel.

San Joaquin Region

Impact 4.5-2: Depletion of groundwater resources		
Advanced Disinfection	SJ-1	LS
Lawrence Livermore	SJ-2	N/A
SJPL System	SJ-3	LS
SJPL Rehabilitation	SJ-4	LS
Tesla Portal Disinfection	SJ-5	LS

Temporary groundwater dewatering could be required during construction of the Advanced Disinfection (SJ-1), SJPL System (SJ-3), SJPL Rehabilitation (SJ-4), and Tesla Portal Disinfection (SJ-5) projects. However, only shallow groundwater resources would be affected. Therefore, impacts related to the depletion of groundwater resources would be *less than significant* for these projects.

The Lawrence Livermore project (SJ-2) would not require construction dewatering or involve tunneling. Therefore, impacts related to the depletion of groundwater resources would *not apply* to this project.

Sunol Valley Region

Impact 4.5-2: Depletion of groundwater resources		
Alameda Creek Fishery	SV-1	LS
Calaveras Dam	SV-2	LS
40-mgd Treated Water	SV-3	N/A
New Irvington Tunnel	SV-4	PSM
Treated Water Reservoirs	SV-5	N/A
SABUP	SV-6	LS

Springs located in the vicinity of the proposed alignment of the New Irvington Tunnel project (SV-4) indicate a groundwater level of at least 683 feet (more than 300 feet above the planned elevation of the tunnel bore), so considerable hydrostatic pressure can be expected at tunnel grade, and dewatering would be required during construction of the tunnel (Water Infrastructure Partners, 2005). Dewatering for construction of the existing Irvington Tunnel in the 1930s produced an average of about 250 gallons per minute (gpm) of groundwater and maximum sustained groundwater flows of about 1,000 gpm. This dewatering stopped or decreased flows in several local springs and caused groundwater levels to fall in some nearby wells. Under the New Irvington Tunnel project, groundwater dewatering would be conducted at rates of up to 2,000 gpm over a period of two years. Although many of the 104 wells noted in the vicinity of the Irvington Tunnel in the 1930s (described in the Setting) may have since been abandoned or may no longer be in use, construction of the tunnel and associated dewatering under the New Irvington Tunnel project could stop or decrease spring flow or lower groundwater levels in nearby wells, thus reducing the capacity of the wells or rendering them inoperable.

The effects of this dewatering on nearby springs and wells cannot be estimated without conducting an inventory of the existing springs and wells within the affected groundwater zone and performing additional site-specific analysis of the area's geology and groundwater

occurrence as well as dewatering requirements for the project. Therefore, impacts related to the depletion of groundwater resources are considered *potentially significant* for the New Irvington Tunnel project (SV-4), but would likely be reduced to a less-than-significant level though implementation of site-specific analysis and identified measures (as outlined in Measure 4.5-2). These impacts would be evaluated in greater detail as part of separate, project-level CEQA review for this project.

Temporary groundwater dewatering could be required during construction of the Alameda Creek Fishery (SV-1), Calaveras Dam (SV-2), and SABUP (SV-6) projects. However, only shallow groundwater resources would be affected. Therefore, impacts related to the depletion of groundwater resources would be *less than significant* for these projects. The 40-mgd Treated Water (SV-3) and Treated Water Reservoirs (SV-5) projects would not require construction dewatering or involve tunneling. Therefore, impacts related to the depletion of groundwater resources would *not apply* to these projects.

Bay Division Region

Impact 4.5-2: Depletion of groundwater resources		
BDPL Reliability Upgrade	BD-1	LS
BDPL 3 and 4 Crossovers	BD-2	LS
BDPL 3 and 4 Seismic Upgrade at Hayward Fault	BD-3	LS

The BDPL Reliability Upgrade project (BD-1) would involve construction dewatering along the portions of the alignment where pipeline would be installed using cut-and-cover methods. However, only shallow groundwater resources would be affected. The tunnel shafts for this project would be constructed using a slurry panel wall or secant pile method, which would prevent water from entering the work shaft. Although limited dewatering could be required at the base of the Ravenswood tunnel shaft to reduce uplift, dewatering would not be allowed at the Newark tunnel shaft, where there is groundwater contamination. Therefore, impacts related to the depletion of shallow and deep groundwater resources would be *less than significant* for this project.

Both the BDPL 3 and 4 Crossovers (BD-2) and BDPL 3 and 4 Seismic Upgrade at Hayward Fault (BD-3) projects would require construction dewatering. However, only shallow groundwater resources would be affected. Therefore, impacts related to the depletion of groundwater resources would be *less than significant* for these projects.

Peninsula Region

Impact 4.5-2: Depletion of groundwater resources		
Baden and San Pedro Valve Lots	PN-1	LS
CS/SA Transmission	PN-2	LS
HTWTP Long-Term	PN-3	LS
Lower Crystal Springs Dam	PN-4	LS
Pulgas Balancing Reservoir	PN-5	LS

All of the Peninsula Region projects (Baden and San Pedro Valve Lots, PN-1; CS/SA Transmission, PN-2; HTWTP Long-Term, PN-3; Lower Crystal Springs Dam, PN-4; and Pulgas Balancing Reservoir, PN-5) could require construction dewatering. However, only shallow groundwater resources would be

affected. Therefore, impacts related to the depletion of groundwater resources would be *less than significant* for these projects.

San Francisco Region

Impact 4.5-2: Depletion of groundwater resources		
SAPL 3 Installation	SF-1	LS
Groundwater Projects	SF-2	N/A
Recycled Water Projects	SF-3	LS

Both the SAPL 3 Installation (SF-1) and Recycled Water Projects (SF-3) could require construction dewatering. However, only shallow groundwater resources would be affected. Therefore, impacts related to the depletion of groundwater resources would be *less than significant* for these projects. The Groundwater Projects (SF-2) would not require construction dewatering. Therefore, impacts related to the depletion of groundwater resources would *not apply* to this project. (Potential depletion of groundwater resources resulting from operation of the groundwater projects is addressed in Chapter 5, Section 5.6.)

Impact 4.5-3: Construction dewatering discharges to surface waters and construction-related discharges of treated water.

Dewatering would be necessary for construction of facilities where excavation is required below the groundwater table; for pipeline projects where there is a shallow groundwater table and at stream crossings; and for all tunnel projects. Water produced during construction dewatering could contain sediments and contaminants that could degrade water quality if the water were discharged directly to surface water or if it infiltrated to groundwater. Water from dewatering during tunnel construction is expected to contain sediment, oils, and grout. Water quality impacts and permitting requirements related to these discharges are discussed below and analyzed by region in Impact 4.5-3a.

Construction-related discharges of treated water would also be required for construction of some WSIP facilities. These discharges could contain chlorine or chloramines and could degrade water quality and affect aquatic organisms. Depending on the rate of discharge, either type of discharge could also result in erosion in the receiving water or cause downstream flooding. Water quality impacts and permitting requirements related to these discharges are discussed below and analyzed by region in Impact 4.5-3b.

For projects that are subject to the Construction General Permit (described in Impact 4.5-1, above), the discharges could possibly be made in accordance with this permit, provided it could be demonstrated that the water is uncontaminated. In the San Joaquin Region, the groundwater could possibly be discharged to surface water under the General Order for Dewatering and Other Low Threat Discharges to Surface Waters, as described in the Setting, although in all regions an individual NPDES permit, or waiver, might be required. In agricultural areas or other areas where the groundwater would be discharged to land, the discharges could possibly be made under the Statewide General Waste Discharge Requirements for Discharges to Land with Low Threat to Water Quality, although individual waste discharge requirements, or a waiver, could be required. If discharges were made to lands not owned, controlled, or leased by

the CCSF, then the CCSF would enter into agreements with landowners for the discharge. Discharges to a local sanitary sewer system would comply with the requirements of the local permitting agency. Other General Permits in the San Francisco Region under which dewatered groundwater may be discharged include the following General NPDES Permits:

- General NPDES Permit for VOC Cleanups (Order No. R2-2004-0055)
- General NPDES Permit for Fuel Cleanups (Order No. R2-2006-0075)
- General NPDES Permit for Groundwater Dewatering (Order No. R2-2006-0075)

Before discharging under any general permit, the SFPUC must submit a completed Notice of Intent that includes a dewatering plan with appropriate treatment and monitoring specifications. The SFPUC should also allow at least 60 days for the RWQCB review and acceptance of the Notice of Intent and dewatering plans.

For projects located in San Francisco, the construction contractor(s) would obtain approval from the SFPUC and comply with all NPDES permit requirements for the discharge of treated water to the combined sewer system, subject to the provisions of Article 4.1 of the San Francisco Public Works Code.

In accordance with the requirements of these permits or waivers, the contractor(s) would be required to implement control measures to ensure adequate quality of the discharged water, conduct the appropriate sampling to demonstrate permit compliance, and regulate flow rates to prevent erosion or downstream flooding in the receiving water. A groundwater treatment unit would be used, as needed, to comply with discharge requirements.

The contractor(s) would also be required to obtain the necessary permit from the local flood control district or any appropriate local agencies. For any discharge facilities affecting areas immediately adjacent to or within creeks and rivers, permits would be obtained from the Corps, CDFG, and RWQCB if needed. Depending on the location, the SFPUC would consult with and/or obtain approval from the U.S. Fish and Wildlife Service and/or National Marine Fisheries Service if sensitive aquatic species or habitat could be affected. If required, permits would include provisions for energy dissipation of discharges and regulation of flow rates to prevent downstream flooding.

Implementation of control measures in compliance with the permitting requirements described above would ensure that construction-related dewatering discharges would not degrade water quality or violate any water quality standards or waste discharge requirements. In addition, all WSIP projects would be required to implement SFPUC Construction Measure #4 (groundwater), which requires the preparation of a dewatering plan to ensure groundwater discharges to the storm sewer system comply with applicable local standards and discharge permit requirements.

In addition, WSIP projects in the Sunol Valley Region would be located within the Alameda watershed (and subject to the Alameda WMP), while some of the WSIP projects in the Peninsula Region would be located within the Peninsula watershed (and subject to the Peninsula WMP). Since these WSIP projects would be required to implement all pertinent watershed management

plan policies and actions, this analysis assumes the following action pertaining to dechlorination of water prior to discharge would be implemented as part of the WSIP projects:

- *Action fis6*. Identify and adopt alternative nontoxic management practices for the protection of aquatic resources in coordination with the Integrated Pest Management program. Guidelines include:

  – Dechlorinate water before it is discharged to streams and reservoirs

  – Minimize the use of copper sulfate in the treatment of algal blooms in reservoirs

  – Limit the use of chemical fire retardants and Class A foams (except protein-based foams) in or near aquatic zones

Construction dewatering and construction-related discharges of clear water are evaluated separately below.

Degradation of Water Quality Due to Construction Dewatering Discharges

San Joaquin Region

Impact 4.5-3a: Degradation of water quality due to construction dewatering discharges		
Advanced Disinfection	SJ-1	LS
Lawrence Livermore	SJ-2	N/A
SJPL System	SJ-3	LS
SJPL Rehabilitation	SJ-4	LS
Tesla Portal Disinfection	SJ-5	LS

The Advanced Disinfection (SJ-1), SJPL System (SJ-3), SJPL Rehabilitation (SJ-4), and Tesla Portal Disinfection (SJ-5) projects could involve construction dewatering, with potential discharges to a surface water body, storm sewer system, sanitary sewer system, or land. However, potential water quality impacts related to these construction discharges would be *less than significant* for all projects in this region with implementation of control measures in compliance with NPDES permitting, waste discharge requirements, or local agency permitting requirements (described above). SFPUC Construction Measure #4 (groundwater) would also require preparation of a dewatering plan for discharges to the storm sewer system.

The Lawrence Livermore project (SJ-2) would not likely involve dewatering; therefore, this impact would *not apply* to this project.

Sunol Valley Region

Impact 4.5-3a: Degradation of water quality due to construction dewatering discharges		
Alameda Creek Fishery	SV-1	LS
Calaveras Dam	SV-2	LS
40-mgd Treated Water	SV-3	N/A
New Irvington Tunnel	SV-4	LS
Treated Water Reservoirs	SV-5	N/A
SABUP	SV-6	LS

The Alameda Creek Fishery (SV-1), Calaveras Dam (SV-2), New Irvington Tunnel (SV-4), and SABUP (SV-6) projects could each involve construction dewatering, with potential discharges to a surface water body or storm sewer system. However, potential water quality impacts related to these construction discharges would be *less than significant* for all projects in this region with implementation of control measures in compliance with NPDES permitting requirements for these discharges (described above). SFPUC Construction Measure #4 (groundwater) would also require preparation of a dewatering plan for discharges to the storm sewer system.

The 40-mgd Treated Water (SV-3) and Treated Water Reservoirs (SV-5) projects would not likely involve dewatering; therefore, this impact would *not apply* to these projects.

Bay Division Region

Impact 4.5-3a: Degradation of water quality due to construction dewatering discharges		
BDPL Reliability Upgrade	BD-1	LS
BDPL 3 and 4 Crossovers	BD-2	LS
BDPL 3 and 4 Seismic Upgrade at Hayward Fault	BD-3	LS

All WSIP projects in this region (BDPL Reliability Upgrade, BD-1; BDPL 3 and 4 Crossovers, BD-2; and BDPL 3 and 4 Seismic Upgrade at Hayward Fault, BD-3) could involve construction dewatering, with potential discharges to a surface water body, storm sewer system, or sanitary sewer system. However, potential water quality impacts related to these construction discharges would be *less than significant* for all projects in this region with implementation of control measures in compliance with NPDES and local agency permitting requirements for these discharges (described above). SFPUC Construction Measure #4 (groundwater) would also require preparation of a dewatering plan for discharges to the storm sewer system.

Peninsula Region

Impact 4.5-3a: Degradation of water quality due to construction dewatering discharges		
Baden and San Pedro Valve Lots	PN-1	LS
CS/SA Transmission	PN-2	LS
HTWTP Long-Term	PN-3	LS
Lower Crystal Springs Dam	PN-4	LS
Pulgas Balancing Reservoir	PN-5	LS

All WSIP projects in this region (Baden and San Pedro Valve Lots, PN-1; CS/SA Transmission, PN-2; HTWTP Long-Term, PN-3; Lower Crystal Springs Dam, PN-4; and Pulgas Balancing Reservoir, PN-5) could involve construction dewatering, with potential discharges to a surface water body, storm sewer system, or sanitary sewer system. However, potential water quality impacts related to these construction discharges would be *less than significant* for all projects in this region with implementation of control measures in compliance with NPDES and local agency permitting requirements (described above). SFPUC Construction Measure #4 (groundwater) would also require preparation of a dewatering plan for discharges to the storm sewer system.

San Francisco Region

Impact 4.5-3a: Degradation of water quality due to construction dewatering discharges to surface water		
SAPL 3 Installation	SF-1	LS
Groundwater Projects	SF-2	N/A
Recycled Water Projects	SF-3	LS

The SAPL 3 Installation (SF-1) and Recycled Water Projects (SF-3) could involve construction dewatering, with potential discharges to a surface water body, storm sewer system, or sanitary sewer system. However, potential water quality impacts related to these construction discharges would be *less than significant* for each project with implementation of control measures in compliance with NPDES and local agency permitting requirements for those projects or portions of a project outside of San Francisco (described above), and compliance with Article 4.1 of the San Francisco Public Works Code for those projects or portions of a project within San Francisco. SFPUC Construction Measure #4 (groundwater) would also require preparation of a dewatering plan for discharges to the storm sewer system.

The Groundwater Projects (SF-2) would not likely involve dewatering; therefore, this impact would *not apply* to this project.

Degradation of Water Quality Due to Construction-Related Discharges of Treated Water

San Joaquin Region

Impact 4.5-3b: Degradation of water quality due to construction-related discharges of treated water		
Advanced Disinfection	SJ-1	LS
Lawrence Livermore	SJ-2	LS
SJPL System	SJ-3	LS
SJPL Rehabilitation	SJ-4	LS
Tesla Portal Disinfection	SJ-5	LS

Construction of the proposed crossover facilities and construction of valving and connections for the SJPL System project (SJ-3) and rehabilitation of pipelines under the SJPL Rehabilitation project (SJ-4) would require the discharge of water from the pipeline system during construction. This portion of the pipeline system contains raw water that has not been chlorinated or chloraminated; thus, dechlorination would not be required. Small discharges of chlorinated water could be required during construction of the Advanced Disinfection (SJ-1), Lawrence Livermore (SJ-2), and Tesla Portal Disinfection (SJ-5) projects. However, impacts related to construction discharges of raw and treated water from these facilities would be *less than significant* with implementation of control measures in compliance with NPDES permit or waste discharge requirements and the requirements of other regulatory agencies, as described above.

Sunol Valley Region

Impact 4.5-3b: Degradation of water quality due to construction-related discharges of treated water		
Alameda Creek Fishery	SV-1	N/A
Calaveras Dam	SV-2	N/A
40-mgd Treated Water	SV-3	LS
New Irvington Tunnel	SV-4	LS
Treated Water Reservoirs	SV-5	LS
SABUP	SV-6	LS

Small discharges of chloraminated water could be required during construction of improvements to the Sunol Valley WTP for the 40-mgd Treated Water (SV-3) and Treated Water Reservoirs (SV-5) projects. However, these discharges would be managed in compliance with the Regionwide General NPDES Permit for Discharges from Surface Water Treatment Facilities for Potable Supply, as described in the Setting. Therefore, water quality impacts related to these discharges would be *less than significant* with implementation of control measures in compliance with existing regulations.

The SABUP project (SV-6) would likely require the discharge of chloraminated water for construction of valving and connections, and the New Irvington Tunnel project (SV-4) could require dewatering of the existing tunnel. However, water quality impacts related to these construction discharges of treated water would be *less than significant* with implementation of control measures in compliance with NPDES permit requirements and the requirements of other regulatory agencies, as described above. Implementation of Alameda WMP Action fis6 regarding the discharge of chlorinated water would also be required for all projects in the Sunol Valley Region.

No construction discharges of treated water are expected with the remaining Sunol Valley Region projects (Alameda Creek Fishery, SV-1, and Calaveras Dam, SV-2). Therefore, this impact would *not apply* to these projects.

Bay Division Region

Impact 4.5-3b: Degradation of water quality due to construction-related discharges of treated water		
BDPL Reliability Upgrade	BD-1	LS
BDPL 3 and 4 Crossovers	BD-2	LS
BDPL 3 and 4 Seismic Upgrade at Hayward Fault	BD-3	LS

Construction-related discharges of chloraminated water would be required for all WSIP projects in this region (BDPL Reliability Upgrade, BD-1; BDPL 3 and 4 Crossovers, BD-2; and BDPL 3 and 4 Seismic Upgrade at Hayward Fault, BD-3). However, water quality impacts related to these construction discharges of treated water would be *less than significant* with implementation of control measures in compliance with NPDES permit requirements and the requirements of other regulatory agencies, as described above.

Peninsula Region

Impact 4.5-3b: Degradation of water quality due to construction-related discharges of treated water		
Baden and San Pedro Valve Lots	PN-1	N/A
CS/SA Transmission	PN-2	N/A
HTWTP Long-Term	PN-3	LS
Lower Crystal Springs Dam	PN-4	N/A
Pulgas Balancing Reservoir	PN-5	LS

Small discharges of chloraminated water could be required during construction of treatment plan improvements under the HTWTP Long-Term project (PN-3). However, these discharges would be managed in compliance with the Regionwide General NPDES Permit for Discharges from Surface Water Treatment Facilities for Potable Supply; therefore, water quality impacts related to these chloraminated water discharges would be *less than significant* with implementation of control measures in compliance with these regulations.

Discharges of chloraminated water could also be required for construction of the Pulgas Balancing Reservoir (PN-5) project. However, water quality impacts related to these construction discharges would be *less than significant* with implementation of control measures in compliance with NPDES permit requirements and the requirements of other regulatory agencies. Because the Pulgas Balancing Reservoir project would be located within the Peninsula watershed, implementation of Peninsula WMP Action fis6 regarding the discharge of chlorinated water would also be required.

The Baden and San Pedro Valve Lots (PN-1), CS/SA Transmission (PN-2), and Lower Crystal Springs Dam (PN-4) projects are not expected to require construction-related discharges of chloraminated water. Therefore, this impact would *not apply* to these projects.

San Francisco Region

Impact 4.5-3b: Degradation of water quality due to construction-related discharges of treated water		
SAPL 3 Installation	SF-1	LS
Groundwater Projects	SF-2	N/A
Recycled Water Projects	SF-3	N/A

Small discharges of chloraminated water could be required for the SAPL 3 Installation project (SF-1). However, water quality impacts related to these construction discharges would be *less than significant* with implementation of control measures in compliance with NPDES permit requirements and the requirements of other regulatory agencies for discharges to surface waters or separate storm sewer systems outside of San Francisco, as well as implementation of control measures in compliance with Article 4.1 of the San Francisco Municipal Code for discharges to the combined sewer system in San Francisco.

The Groundwater Projects (SF-2) and Recycled Water Projects (SF-3) are not expected to involve construction-related discharges of chlorinated or chloraminated water. Therefore, this impact would *not apply* to these projects.

Impact 4.5-4: Flooding and water quality impacts associated with impeding or redirecting flood flows.

Construction of WSIP facilities within an existing flood zone could impede or redirect flood flows.

Pipelines and Tunnels. Pipelines and tunnels would be constructed beneath the land surface and therefore would not impede or redirect flood flows once constructed. However, construction activities within FEMA-designated 100-year flood zones could impede flood flows or cause the discharge of sediments and pollutants to flood flows if a flood occurred during construction. Hazardous materials and debris could also be released into flood flows if construction diesel tanks, hazardous materials, or other construction materials were stored in a flood zone. Associated structures would be designed to withstand flood flows and pass the floodwaters without significant impedance or erosion.

Dams. Dams constructed within a creek could increase flooding impacts if located in a flood zone or could cause flooding if located in an area not already subject to flooding. The degree of impact would depend on the design, placement, and operation of the dam.

Other Facilities. Except for groundwater wells proposed under the Alameda Creek Fishery project (SV-1) and proposed crossover facilities located at Barron Creek and Guadalupe River under the BDPL 3 and 4 Crossovers project (BD-2), discussed below under the Bay Division Region projects, no other facilities would be constructed within 100-year flood zones; therefore, flooding impacts are not applicable to these facilities. Outlet structures for crossover facilities could include construction of permanent facilities within a stream channel, which could potentially impede or redirect stream flows and contribute to flooding. However, compliance with

permitting requirements would ensure that these facilities are designed such that they do not impede or redirect stream flows.

San Joaquin Region

Impact 4.5-4: Flooding and water quality impacts associated with impeding or redirecting flood flows		
Advanced Disinfection	SJ-1	N/A
Lawrence Livermore	SJ-2	N/A
SJPL System	SJ-3	PSM
SJPL Rehabilitation	SJ-4	PSM
Tesla Portal Disinfection	SJ-5	N/A

As discussed in the Setting, the existing San Joaquin Pipelines cross an approximate 3.6-mile-wide section of the 100-year flood zone of the San Joaquin River. None of the new pipeline segments proposed under the SJPL System project (SJ-3) would be located within this flood zone, although the western crossover facility with an aboveground power supply could potentially be located within this zone. Power supply facilities for the SJPL System project would be designed to withstand flood flows and pass the floodwaters without substantial impedance or erosion. Although this facility would not redirect or impede flood flows, impacts related to flooding are considered *potentially significant* for this project, because construction of this facility could still contribute sediment or contaminants to flood flows. Rehabilitation activities under the SJPL Rehabilitation project (SJ-4) could occur anywhere along the existing San Joaquin Pipelines, including within the flood zone. Therefore, impacts related to the diversion of flood flows or contribution of sediment or contaminants to flood flows during construction are also considered *potentially significant* for this project. However, incorporation and implementation of flood flow protection measures (Measure 4.5-4a) in the erosion control measures or SWPPP prepared for the SJPL System and SJPL Rehabilitation projects would reduce this impact to a less-than-significant level.

None of the components of other San Joaquin Region projects (Advanced Disinfection, SJ-1; Lawrence Livermore, SJ-2; and Tesla Portal Disinfection, SJ-5) would be located within a 100-year floodplain. Therefore, flooding impacts would *not apply* to these projects.

Sunol Valley Region

Impact 4.5-4: Flooding and water quality impacts associated with impeding or redirecting flood flows		
Alameda Creek Fishery	SV-1	PSM
Calaveras Dam	SV-2	N/A
40-mgd Treated Water	SV-3	N/A
New Irvington Tunnel	SV-4	PSM
Treated Water Reservoirs	SV-5	N/A
SABUP	SV-6	PSM

The Alameda Creek Fishery project (SV-1) could construct new facilities such as groundwater extraction wells, pipelines, or pump stations within the 100-year floodplain of Alameda Creek. The SABUP project (SV-6) would install a new outfall energy dissipation structure within this flood zone (FEMA, 1981). Any groundwater extraction wells constructed under the Alameda Creek Fishery project would be located primarily below ground with, at most, small aboveground structures. The SABUP project would construct an outfall energy dissipation structure within the channel of Alameda Creek and a new outfall structure in San Antonio Creek, but these structures would be designed so they do not substantially impede flow in the creek. Although these structures would not

substantially impede flood flows, impacts related to flooding are considered *potentially significant* for these projects, because construction activities could contribute sediment or contaminants to flood flows. However, incorporation and implementation of flood flow protection measures (Measure 4.5-4a) in the SWPPP prepared for these projects would reduce this impact to a less-than-significant level.

It is possible that a diversion dam or concrete weir could be constructed under the Alameda Creek Fishery project (SV-1). If the diversion dam or weir were located south of the Alameda Siphons, it would be outside of the 100-year floodplain of Alameda Creek. However, if the diversion dam or weir were located north of the Alameda Siphons, it could be constructed within the flood zone. In addition, small earthen dams could be constructed within the 100-year flood zone of Alameda Creek during high stream flows if infiltration galleries are used as part of this project. If located outside of the flood zone, these structures could alter the drainage of surface flows in Alameda Creek, causing flooding or siltation. If located within the flood zone, the dams could exacerbate flooding issues and also contribute to siltation. These effects cannot be estimated without information on stream flows as well as the planned operation of the project. Therefore, impacts related to the impedance or redirection of flood flows would be *potentially significant* for this project. However, implementation of a site-specific flooding analysis and identified measures (Measure 4.5-4b) would be expected to reduce this impact to a less-than-significant level.

Although the primary components of the New Irvington Tunnel project (SV-4) are outside the 100-year floodplain, the proposed permanent access road and bridges, as well as the spoils area, under this project might require placement of fill in the 100-year floodplain area. The potential flooding impacts would be *potentially significant* for this project. However, implementation of flood flow protection measures (Measure 4.5-4a) and a site-specific flooding analysis and identified measures (Measure 4.5-4b) would be expected to reduce this impact to a less-than-significant level.

The Calaveras Dam (SV-2), 40-mgd Treated Water (SV-3), and Treated Water Reservoirs (SV-5) projects would not be located within a mapped 100-year floodplain. Therefore, flooding impacts would *not apply* to these projects.

Bay Division Region

Impact 4.5-4: Flooding and water quality impacts associated with impeding or redirecting flood flows		
BDPL Reliability Upgrade	BD-1	PSM
BDPL 3 and 4 Crossovers	BD-2	PSM
BDPL 3 and 4 Seismic Upgrade at Hayward Fault	BD-3	N/A

The BDPL Reliability Upgrade project (BD-1) would cross 100-year floodplains and areas designated as Zone B[2] (associated with Mission Creek and Lake Elizabeth) and would pass beneath several flood control channels on the east side of San Francisco Bay (FEMA, 1983, 2000a). Flood flows are expected to be contained within each flood control channel. On

[2] Zone B is an area between the limits of the 100-year flood and the 500-year flood; or certain areas subject to 100-year flooding with average depths less than 1 foot or where the contributing drainage area is less than one square mile; or areas protected by levees from the base flood.

the west side of the bay, much of the alignment between the intersection of Ivy and Hollyburne Avenues and the Ravenswood Valve House is located within a broad 100-year flood zone associated with the west bay margin (FEMA, 1999a, 1999b, 1999c, 1999e). The west tunnel shaft would be constructed within this zone. The alignment would also cross a 100-year flood zone at the Bayshore Freeway (FEMA, 1999c) and the 500-year floodplains of Redwood Creek and Jefferson Creek (FEMA, 1982). Facilities constructed within these flood zones would be designed to withstand flood flows and pass the floodwaters without substantial impedance or erosion.

The Barron Creek crossover facility associated with the BDPL 3 and 4 Crossovers project (BD-2) could be located within or near a small 100-year floodplain associated with Barron Creek (FEMA, 1999d). In addition, the existing Bay Division Pipelines Nos. 3 and 4 cross a broad 100-year floodplain between Coyote Creek and the Guadalupe River (FEMA, 1988). The floodplain is located entirely to the east of the river. If the Guadalupe River crossover facility associated with this project were located to the east of the river, it would be located within the 100-year floodplain. If it were located to the west of the river, it would be located in Zone B, where flooding impacts would be less than significant. Outlet structures constructed at each crossover facility under the BDPL 3 and 4 Crossovers project would be designed so they do not substantially impede flood flows in a creek or redirect flood flows.

Even though BDPL Reliability Upgrade (BD-1) and BDPL 3 and 4 Crossovers (BD-2) facilities that would be located within identified 100-year floodplains would be designed so they do not substantially impede flood flows, impacts related to flooding are considered *potentially significant* for these projects, because construction activities could contribute sediment or contaminants to flood flows. However, incorporation and implementation of flood flow protection measures (Measure 4.5-4a) in the SWPPP prepared for these projects would reduce this impact to a less-than-significant level.

The Bear Gulch crossover facility constructed under the BDPL 3 and 4 Crossovers project (BD-2) and the BDPL 3 and 4 Seismic Upgrade at Hayward Fault project (BD-3) would not be located within a 100-year flood zone. Therefore, impacts related to the diversion of flood flows and contribution of sediments and contaminants to flood flows would *not apply* to the Bear Gulch crossover facility (under BD-2) or to the BDPL 3 and 4 Seismic Upgrade at Hayward Fault project.

Peninsula Region

Impact 4.5-4: Flooding and water quality impacts associated with impeding or redirecting flood flows		
Baden and San Pedro Valve Lots	PN-1	N/A
CS/SA Transmission	PN-2	N/A
HTWTP Long-Term	PN-3	N/A
Lower Crystal Springs Dam	PN-4	N/A
Pulgas Balancing Reservoir	PN-5	N/A

The Baden Valve Lot (under PN-1) and the CS/SA Transmission (PN-2), HTWTP Long-Term (PN-3), Lower Crystal Springs Dam (PN-4), and Pulgas Balancing Reservoir (PN-5) projects are not located within a 100-year floodplain. FEMA maps do not cover Daly City, where the San Pedro Valve Lot (under PN-1) is located. However, none of these sites is near a surface water feature and would not likely be subject to flooding. Therefore, flooding impacts would *not apply* to projects in this region.

San Francisco Region

Impact 4.5-4: Flooding and water quality impacts associated with impeding or redirecting flood flows		
SAPL 3 Installation	SF-1	N/A
Groundwater Projects	SF-2	PSM
Recycled Water Projects	SF-3	N/A

San Francisco is not presently mapped by FEMA, but localized flooding does occur during periods of intense precipitation, especially in low-lying areas where storm drains become clogged with debris. Because major flooding would not be expected in San Francisco, flooding impacts are not applicable to San Francisco Region projects within San Francisco. In addition, FEMA has not produced flood maps for Daly City, where the southern portion of the SAPL 3 Installation project (SF-1) would be located. Therefore, impacts related to the diversion of flood flows or contribution of sediment or contaminants to flood flows during construction would *not apply* to the SAPL 3 Installation which is located in San Francisco and Daly City and Recycled Water Projects (SF-3) which is located in San Francisco.

Some facilities under the Groundwater Projects (SF-2) would be constructed in San Mateo County, but their locations have not been determined. These facilities would be designed so they do not substantially impede flood flows, but if the facilities were constructed in a flood zone, impacts related to flooding would be *potentially significant* for these facilities, because construction activities could contribute sediment or contaminants to flood flows. However, incorporation and implementation of flood flow protection measures (Measure 4.5-4a) in the SWPPP prepared for this project would reduce this impact to a less-than-significant level.

Operational Impacts

Impact 4.5-5: Degradation of water quality and increased flows due to discharges to surface water during operation.

Various facilities would require the discharge of treated water to local surface waters during operation of proposed improvements, resulting in potential impacts related to water quality, aquatic organisms, and/or downstream flooding. Chemicals present in treated (chlorinated or chloraminated) water could affect aquatic organisms, as could temperature differences between the discharge and receiving waters. In addition, depending on the volume, timing, and location of the discharge, discharges could result in increased flows and related increases in erosion in surface waters and downstream flooding. Nutrients present in recycled water or treated stormwater could also cause eutrophication[3] of Lake Merced. The potential water quality effects, the types of discharges that would occur from each facility type, and the expected operational discharges within each region are described below.

[3] Eutrophication is the over-enrichment of a water body with nutrients, resulting in the excessive growth of organisms and depletion of dissolved oxygen.

Water Quality Effects of Discharges

Toxicity Effects. While both chlorine and chloramine are effective disinfectants for potable water, the discharge of chlorinated and chloraminated water into natural waters can be detrimental due to the toxicity of chlorine, ammonia, and chloramine to aquatic organisms. Chlorine residuals (both free and combined) are acutely toxic to aquatic organisms at low concentrations and are persistent due to their stability. The San Francisco Bay Basin Plan standard for residual chlorine is 0.0 milligrams per liter and the Central Valley Region General Order for Dewatering and Other Low Threat Discharges to Surface Waters standard for residual chlorine is 0.02 milligrams per liter; thus, dechlorination of any discharges would be required in order to remove all residual chlorine prior to discharge to surface waters, and to assure compliance with RWQCB requirements. There would be a potential for discharges of chlorinated water during operation of WSIP projects located downstream of chlorination (Tesla Disinfection Facility) and chloramination (Alameda Disinfection Facility) processes in the regional system.

Ammonia, which is contained in chloraminated water, exists in two forms in water: un-ionized and ionized. The un-ionized form of ammonia is toxic, while the ionized form is relatively harmless. In the temperature and pH range of natural waters, ammonia exists predominately in its nontoxic form. In general, ammonia in chloraminated discharges would be diluted or degraded to a nontoxic form fairly rapidly. Therefore, the potential for ammonia toxicity as a result of chloraminated water discharges would be less than significant.

Chloramine is regulated in the Basin Plan as a form of chlorine. Like chlorine and ammonia, chloramine is toxic to aquatic life due to its reactive nature. In general, removal of the chlorine portion of chloramine is required to eliminate toxicity before water is discharged to surface waters. Dechlorination of discharges would therefore reduce potential impacts on surface water quality and aquatic organisms to a less-than-significant level.

Temperature Effects. The sensitivity of aquatic organisms to water temperature depends on numerous factors, including the species, the stage in its life cycle, and the surrounding conditions. In particular, discharges to surface waters during the dry, summer months can result in thermal shock to aquatic organisms when a large volume of cool water enters a natural stream with relatively warm water.

Eutrophication. Increased aquatic plant growth (such as an increase in algae), known as eutrophication, can result from the addition of nutrients to a water body. Although algal blooms usually pose no direct health effects for humans, some species of algae flourish in highly eutrophic waters and can develop noxious blooms that cause offensive tastes and odors. Excessive algal growth may also deplete dissolved oxygen and cause toxic conditions for fish.

Erosional and Flooding Effects. Depending on such factors as the location, timing, and volume, discharges could result in erosional effects on surface water bodies and increase the potential for downstream flooding. Effects could include scouring of banks or vegetation, particularly in smaller creeks. In general, the larger watercourses and static water bodies would be less sensitive to discharges. Sites with stabilized banks and channels would also be less sensitive than natural banks and channels. Where large volumes of water would be discharged to creeks, the installation of

energy dissipation structures and stream bank improvements would minimize scouring, and flows would be regulated to prevent downstream flooding. Energy dissipation structures could be permanently placed in the stream channel, or could be temporarily placed when dewatering occurs.

For any discharge facilities affecting areas immediately adjacent to or within creeks and rivers, permits would likely be required from the Corps, CDFG, and RWQCB; and, depending on the location, consultation/approval with the U.S. Fish and Wildlife Service and/or National Marine Fisheries Service could be necessary if sensitive species or habitat would be affected. If required, permits would include provisions for energy dissipation of discharges and regulation of discharge rates to prevent downstream flooding.

General Discussion of Discharges During Operation

Water Treatment Facilities. During operation, water treatment facilities would be expected to require miscellaneous discharges related to maintenance or emergencies at the facility. These discharges would be dechlorinated or dechloraminated and would occur at a rate that would not cause erosion or downstream flooding. Within the jurisdiction of the San Francisco Bay RWQCB, these discharges would be subject to the Regionwide General NPDES Permit for Discharges from Surface Water Treatment Facilities for Potable Supply, and within the jurisdiction of the Central Valley RWQCB, these discharges would be subject to the General Order for Dewatering and Other Low Threat Discharges to Surface Waters. These permits (described in the Setting) would include provisions to protect water quality and aquatic organisms.

Crossover Facilities and Pipelines. Crossover facilities consist of valves and related equipment that enable operators to isolate and shut down discrete segments of pipelines along the regional system, either for maintenance or emergencies. In either event, shutting down a segment of pipeline could require draining that portion of the pipeline to a local surface water body. This discharge could be treated or raw water of various volumes. Discharges from crossover facilities and pipelines could result in toxicity, temperature, and erosional effects; however, as described above, discharges would be dechlorinated or dechloraminated and would occur at a rate that would not cause erosion or downstream flooding.

In areas under jurisdiction of the Central Valley RWQCB, these discharges could possibly be discharged to surface water under the General Order for Dewatering and Other Low Threat Discharges to Surface Waters, although in all regions, an individual NPDES permit, or waiver, might be required. In agricultural areas or other areas where the water would be discharged to land, the discharges could possibly be made under the Statewide General Waste Discharge Requirements for Discharges to Land with Low Threat to Water Quality, although individual waste discharge requirements, or a waiver, could be required. If discharges were made to lands not owned, controlled, or leased by the CCSF, the CCSF would enter into agreements with landowners for the discharge. Compliance with Corps and CDFG requirements could also be required for these discharges. Permit requirements for any discharges to surface water bodies would include provisions to protect water quality and aquatic organisms.

For projects located in San Francisco, the construction contractor(s) would obtain approval from the SFPUC and comply with all permit requirements for the discharge of treated water to the combined sewer system, subject to the provisions of Article 4.1 of the San Francisco Public Works Code.

Other Facilities. Routine and non-routine discharges of treated water from tunnels, vaults, valve lots, and pump stations would not be required during operation of these facilities.

Use of Recycled Water for Irrigation. The SFPUC would produce and distribute recycled water in San Francisco in compliance with the RWQCB General Water Reuse Order described in the Setting. All recycled water for irrigation purposes would be treated to disinfected tertiary standards specified in Title 22 of the California Code of Regulations, and recycled water would be applied in a manner that is protective of surface and groundwater quality. In addition, the recycled water "users" would comply with San Francisco's Reclaimed Water Ordinance and would be required to obtain a reclaimed water use certificate from the SFPUC in accordance with the ordinance (also described in the Setting). Adherence to these regulatory requirements would ensure that high-quality recycled water is consistently produced, monitored, and carefully applied, and that public health and surface and groundwater quality are protected.

Because recycled water typically has elevated levels of salts (as measured by total dissolved solids, or TDS), the infiltration of recycled water used in irrigation could cause salts to accumulate in the groundwater. However, the potential for salt buildup would be low in San Francisco, since the recycled water would be derived from high-quality SFPUC system water originating primarily from Hetch Hetchy Reservoir. Because SFPUC system water (which is the source of the recycled wastewater) is naturally very low in TDS, the recycled water is also expected to be low in TDS. The RWQCB may determine that irrigation with recycled water could result in salt buildup in the groundwater and may require preparation of a salt management plan in accordance with the General Water Reuse Order.

Lake Augmentation. Augmentation of water levels in Lake Merced using SFPUC system water, recycled water, or treated stormwater could potentially degrade Lake Merced water quality as well as groundwater quality in the shallow groundwater aquifer (the relationship of Lake Merced and the shallow groundwater aquifer is discussed in Section 5.6). Mechanisms that could affect water quality include: eutrophication of surface water resulting from the addition of nutrients in recycled water or stormwater; introduction of chlorine or chloramines in SFPUC system water or recycled water to surface or groundwater, resulting in the toxicity effects noted above; and degradation of surface or groundwater quality by contaminants that could be present in stormwater.

Degradation of Lake Merced water quality could affect the lake's beneficial uses, including cold and warm freshwater habitat, wildlife habitat, fish spawning, and recreational purposes as well as its potential use as an emergency water supply. Degradation of groundwater quality could affect use of the North Westside Groundwater Basin (described in Section 5.6) as a municipal water supply. However, use of any water to augment Lake Merced water levels would be subject to an NPDES permit, which would establish water quality goals and criteria that are protective of the lake's beneficial uses.

Watershed Management Plan Actions

In addition, WSIP projects in the Sunol Valley Region would be located within the Alameda watershed (and subject to the Alameda WMP), while some of the WSIP projects in the Peninsula Region would be located within the Peninsula watershed (and subject to the Peninsula WMP). Since these WSIP projects would be required to follow all pertinent watershed management plan policies and actions, this analysis assumes the following action pertaining to the dechlorination of water prior to discharge would be implemented as part of the WSIP projects.

- *Action fis6.* Identify and adopt alternative nontoxic management practices for the protection of aquatic resources in coordination with the Integrated Pest Management program. Guidelines include:
  - Minimize the use of copper sulfate in the treatment of algal blooms in reservoirs
  - Dechlorinate water before it is discharged to streams and reservoirs
  - Limit the use of chemical fire retardants and Class A foams (except protein-based foams) in or near aquatic zones

San Joaquin Region

Impact 4.5-5: Degradation of water quality and increased flows due to discharges to surface water during operation		
Advanced Disinfection	SJ-1	N/A
Lawrence Livermore	SJ-2	N/A
SJPL System	SJ-3	LS
SJPL Rehabilitation	SJ-4	N/A
Tesla Portal Disinfection	SJ-5	N/A

Operation of the SJPL System project (SJ-3) could result in minor discharges of raw water from the crossover facilities for pipeline maintenance or repairs. However, water quality impacts related to these discharges during operation would be *less than significant* with implementation of control measures in compliance with NPDES permit or waste discharge requirements and the requirements of other regulatory agencies, as described above.

No new discharges would be expected during operation of the Advanced Disinfection (SJ-1), SJPL Rehabilitation (SJ-4), and Tesla Portal Disinfection (SJ-5) projects, and discharges would not be expected during operation of the Lawrence Livermore project (SJ-2). Therefore, this impact would *not apply* to these projects.

Sunol Valley Region

Impact 4.5-5: Degradation of water quality and increased flows due to discharges to surface water during operation		
Alameda Creek Fishery	SV-1	N/A
Calaveras Dam	SV-2	N/A
40-mgd Treated Water	SV-3	LS
New Irvington Tunnel	SV-4	N/A
Treated Water Reservoirs	SV-5	LS
SABUP	SV-6	LS

The 40-mgd Treated Water (SV-3) and Treated Water Reservoirs (SV-5) projects at the Sunol Valley WTP would not likely result in new discharges of chloraminated water during operation, although intermittent discharges could be required for maintenance. Water quality impacts related to these intermittent discharges would be *less than significant* with implementation of control measures in compliance with the Regionwide General NPDES Permit for Discharges from Surface Water Treatment Facilities for Potable Supply.

Under the SABUP project (SV-6), chloraminated water would be dechlorinated using the existing dechlorination train and discharged to San Antonio Creek using the San Antonio Pipeline. Under this project, new discharge facilities consisting of a cone valve and stilling basin would be installed as energy dissipation devices to reduce erosion in San Antonio Creek, and the creekbeds at the discharge point would be armored to prevent scouring. Vent overflows from the Alameda East Portal would also be discharged to Alameda Creek and would be dechlorinated using the existing chlorination trains. An energy dissipation structure and creekbed armoring would be installed at the point of discharge to prevent erosion of Alameda Creek. Water quality impacts related to these discharges would be *less than significant* with implementation of control measures in compliance with NPDES permit requirements and the requirements of other regulatory agencies, as described above.

The SFPUC would also implement Alameda WMP Action fis6, as described above, as it applies to discharges from the 40-mgd Treated Water (SV-3), Treated Water Reservoirs (SV-5), and SABUP (SV-6) projects.

No discharges of treated water would be expected during operation of the remaining Sunol Valley Region projects (Alameda Creek Fishery, SV-1; Calaveras Dam SV-2; and New Irvington Tunnel, SV-4). Therefore, this impact would *not apply* to these projects.

Bay Division Region

Impact 4.5-5: Degradation of water quality and increased flows due to discharges to surface water during operation		
BDPL Reliability Upgrade	BD-1	LS
BDPL 3 and 4 Crossovers	BD-2	LS
BDPL 3 and 4 Seismic Upgrade at Hayward Fault	BD-3	N/A

Infrequent discharges of chloraminated water would be required for maintenance during operation of the BDPL Reliability Upgrade (BD-1) and BDPL 3 and 4 Crossovers (BD-2) projects. However, water quality impacts related to these discharges would be *less than significant* with implementation of control measures in compliance with NPDES permit requirements and the requirements of other regulatory agencies, as described above.

No discharges of treated water would be associated with operation the BDPL 3 and 4 Seismic Upgrade at Hayward Fault project (BD-3). Therefore, this impact would *not apply* to this project.

Peninsula Region

Impact 4.5-5: Degradation of water quality and increased flows due to discharges to surface water during operation		
Baden and San Pedro Valve Lots	PN-1	N/A
CS/SA Transmission	PN-2	LS
HTWTP Long-Term	PN-3	LS
Lower Crystal Springs Dam	PN-4	N/A
Pulgas Balancing Reservoir	PN-5	LS

The HTWTP Long-Term project (PN-3) would not likely result in new discharges of chloraminated water during operation, although intermittent discharges could be required for maintenance. However, water quality impacts related to these discharges would be *less than significant* with implementation of control measures in

compliance with the Regionwide General NPDES Permit for Discharges from Surface Water Treatment Facilities for Potable Supply.

Current discharges of treated water at Pulgas Balancing Reservoir occur in accordance with a permit from the RWQCB, and these discharges would continue following implementation of proposed improvements at this reservoir under PN-5. These discharges flow down an unnamed drainage south of the Pulgas Water Temple public parking lot and eventually flow to Upper Crystal Springs Reservoir. Proposed improvements under the Pulgas Balancing Reservoir project would include modifications to the dechlorination system so that treated discharges would be reliably dechlorinated prior to flowing to Crystal Springs Reservoir. With construction of these improvements and implementation of control measures in compliance with NPDES and other agency permitting requirements, water quality impacts associated with this discharge would be *less than significant*. Operational discharges of treated water could also occur as a result of construction of the CS/SA Transmission project (PN-2); however, water quality impacts associated with these discharges would be *less than significant* with compliance with NPDES discharge requirements and the requirements of other regulatory agencies, as described above. The SFPUC would also implement Peninsula WMP Action fis6 as it applies to these discharges.

The Baden and San Pedro Valve Lots (PN-1) and Lower Crystal Springs Dam (PN-4) projects would not result in discharges of treated water during operation. Therefore, this impact would *not apply* to these projects.

San Francisco Region

Impact 4.5-5: Degradation of water quality and increased flows due to discharges to surface water during operation		
SAPL 3 Installation	SF-1	N/A
Groundwater Projects	SF-2	PSM
Recycled Water Projects	SF-3	LS

Augmentation of Lake Merced. Under the Local Groundwater Projects (SF-2), SFPUC system water, treated stormwater, or recycled water would be added to Lake Merced to augment lake levels (restoration of lake levels and potential effects on groundwater resources are discussed in Section 5.6). If recycled water were used, it would be produced under the Recycled Water Projects (SF-3). Addition of SFPUC system water, treated stormwater, or recycled water could degrade water quality in Lake Merced, potentially causing eutrophication or otherwise affecting beneficial uses of the lake. Degradation of shallow groundwater quality could also occur, because the lake recharges the shallow groundwater system, as discussed in Section 5.6.

Although water added to Lake Merced to maintain water levels would be dechlorinated to meet Basin Plan standards and would be conducted under an NPDES permit from the RWQCB, studies in support of the Recycled Water Projects (SF-3) have shown that it may also be necessary to remove nutrients from the recycled water to avoid eutrophication of Lake Merced (RMC, 2006). Because advanced treatment is proposed under the Recycled Water Projects, impacts related to eutrophication of Lake Merced would be less than significant if recycled water were used to augment water levels. However, because of the potential for nutrients in treated stormwater, eutrophication could occur if stormwater were used to augment Lake Merced water levels.

Eutrophication would result in an increase algal growth in the lake, potentially lowering dissolved oxygen levels in the lake and affecting aquatic organisms.

The use of treated stormwater for groundwater recharge could affect groundwater quality if the bacterial standards for the source water were less stringent than those for drinking water. Therefore, water quality impacts related to the addition of treated stormwater to Lake Merced are considered *potentially significant* for the Groundwater Projects (SF-2), but would be reduced to a less-than-significant level with treatment to remove nutrients from stormwater and implementation of groundwater monitoring in the vicinity of Lake Merced (specified in Measure 4.5-5). Requirements for treatment are determined on a case-by-case basis and would be identified during separate, project-level CEQA review for the Local Groundwater Projects.

Ocean Outfall Discharges. If it became necessary to implement advanced tertiary treatment of wastewater under the Recycled Water Projects (SF-3) to avoid adverse water quality effects of recycled water use in Lake Merced, the treatment process could require discharges of reverse-osmosis concentrate, likely through the ocean outfall. Discharges from this outfall are regulated under the City of San Francisco's NPDES permit for the Oceanside Water Pollution Control Plant, and this permit would be modified as necessary to cover discharges of reverse-osmosis concentrate. With implementation of control measures in compliance with NPDES permitting requirements, water quality impacts related to this discharge would be *less than significant*.

Discharges to Surface Waters or Sewer Systems. Incidental discharges of chlorinated water to surface waters, a separate storm sewer system, or the combined sewer system could be required for maintenance purposes during operation of the Recycled Water Projects (SF-3). However, if any treated water were discharged directly to surface water or a separate storm sewer system as part of project operations, these discharges would need to comply with NPDES permit requirements and the requirements of other regulatory agencies, as described above. Discharges to the combined sewer system would need to comply with Article 4.1 of the San Francisco Public Works Code. With implementation of control measures in compliance with these regulatory requirements, water quality impacts associated with these maintenance discharges to surface water, the combined sewer, or a separate storm sewer system would be *less than significant*.

Irrigation Uses of Recycled Water. The Recycled Water Projects (SF-3) would include development of projects to provide recycled water treated to a disinfected tertiary level for irrigation at Golden Gate Park, Lincoln Park, Lincoln Park Golf Course, San Francisco Zoo, Sunset Boulevard medians, and San Francisco State University. The potential for the accumulation of salts in the groundwater would be low in San Francisco, because the recycled water would be derived from high-quality SFPUC system water originating primarily from the Hetch Hetchy Reservoir, which is naturally very low in TDS. Regardless, a salt management plan would be prepared in accordance with the General Water Reuse Order if the recycled water user or RWQCB determines that irrigation with recycled water could result in salt buildup in the groundwater. With implementation of this plan in accordance with RWQCB regulatory requirements, if needed, groundwater quality impacts related to the use of recycled water for

irrigation under the Recycled Water projects would be *less than significant*. However, this program-level review would be further refined as part of the separate, project-level CEQA review for the Recycled Water Projects, which could result in a change in the significance determination.

The SAPL 3 Installation project (SF-1) would not require discharges of treated water. Therefore, this impact would be *not apply* to this project.

Impact 4.5-6: Degradation of water quality, including offsite erosion and flooding, as a result of alteration of drainage patterns or an increase in impervious surfaces.

Construction of the WSIP facilities could alter drainage patterns and would result in a minor increase in impervious surfaces associated with new structures and paved areas, potentially resulting in offsite erosion or flooding. Although the amount of impervious surfaces that would be added is negligible compared to the existing acreage of impervious surfaces throughout the program area, the WSIP's addition of impervious surfaces could result in an incremental increase in surface runoff and related stormwater pollutants.

However, implementation of SFPUC Construction Measure #10 (project site) would require the SFPUC or its contractor(s) to return project sites to the general condition that existed prior to construction, including regrading the site and revegetating disturbed areas, which would ensure that drainage patterns are not altered in a way that would cause offsite flooding, erosion, or sedimentation. In addition, projects in all regions would be required to implement permanent erosion control measures in accordance with SFPUC Construction Measure #3 (onsite air and water quality measures during construction) and to implement control measures in compliance with applicable water quality regulations, including Article 4.1 of the San Francisco Public Works Code for projects in San Francisco and NPDES stormwater permitting requirements for other projects. In accordance with these requirements, projects would incorporate BMPs for temporary and permanent erosion control and incorporate stormwater control measures to reduce the quantity and rate of stormwater runoff and related erosion and flooding effects, as well as the potential for pollutants in stormwater.

Tunnels and Pipelines. Where a pipeline is located in a public right-of-way, construction could result in the replacement of asphalt or other impervious surfaces. However, the replacement of paved surfaces within a public right-of-way is generally exempted from municipal stormwater permitting requirements related to impervious surfaces. Additionally, the installation of pipelines in unpaved areas and the construction of tunnels would generally not result in the creation or replacement of impervious surfaces, because these facilities are underground and would not be paved. Therefore, there would be no water quality impacts associated with increased impervious surfaces for tunnel and pipeline projects, unless new impervious surfaces would be constructed.

Installation of pipelines and tunnels in unpaved areas would not alter drainage patterns in a way that results in offsite flooding, erosion, or sedimentation because, in accordance with SFPUC Construction Measure #10 (project site), the contractor(s) would be required to return the project

site to the general condition that existed prior to construction, including regrading the site and revegetating disturbed areas. These projects would also be required to implement BMPs for temporary and permanent erosion control in accordance with SFPUC Construction Measure #3 (onsite air and water quality measures during construction), Article 4.1 of the San Francisco Public Works Code for projects in San Francisco, and NPDES construction stormwater permitting requirements for other projects.

Other Projects. With the exception of San Francisco and San Joaquin County, the municipal stormwater permits for the counties within the WSIP study area require new development and redevelopment projects that involve the creation or replacement of impervious surfaces to incorporate treatment measures and other appropriate source control and site design features to reduce the pollutant load in stormwater discharges and to manage runoff flows; the applicability of countywide MS4 stormwater management controls to the WSIP will be determined on a project-by-project basis as part of project-level review of individual WSIP projects. In each county, projects subject to these controls that involve the creation or replacement of one or more acres of impervious surfaces were required to comply with the new development and redevelopment requirements as of February 15, 2005. Projects subject to countywide MS4 stormwater management controls that involve the creation or replacement of 10,000 square feet or more of impervious surfaces were required to comply with the requirements by August 15, 2006. These thresholds apply to individual projects and are not applied to a cumulative set of projects if the locations of the cumulative set of projects under a single program are noncontiguous and/or are not part of a single common plan of development. To the extent that projects subject to countywide MS4 stormwater management controls are part of a single common plan of development that cumulatively exceeds 10,000 square feet of new or replaced impervious surface, the smaller amount of impervious surface from each sub-project would require appropriately sized stormwater treatment BMPs.

In addition, projects subject to countywide MS4 stormwater management controls that involve land disturbance of more than one acre would be required to include post-construction erosion and sediment control BMPs in the SWPPP prepared for the project (Described in the Setting and in Impact 4.5-1). For projects subject to countywide MS4 stormwater management controls, the post-construction erosion and sediment control BMPs for projects located in Alameda, Santa Clara, and San Mateo Counties and creating or replacing more than one acre of impervious surface must also comply with requirements in the Hydrograph Modification Management Plans for those counties. Post-construction BMPs could include minimizing land disturbance or the amount of impervious surfaces; treating stormwater runoff using infiltration, detention/retention, or biofilters; using efficient irrigation systems; ensuring that interior drains are not connected to a storm sewer system; and using appropriately designed and constructed energy dissipation devices. These measures would be designed to ensure that drainage patterns are not changed in a way that results in offsite erosion or flooding, and must be consistent with all local post-construction stormwater management requirements, policies, and guidelines. Coverage under the General Construction Permit cannot be terminated until the site is in compliance with all local stormwater management requirements and a post-construction stormwater management plan is in place, as described in the SWPPP.

Projects located in San Francisco would not be subject to the new development and redevelopment guidelines described above because stormwater discharges to the combined sewer system are regulated under the City's NPDES permit, in conformance with the Combined Sewer Overflow Control Policy. However, an increase in impervious surfaces could result in an incremental increase in the number or volume of combined sewer discharges. Projects located in San Joaquin County would not be regulated under a municipal stormwater permit.

Alameda and Peninsula Watershed Plans Actions. WSIP projects located in the Alameda and Peninsula watersheds would also be required to implement the following watershed management plan action pertaining to onsite stormwater collection and drainage systems:

- *Action sto1*. Assess the onsite stormwater collection and drainage systems at SFPUC facilities, Sunol Water Temple, applicable East Bay Regional Park District facilities, the Sunol Valley Golf Course, quarries, and nurseries for adequate sizing and erosion. Remediate where necessary by establishing preventive maintenance programs, infiltration drainfields and trenches, or wet and dry detention basins to optimize the quality of stormwater which flows into reservoirs and tributaries.

San Joaquin Region

Impact 4.5-6: Degradation of water quality as a result of alteration of drainage patterns or an increase in impervious surfaces		
Advanced Disinfection	SJ-1	LS
Lawrence Livermore	SJ-2	PSM
SJPL System	SJ-3	LS
SJPL Rehabilitation	SJ-4	LS
Tesla Portal Disinfection	SJ-5	LS

The Advanced Disinfection (SJ-1) and Tesla Portal Disinfection (SJ-5) projects would include construction of new disinfection facilities, most likely at Tesla Portal, and could involve the creation or replacement of impervious surfaces. Construction of two crossover facilities under the SJPL System project (SJ-3) would also create new impervious surfaces. These facilities would not be covered by a municipal stormwater permit. However, the construction contractor(s) would be required to comply with SFPUC Construction Measure #10 (project site); post-construction stormwater controls would be implemented and maintained, as specified in the SWPPP; and a post-construction stormwater management plan would be prepared for these projects. With implementation of SFPUC Construction Measure #10 (project site) and implementation of control measures in compliance with these legal requirements, impacts related to increases in surface runoff, stormwater pollutants, and the potential for offsite erosion and flooding would be *less than significant* for these projects.

The Lawrence Livermore project (SJ-2) would construct a new disinfection facility, most likely at Thomas Shaft, and would create new impervious surfaces. If this project involved less than one acre of land disturbance, it would not be covered by the General Construction Stormwater Permit. Therefore, NPDES permitting requirements would not apply, and impacts related to increases in surface runoff and stormwater pollutants as well as the potential for offsite erosion and flooding would be *potentially significant*, but would be reduced to a less-than-significant level with implementation of SFPUC Construction Measure #10 (project site) and implementation of appropriate source control and site design measures (Measure 4.5-6).

The SJPL Rehabilitation project (SJ-4) would involve rehabilitation of pipelines in a public right-of-way and would not result in the creation of new impervious surfaces. Although ground disturbance would occur, impacts related to the potential to alter drainage patterns would be *less than significant* with implementation of SFPUC Construction Measure #10 (project site) and post-construction erosion and sediment control BMPs required by NPDES regulations.

Sunol Valley Region

Impact 4.5-6: Degradation of water quality as a result of alteration of drainage patterns or an increase in impervious surfaces		
Alameda Creek Fishery	SV-1	LS
Calaveras Dam	SV-2	LS
40-mgd Treated Water	SV-3	LS
New Irvington Tunnel	SV-4	LS
Treated Water Reservoirs	SV-5	LS
SABUP	SV-6	LS

The Alameda Creek Fishery project (SV-1) could include the construction of a pump house, which would create new impervious surfaces. The 40-mgd Treated Water (SV-3) and Treated Water Reservoirs (SV-5) projects would include improvements to the Sunol Valley WTP to provide new and upgraded water treatment facilities and increased treated water storage and would therefore result in the creation or replacement of impervious surfaces. Construction of new tunnel portals for the New Irvington Tunnel project (SV-4) would involve the creation or replacement of impervious surfaces, and the Calaveras Dam project (SV-2) would involve construction of new access roads, which would create new impervious surfaces. Each of these projects would also include ground disturbance activities with the potential to alter drainage patterns, including excavation of the proposed borrow and disposal areas the under the Calaveras Dam project; this project would also inundate a portion of Alameda Creek downstream of the dam.

However, impacts related to increased surface runoff and stormwater pollutants, as well as the potential for offsite erosion and flooding resulting from alteration of drainage patterns, would be *less than significant* with implementation of SFPUC Construction Measure #10 (project site) and implementation of control measures in compliance with stormwater permitting requirements. Stormwater control measures to achieve compliance with permitting requirements would be specified in the SWPPP and the post-construction stormwater management plan prepared for these projects. These projects would also implement Alameda WMP Action sto1 regarding stormwater collection systems, as described above. Inundation of a portion of Alameda Creek due to construction of the Calaveras Dam project (SV-2) would not result in offsite flooding, erosion, or sedimentation because releases from the dam would be controlled to prevent these effects.

The SABUP project (SV-6) would not involve the creation or replacement of impervious surfaces. Although ground disturbance would occur, impacts related to the potential to alter drainage patterns would be *less than significant* with implementation of SFPUC Construction Measure #10 (project site) and post-construction erosion and sediment control BMPs required by NPDES regulations.

Bay Division Region

Impact 4.5-6: Degradation of water quality as a result of alteration of drainage patterns or an increase in impervious surfaces		
BDPL Reliability Upgrade	BD-1	LS
BDPL 3 and 4 Crossovers	BD-2	LS
BDPL 3 and 4 Seismic Upgrade at Hayward Fault	BD-3	LS

The BDPL Reliability Upgrade (BD-1), BDPL 3 and 4 Crossovers (BD-2), and BDPL 3 and 4 Seismic Upgrade at Hayward Fault (BD-3) projects would include construction of new vaults, shafts, and other structures, which would result in a small increase in impervious surfaces. Depending on the alternative selected,

the BDPL 3 and 4 Seismic Upgrade at Hayward Fault project could construct up to 128,000 square feet of impervious surface. Impacts related to increased surface runoff and stormwater pollutants, as well as the potential for erosion and flooding resulting from alteration of drainage patterns, would be *less than significant* with implementation of SFPUC Construction Measure #10 (project site) and implementation of control measures in compliance with stormwater permitting requirements. Stormwater control measures to achieve compliance with permitting requirements would be specified in the SWPPP and post-construction stormwater management plan prepared for these projects.

Peninsula Region

Impact 4.5-6: Degradation of water quality as a result of alteration of drainage patterns or an increase in impervious surfaces		
Baden and San Pedro Valve Lots	PN-1	LS
CS/SA Transmission	PN-2	LS
HTWTP Long-Term	PN-3	LS
Lower Crystal Springs Dam	PN-4	LS
Pulgas Balancing Reservoir	PN-5	LS

Impervious surfaces could be created or replaced under the Baden and San Pedro Valve Lots (PN-1), CS/SA Transmission (PN-2), HTWTP Long-Term (PN-3), Lower Crystal Springs Dam (PN-4), and Pulgas Balancing Reservoir (PN-5) projects. Impacts related to increased surface runoff and stormwater pollutants, as well as the potential for offsite erosion and flooding due to the alteration of drainage patterns, would be *less than significant* with implementation of SFPUC Construction Measure #10 (project site) and implementation of control measures in compliance with stormwater permitting requirements. Stormwater controls to achieve compliance with permitting requirements would be specified in the SWPPP and post-construction stormwater management plan prepared for these projects. The CS/SA Transmission (PN-2), Lower Crystal Springs Dam (PN-4), and Pulgas Balancing Reservoir (PN-5) projects and those portions of the Baden and San Pedro Valve Lots project within the Peninsula watershed would also be required to implement Peninsula WMP Action sto1, as described above.

San Francisco Region

Impact 4.5-6: Degradation of water quality as a result of alteration of drainage patterns or an increase in impervious surfaces		
SAPL 3 Installation	SF-1	LS
Groundwater Projects	SF-2	LS
Recycled Water Projects	SF-3	LS

Impervious surfaces associated with San Francisco Region projects could increase stormwater flows to the combined sewer system, with an associated potential increase in the volume or frequency of combined sewer discharges. However, none of the projects within San Francisco are expected to increase stormwater flows or alter drainage patterns in a way that would result in offsite erosion or flooding, because these projects would replace existing impervious surfaces. If new impervious surfaces were created, the extent would be minimal and would not be expected to measurably affect the volume or frequency of combined sewer discharges. Furthermore, projects in San Francisco would be required to implement erosion control measures in accordance with SFPUC Construction Measure #3 (onsite air and water quality measures during construction) and Article 4.1 of the San Francisco Public Works Code.

Therefore, impacts related to the alteration of drainage patterns and an increase in stormwater flows due to increased impervious surfaces would be *less than significant* for all San Francisco Region projects located in San Francisco (portions of the SAPL 3 Installation, SF-1; portions of the Groundwater Projects, SF-2; and the Recycled Water Projects, SF-3).

The Regional Groundwater Projects (SF-2) constructed within San Mateo County could involve the creation or replacement of impervious surfaces. Impacts related to increased surface runoff and stormwater pollutants, as well as the potential for offsite erosion and flooding due to the alteration of drainage patterns, would be *less than significant* with implementation of SFPUC Construction Measure #10 (project site) and implementation of control measures in compliance with stormwater permitting requirements. Stormwater controls to achieve compliance with permitting requirements would be specified in the SWPPP and post-construction stormwater management plan prepared for this project.

The portions of SAPL 3 Installation (SF-1) located in San Mateo County would include underground pipeline construction, either in unpaved areas or within a public right-of-way, and would not result in the creation of new impervious surfaces. Although ground disturbance would occur, impacts related to the potential to alter drainage patterns would be *less than significant* with implementation of SFPUC Construction Measure #10 (project site) and post-construction erosion and sediment control BMPs required by NPDES regulations.

4.5.3 References – Hydrology and Water Quality

California Department of Health Services (DHS), Division of Drinking Water and Environmental Management, DHS's Regulations and Guidance for Recycled Water, available online at http://www.dhs.ca.gov/ps/ddwem/waterrecycling/default.htm, accessed June 8, 2007.

Federal Emergency Management Agency (FEMA), Flood Insurance Rate Map, Alameda County, California (Unincorporated Areas), Community Panel Number 0600010215A. April 15, 1981.

Federal Emergency Management Agency (FEMA), Flood Insurance Rate Map, City of Redwood City, California, San Mateo County, Community Panel Number 0603250015B, May 17, 1982.

Federal Emergency Management Agency (FEMA), Flood Insurance Rate Map, City of Fremont, California, Alameda County. Community Panel Number 0650280031B, May 2, 1983.

Federal Emergency Management Agency (FEMA), Flood Insurance Rate Map, City of San Jose, California, Santa Clara County, Community Panel Number 0603490008F, December 16, 1988.

Federal Emergency Management Agency (FEMA), Flood Insurance Rate Map, City of Menlo Park, California, San Mateo County, Community Panel Number 0603210005D, April 21, 1999a.

Federal Emergency Management Agency (FEMA), Flood Insurance Rate Map, City of Menlo Park, California, San Mateo County, Community Panel Number 0603210008D, April 21, 1999b.

Federal Emergency Management Agency (FEMA), Flood Insurance Rate Map, City of Menlo Park, California, San Mateo County, Community Panel Number 0603210007D, April 21, 1999c.

Federal Emergency Management Agency (FEMA), Flood Insurance Rate Map, City of Palo Alto, California, Santa Clara County, Community Panel Number 0603480005E, June 2, 1999d.

Federal Emergency Management Agency (FEMA), Flood Insurance Rate Map, City of East Palo Alto, California, San Mateo County, Community Panel Number 0607080001B, August 23, 1999e.

Federal Emergency Management Agency (FEMA), Flood Insurance Rate Map, City of Fremont, California, Alameda County. Community Panel Number 0650280030C, February 9, 2000a.

Federal Emergency Management Agency (FEMA), Flood Insurance Rate Map, Alameda County, California (Unincorporated Areas), Map Index, February 9, 2000b.

Federal Emergency Management Agency (FEMA), Flood Insurance Rate Map, Stanislaus County, California (Unincorporated Areas), Community Panel Number 0603840250C, September 30, 2004.

Regional Water Quality Control Board (RWQCB), San Francisco Bay Region, Order 96-011, General Water Reuse Requirements for: Municipal Wastewater and Water Agencies, January 17, 1996.

Regional Water Quality Control Board (RWQCB), Central Valley Region, Order No. 5-00-175, NPDES No. CAG995001, Waste Discharge Requirements, General Order for Dewatering and Other Low Threat Discharges to Surface Water, June 16, 2000.

Regional Water Quality Control Board (RWQCB), San Francisco Bay Region, *Order No. R2-2003-0062, NPDES General Permit No. CAG382001: Regionwide General National Pollutant Discharge Elimination System (NPDES) Permit for Discharges from Surface Water Treatment Facilities for Potable Water Supply,* June 18, 2003.

RMC Water and Environment, *Recycled Water Master Plan for the City and County of San Francisco*, March 2006.

San Francisco Public Utilities Commission (SFPUC), *Alameda Watershed Management Plan,* prepared by EDAW, Inc., April 2001.

State Water Resources Control Board (SWRCB), *Water Quality Order 99-08-DWQ, National Pollutant Discharge Elimination System (NPDES) Permit for Stormwater Discharges Associated with Construction Activity (General Permit),* 1999.

State Water Resources Control Board (SWRCB), *Order No. 2003-007-DWQ, National Pollutant Discharge Elimination System (NPDES) General Permit No. CAS000005, Waste Discharge*

Requirements (WDRs) for Discharges of Stormwater Runoff Associated With Small Linear Underground/Overhead Construction Projects (General Permit), 2003a.

State Water Resources Control Board (SWRCB), Water Quality Order No. 2003-003-DWQ, Statewide General Waste Discharge Requirements for Discharges to Land With a Low Threat to Water Quality (General WDRs), April 2003b.

State Water Resources Control Board (SWRCB), Proposed 2006 CWA Section 303(d) List of Water Quality Limited Segments, approved by the SWRCB on October 25, 2006a.

State Water Resources Control Board (SWRCB), Proposed 2006 CWA Section 303(d) List of Water Quality Limited Segments Being Addressed by USEPA Approved TMDLs, approved by the SWRCB on October 25, 2006b.

State Water Resources Control Board (SWRCB), Draft Total Residual Chlorine and Chlorine Produced Oxidants Policy of California. June, 2006c.

State Water Resources Control Board (SWRCB), 2007. *National Pollutant Discharge Elimination System (NPDES) General Permit for Storm Water Discharges Associated with Construction and Land Disturbance Activities, Preliminary Draft*, March 2, 2007.

Water Infrastructure Partners, *New Irvington Tunnel Conceptual Engineering Report*, September 2005.