5.5 San Francisco Peninsula Streams and Reservoirs

5.5 San Francisco Peninsula Streams and Reservoirs

Section 5.5 Subsections

5.5.1 Stream Flow and Reservoir Water Levels

The following setting section describes the streams and reservoirs on the San Francisco Peninsula that could be affected by the WSIP. The impact section (Section 5.5.1.2) provides a description of the changes in stream flow and reservoir water levels that would result from implementation of the WSIP.

5.5.1.1 Setting

The SFPUC operates four water supply reservoirs on the San Francisco Peninsula: Pilarcitos, Upper and Lower Crystal Springs, and San Andreas Reservoirs. The Spring Valley Water Company built the reservoirs between 1864 and 1890. The four reservoirs and two streams (San Mateo Creek and Pilarcitos Creek) on the Peninsula could be affected by the WSIP. San Mateo Creek, and its tributary San Andreas Creek, flow southward in the rift valley formed by the San Andreas fault and then turn east, flowing to San Francisco Bay. Pilarcitos Creek also flows southward, but it turns to the west and flows to the Pacific Ocean. **Figure 5.5.1-1** shows the boundaries of the drainage areas of the four Peninsula reservoirs, and **Figure 5.5.1-2** shows the SFPUC regional facilities associated with these reservoirs. The SFPUC's water supply facilities on the San Francisco Peninsula lie within two watersheds, the San Mateo Creek and Pilarcitos Creek watersheds, which are referred to collectively as the Peninsula watershed.

San Mateo Creek

General Description

San Mateo Creek, and its major tributary San Andreas Creek, rises in the Coast Range mountains west of the city of Millbrae. San Mateo and San Andreas Creeks are fed by rainfall, which varies with altitude and is in the range of 25 to 40 inches annually. Almost all of the rainfall occurs between October and April.

SOURCE: ESA + Orion; USGS 1978

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Figure 5.5.1-1
Peninsula Watersheds and Drainages

SOURCE: ESA + Orion; USGS 1978

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Figure 5.5.1-2
Peninsula Watershed Facilites and Flow Locations Analyzed

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The upper reaches of San Mateo Creek and all reaches of San Andreas Creek are in undeveloped land, most of which is owned by the City and County of San Francisco (CCSF). The lower reaches of San Mateo Creek below Lower Crystal Springs Dam flow through a densely developed urban area to San Francisco Bay, about 1.6 miles north of the Hayward–San Mateo Bridge. The main tributary of San Mateo Creek downstream of Lower Crystal Springs Dam is Polhemus Creek.

Stream Flow and Water System Operations

Flow in San Mateo and San Andreas Creeks was first affected by water system operations in 1870 when San Andreas Dam was built in the upper reaches of San Andreas Creek. The dam impounds San Andreas Reservoir. Upper Crystal Springs Dam was built just upstream of the confluence of San Andreas Creek and San Mateo Creek in 1877 and formed Upper Crystal Springs Reservoir. In 1890, Lower Crystal Springs Dam was built on San Mateo Creek downstream of Upper Crystal Springs Reservoir, forming Lower Crystal Springs Reservoir. In 1924, culverts were built through Upper Crystal Springs Dam to hydraulically link Upper and Lower Crystal Springs Reservoirs. The current maximum capacities of San Andreas and Crystal Springs Reservoirs are 19,000 and 56,800 acre-feet, respectively. (The California Department of Water Resources, Division of Safety of Dams, currently restricts Crystal Springs Reservoir storage). **Figures 5.5.1-3** and **5.5.1-4** show historical water surface elevations in San Andreas and Crystal Springs Reservoirs between 1998 and 2006.

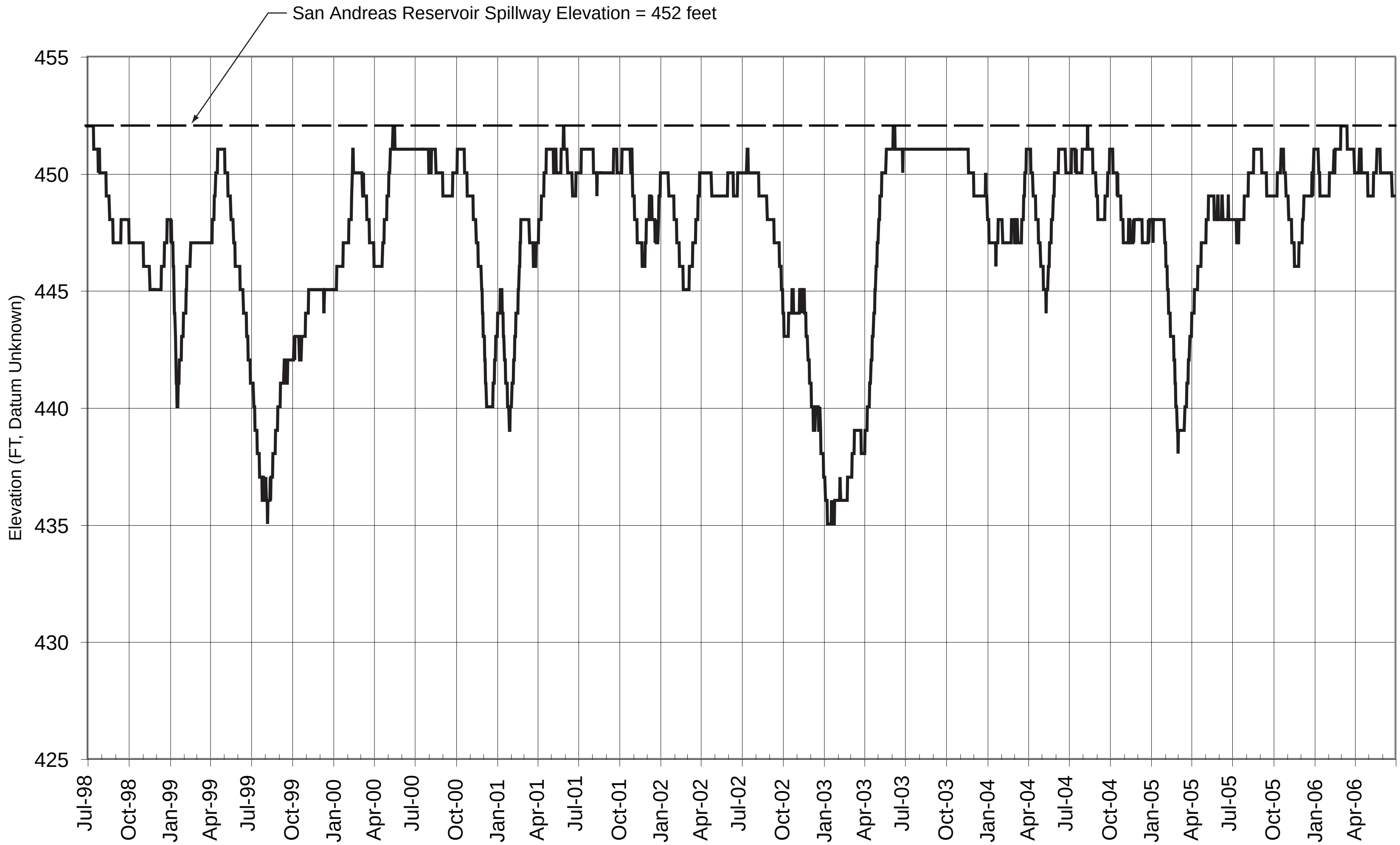
San Andreas and Crystal Springs Reservoirs serve as terminal reservoirs for the SFPUC water system. They not only capture local runoff but also store water conveyed from the Tuolumne River, the Alameda Creek watershed, and Pilarcitos Creek; consequently, the reservoirs are larger than would be necessary if their sole purpose were to capture runoff from local watersheds. The reservoirs on San Andreas and San Mateo Creeks eliminate flow in the creeks immediately below the dams, except for occasional spills or releases from the reservoirs and seepage through the dams. The creeks gain flow in a downstream direction as a result of tributary flow from surface and groundwater sources. No measurements of flow in either creek are available.

Although flood reduction was not one of the original purposes of the CCSF's reservoirs in the San Mateo Creek watershed, Crystal Springs Reservoir reduces peak flow in the creek most of the time. Space for floodwaters is provided in the reservoir when major storms are expected. Once the space allocated for flood storage is filled, uncontrolled flow over the spillway at Lower Crystal Springs Dam can occur, or controlled releases can be made from outlets equipped with valves. Before the valves are opened, the SFPUC considers potential downstream effects. The dam is operated so that peak flows do not increase above the peak flows that would have existed had the reservoirs not been constructed.

Pilarcitos Creek/Pilarcitos Reservoir

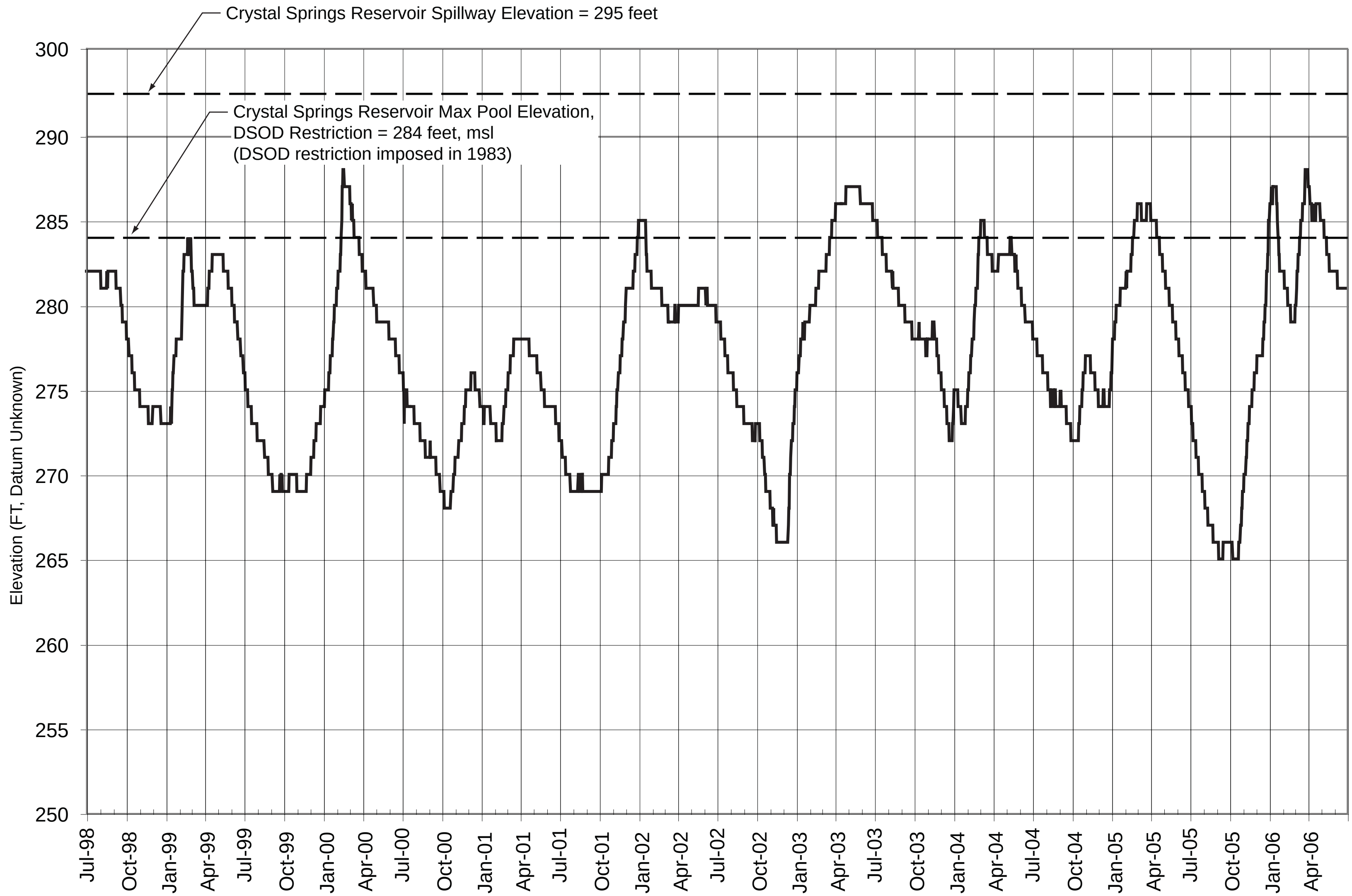
General Description

Pilarcitos Creek rises on the eastern flanks of Montara Mountain in the Coast Ranges. The creek flows southward through the mountains before turning westward and discharging to the Pacific Ocean at Half Moon Bay, as shown in **Figure 5.5.1-5**. Rainfall in the Pilarcitos Creek watershed



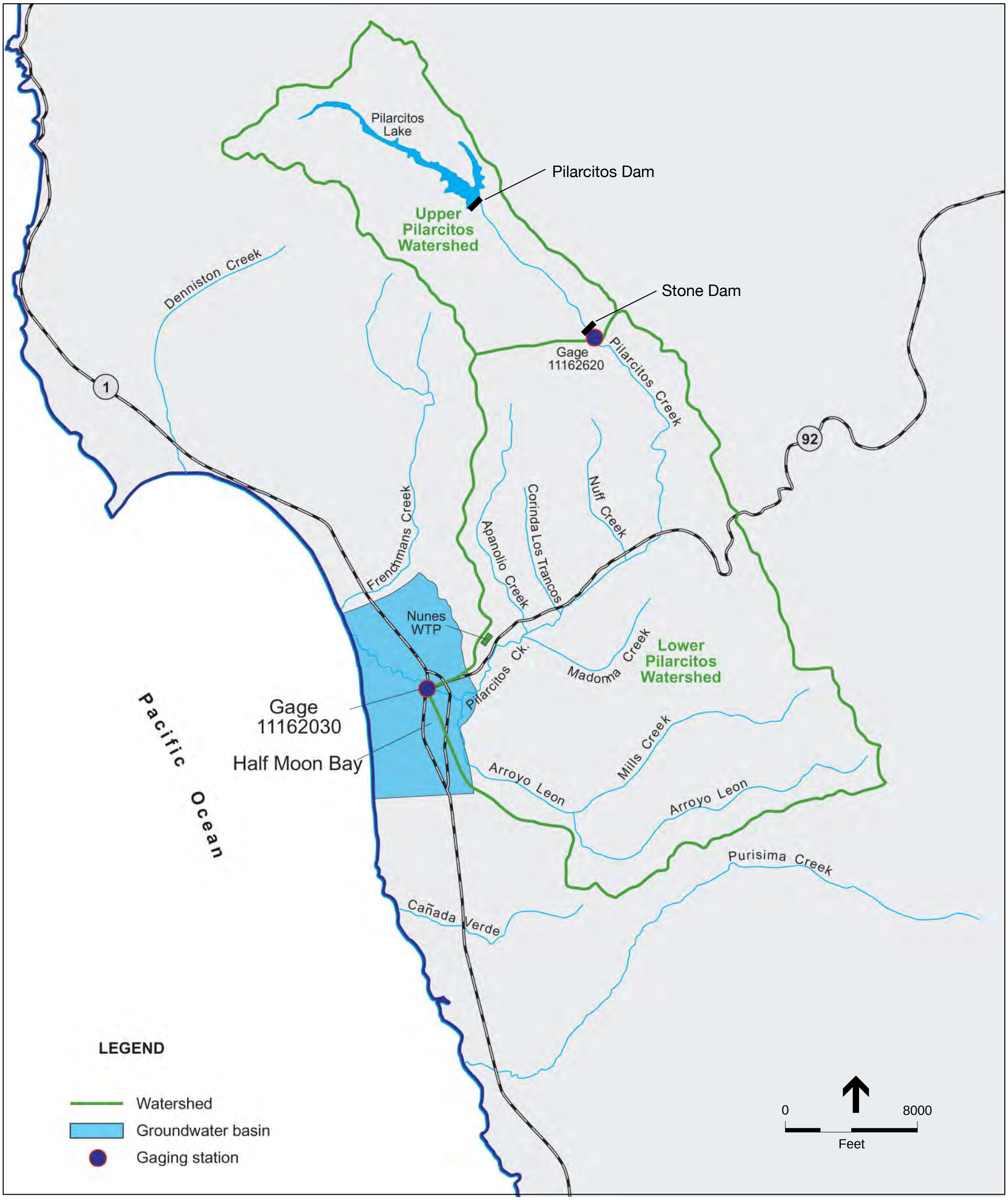
SOURCE: SFPUC, HH/LSM (see Appendix H)

Figure 5.5.1-3
San Andreas Reservoir, Historical Water Levels, 1998 to 2006



SOURCE: SFPUC, HH/LSM (see Appendix H)

Figure 5.5.1-4
Crystal Springs Reservoir, Historical Water Levels, 1998 to 2006



SOURCE: Todd Engineers

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Figure 5.5.1-5
Pilarcitos Creek Watershed

is variable, ranging from 26 inches annually at the coast to 42 inches near Pilarcitos Reservoir. The approximately 27-square-mile Pilarcitos Creek watershed consists primarily of relatively rugged uplands, characterized by shrubs and grasslands. The CCSF owns substantial portions of the upper watershed, and the Peninsula Open Space Trust protects large areas of the lower watershed above Arroyo Leon. Developed lands within the watershed are primarily agricultural and are located along the lower reaches of the stream corridors. Residential land uses are also present in the watershed, generally along roadways. Other land uses include a cemetery on Highway 92 at Skyline Boulevard, a sanitary landfill in upper Corrida Los Trancos Canyon, and a quarry in Nuff Creek Canyon.

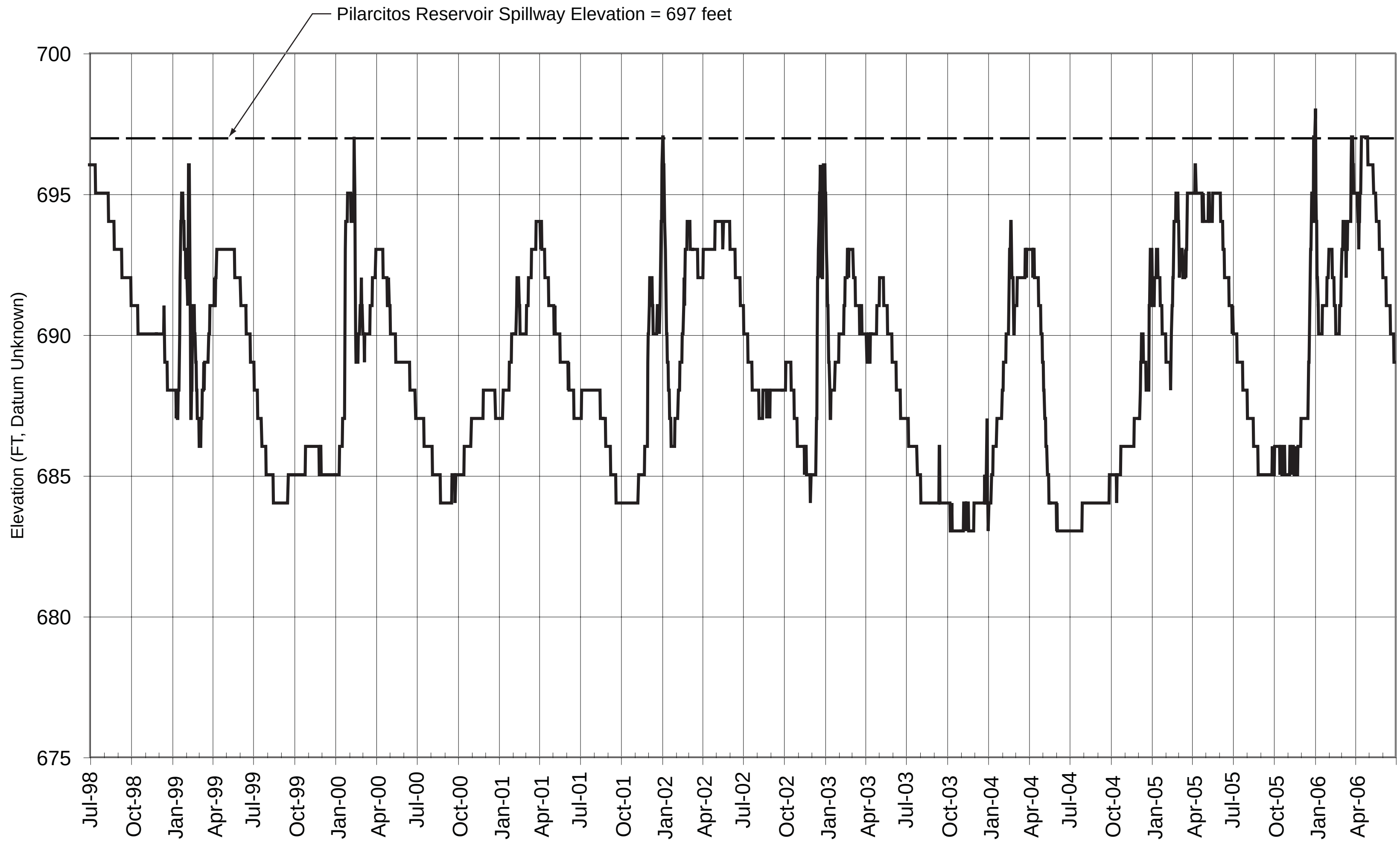
Stream Flow and Water System Operations

Flow in Pilarcitos Creek was first affected by water system operations in 1864 when Pilarcitos Dam was built, and again in 1871 when Stone Dam was built. Pilarcitos Dam impounds Pilarcitos Reservoir, which has a maximum capacity of 3,100 acre-feet of water. Stone Dam, which is about two miles downstream of Pilarcitos Reservoir, is essentially a diversion dam; it impounds about 15 acre-feet of water.

Local runoff from an approximately six-square-mile watershed is Pilarcitos Reservoir's only source of water. Inflow to the reservoir occurs predominantly from rainfall during December through April. Annual runoff to Pilarcitos Reservoir is quite variable and has ranged from almost nothing to more than 15,000 acre-feet. Average annual runoff is estimated to be approximately 4,000 acre-feet per year. Tributaries that join Pilarcitos Creek between Pilarcitos Reservoir and Stone Dam contribute an average annual of about 1,850 acre-feet per year.

The SFPUC uses Pilarcitos Reservoir to store water for use by the Coastside County Water District (Coastside CWD) and to store and divert water for its own use. During the winter months, the SFPUC typically diverts most of the runoff into Pilarcitos Reservoir from the Pilarcitos Creek watershed to its reservoirs in the San Mateo Creek watershed, primarily to San Andreas Reservoir, but also to Crystal Springs Reservoirs. At the end of the rainy season, diversions from Pilarcitos Creek to San Andreas Reservoir are curtailed, with the goal of filling Pilarcitos Reservoir by the late spring. As indicated in **Figure 5.5.1-6**, which shows historical water surface elevations in Pilarcitos Reservoir from 1998 to 2006, the reservoir refills or almost refills in the winter or spring of most years. After the reservoir has filled, the SFPUC attempts to limit releases from Pilarcitos Reservoir to that amount requested by Coastside CWD to meet its water needs. However, at times, additional water may be released from Pilarcitos Reservoir and diverted to Crystal Springs Reservoir at Stone Dam or released from Stone Dam (see discussion below regarding experimental releases from Stone Dam to Pilarcitos Creek).

The SFPUC releases water from Pilarcitos Reservoir to Pilarcitos Creek during the summer for use by Coastside CWD and during the winter diverts water from Pilarcitos Reservoir to San Andreas Reservoir through Pilarcitos Tunnels No. 1 and 2. It can also divert water from Pilarcitos Reservoir to Crystal Springs Reservoir through Pilarcitos Tunnel No. 1 and from Stone Dam to Crystal Springs Reservoir through Stone Dam Tunnel No. 1; this is less desirable than transfers to San Andreas Reservoir, however, because San Andreas Reservoir is at a higher elevation than Crystal Springs Reservoir. Any water diverted from Pilarcitos Creek to Crystal Springs Reservoir must ultimately be pumped to San Andreas Reservoir before it is treated and delivered to retail customers. Consequently, the SFPUC only diverts water from the Pilarcitos Creek watershed to



SOURCE: SFPUC, 2007

Figure 5.5.1-6
Pilarcitos Reservoir, Historical Water Levels, 1998 to 2006

Crystal Springs Reservoir when the available water at Pilarcitos Reservoir exceeds the conveyance capacity of Pilarcitos Tunnels No. 1 and 2, or when water is available as result of tributary flow between Pilarcitos Reservoir and Stone Dam.

Water released from Pilarcitos Reservoir flows down Pilarcitos Creek to Stone Dam. Water is diverted at Stone Dam into a tunnel and pipeline that leads to Stone Dam Tunnel No. 1. Coastside CWD has a turnout from the pipeline just upstream of Stone Dam Tunnel No. 1. Coastside CWD's own pipeline, which has a maximum capacity of about 2 million gallons per day (mgd), conveys water from this turnout to the Nunes Water Treatment Plant and on to its service area.

Coastside CWD supplies water to the city of Half Moon Bay and several unincorporated communities, including El Granada, Miramar, and Princeton-by-the Sea. Its water sources are surface water from Denniston Creek, two groundwater wellfields, and the SFPUC. Coastside CWD's total water demand currently averages 2.5 mgd, but varies seasonally. Demand in December, January, and February is about 1.6 mgd, and in July and August is about 3.2 mgd. Coastside CWD meets its customers' water demand from its own water sources to the degree it can, and then supplements its own supplies with water from the SFPUC.

Because Coastside CWD's own water sources produce only a modest amount of water, Coastside CWD supplements its own water supplies with water from the SFPUC year-round. In the winter months, when demand in the Coastside CWD service area is at its seasonal minimum, Coastside CWD obtains 0.5 to 1 mgd from the SFPUC. In the summer when demand is at its seasonal maximum, Coastside CWD obtains 1.5 to 3 mgd from the SFPUC.

When Coastside CWD needs water from the SFPUC, it requests that the SFPUC release water from Pilarcitos Dam for diversion by Coastside CWD at Stone Dam. During the summer months, Coastside CWD is unable to receive enough water from the Pilarcitos Creek watershed to meet its need for supplemental water supplies. This may be because (1) Pilarcitos Reservoir is drawn down and the SFPUC is unable to release enough water down Pilarcitos Creek to meet Coastside CWD's needs or (2) the capacity of the upper portion of the pipeline from Stone Dam to the Nunes Water Treatment Plant is insufficient to convey the needed volume of water to the Coastside CWD, even when sufficient water is available from the Pilarcitos Creek watershed. Under these circumstances, Coastside CWD activates a pump to lift water out of Crystal Springs Reservoir to a ridge-top storage tank; from there, the water is conveyed to the Nunes Water Treatment Plant.

Currently, and in a normal year, about half the water from the upper Pilarcitos Creek watershed is diverted to San Andreas and Crystal Springs Reservoirs; the other half is released down Pilarcitos Creek and diverted for use by Coastside CWD at Stone Dam. Currently, approximately three-quarters of Coastside CWD's water supply is provided by the SFPUC, either from Pilarcitos Creek or Crystal Springs Reservoir.

Flow in Pilarcitos Creek between Pilarcitos Reservoir and Stone Dam consists of tributary flow from surface and groundwater sources, releases from the reservoir to supply Coastside CWD, and occasional spills from Pilarcitos Reservoir in wet periods. During the dry season, and until recently, no intentional releases were made from Stone Dam to Pilarcitos Creek, and flow in the creek immediately below the dam consisted only of leakage through the spillway boards and seepage through the dam. Currently, experimental releases of a few cubic feet per second (cfs) are being made as part of a study of aquatic resources. In the wet months of wet years, spills over Stone Dam to Pilarcitos Creek are frequent. A tributary adds water to Pilarcitos Creek about one-tenth of a mile below Stone Dam in all but a few months of the driest years.

Flow in Pilarcitos Creek is measured at two gages—one just below Stone Dam, and the other near the creek mouth at Half Moon Bay. Flow measured at the gage in Half Moon Bay varies seasonally, with average monthly flow reaching a seasonal maximum of 53 cfs in February and a seasonal minimum of less than 1 cfs in August and September. Flow varies greatly from year to year. In 1976 and 1977, two very dry years, average monthly flow in the creek did not exceed 2.5 cfs. In 1998, a very wet year, a monthly average flow of 329 cfs was recorded.

Minimum Instream Flow Requirements

No releases are required from Crystal Springs, San Andreas, and Pilarcitos Reservoirs to maintain minimum stream flows in San Mateo, San Andreas, and Pilarcitos Creeks.

5.5.1.2 Impacts

Significance Criteria

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

- Substantially alter stream flows such that they are outside of the range of pre-WSIP conditions and result in adverse hydrologic effects

The stream flow significance threshold is based on the fact that natural stream flows have varied substantially in the past 50 years, and that such variations are a part of the existing baseline. Therefore, variations substantially outside of these past levels due to implementation of the proposed program that would result in adverse hydrologic effects (such as flooding, dewatering, erosion, or drainage alteration, among others) would be considered a significant direct impact.

In addition to direct impacts resulting from changes in stream flows and reservoir levels, this PEIR also considers indirect impacts. However, for organizational purposes, the indirect impacts are not described in this section of the document, but rather in the sections describing the resources that would be indirectly affected by changes in steam flows and reservoir levels. These include geomorphology, surface water quality, groundwater, fisheries, terrestrial biological resources, recreation, and visual resources. It should be noted that there might be cases in which significant indirect impacts could result from less-than-significant direct impacts.

Approach to Analysis

Changes in reservoir storage and water levels attributable to the WSIP in the San Mateo Creek watershed and changes in reservoir storage, water levels and stream flows in the Pilarcitos Creek watershed attributable to the WSIP were estimated using the Hetch Hetchy/Local Simulation Model (HH/LSM). An overview of the model is provided in Section 5.1. Detailed information on the model and the assumptions that underlie it are provided in Appendix H. Stream flows in San Mateo Creek and stream flows and changes in reservoir storage and water levels for the Pilarcitos Creek watershed were estimated semi-quantitatively based on results from the model in addition to interviews with individuals knowledgeable about historical, current and expected future (with-WSIP) water system operations. Information on the limitations of the HH/LSM and reasons for using supplemental information are provided in Section 5.1. Information on current and expected future operations in the Pilarcitos Creek watershed is provided in Appendix H2-3 and H2-7.

Total water demand in the Coastside CWD service area is expected to increase from an annual average of 2.7 mgd in 2005 to an annual average of about 3.2 mgd in 2030. Coastside CWD intends to meet future demand by increasing its purchase request from the SFPUC. The SFPUC and Coastside CWD are currently discussing how the SFPUC might meet the increased purchase request, but no decision on a course of action has yet been made. However, in order to perform a conservative assessment of potential environmental impacts, a course of action was assumed that would have greater environmental consequences for Pilarcitos Reservoir and Pilarcitos Creek than other possible courses of action. Under the assumed scenario, the SFPUC would supply water to Coastside CWD from both Pilarcitos Creek and Crystal Springs Reservoir, as it does currently, but it would take more water from both sources. Most of the additional water would come from Crystal Springs Reservoir.[1] The SFPUC already takes all of the water from the Pilarcitos Creek watershed upstream of Stone Dam in normal, below-normal, and dry years, so any further use of Pilarcitos Creek water would come at the expense of spills from Stone Dam in the wet months of wet years.

Meeting Coastside CWD's future purchase requests might require the construction of new facilities. The environmental impacts of the new facilities are not analyzed in this PEIR, but would be addressed during subsequent, project-level CEQA review. The project-level review would occur after the SFPUC determines how it will meet Coastside CWD's 2030 purchase request, but before the facilities are constructed. However, it is expected that any construction impacts could be reduced to a less-than-significant level by conventional and project-specific construction mitigation measures.

Impact Summary

Table 5.5.1-1 presents a summary of the impacts on stream flow in Peninsula watershed water bodies that could result from implementation of the proposed water supply and system operations.

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[1] Increased diversions of water from Crystal Springs Reservoir could in turn increase diversions of water from the Tuolumne River. Chapter 8 provides an analysis of the environmental effects of several variants of the proposed program. The environmental analysis of Variant 1, which would involve meeting all of the additional purchase requests from the Tuolumne River, provides an indication of the likely effects of increased diversions from the Tuolumne River, as would occur (but on a much smaller scale) under this scenario.

TABLE 5.5.1-1
SUMMARY OF IMPACTS – STREAM FLOW
IN SAN FRANCISCO PENINSULA STREAMS

Impact	Significance Determination
Impact 5.5.1-1: Effects on flow along San Mateo Creek	LS
Impact 5.5.1-2: Effects on flow along Pilarcitos Creek	LS

LS = Less than Significant impact, no mitigation required

Impact Discussion

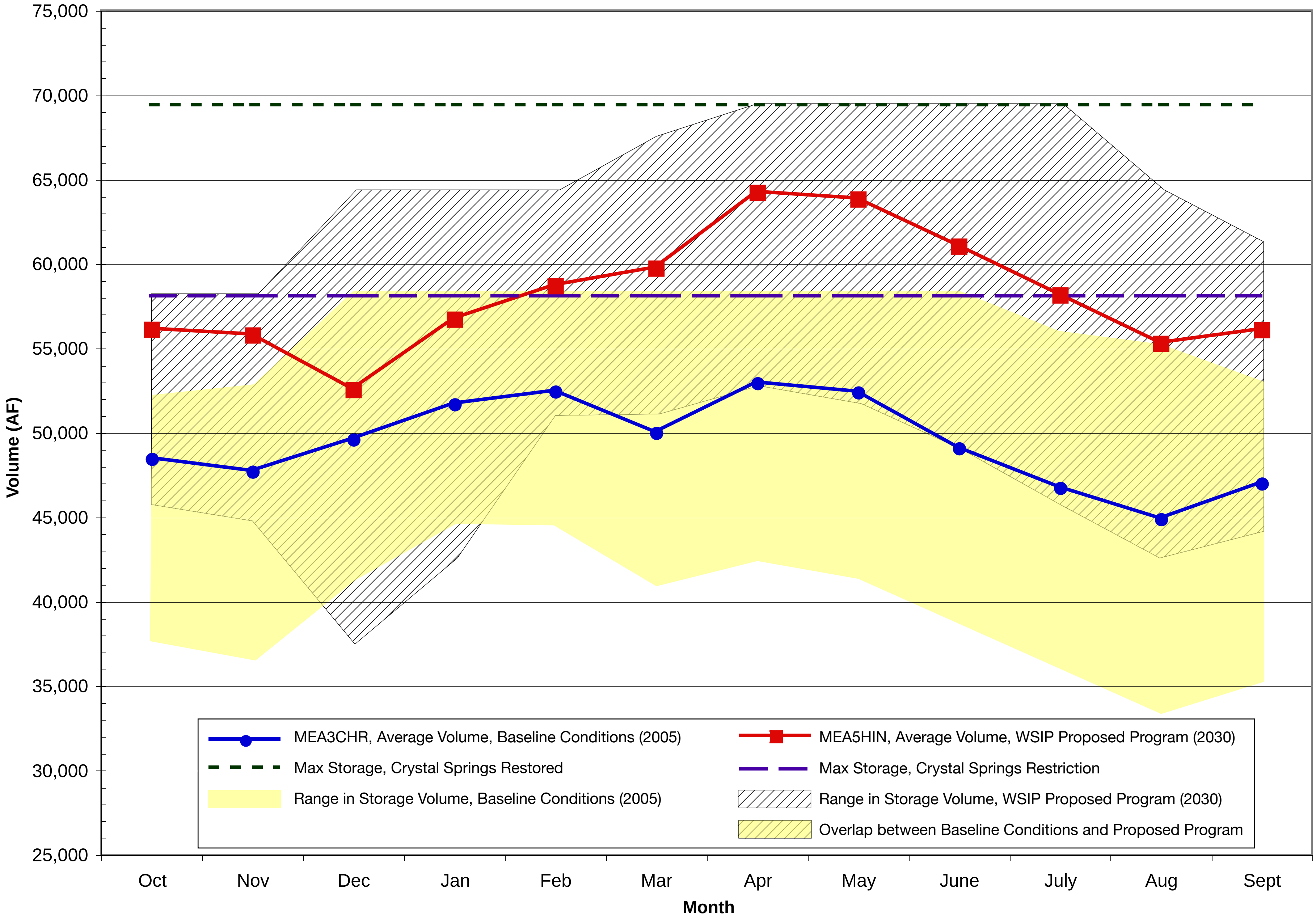
Impact 5.5.1-1: Effects on flow along San Mateo Creek.

Reservoir Operations

Crystal Springs and San Andreas Reservoirs store water from their local watersheds and water imported from the Tuolumne River and Pilarcitos Creek. The reservoirs are filled during the rainy season in the Bay Area and the snowmelt season in the Sierra Nevada. During the summer, when local demand exceeds the supply of water that can be delivered from the Tuolumne River, water is drawn from Crystal Springs and San Andreas Reservoirs to meet part of the demand. Storage in the reservoirs is replenished in the following winter, spring, and early summer. The reservoirs are operated to minimize spills from Crystal Springs Reservoir to San Mateo Creek. The WSIP would not change the SFPUC’s operational goals for Crystal Springs and San Andreas Reservoirs, but it would affect water levels in the reservoirs and could affect the volume of spills from Crystal Springs Reservoir to San Mateo Creek.

Water Storage and Water Levels in Crystal Springs and San Andreas Reservoirs

The proposed program would increase average monthly storage in Crystal Springs Reservoir year-round compared to the existing condition. **Figure 5.5.1-7** shows average monthly storage in the reservoir. The increase in average monthly storage would mostly be attributable to the Lower Crystal Springs Dam project (PN-4), but also to improvements to the SFPUC regional water system as a whole. The improvements to Crystal Springs Dam are part of the WSIP and would allow the reservoir to be operated at its full capacity of 68,000 acre-feet, or 22.2 billion gallons. The Division of Safety of Dams currently limits the maximum storage capacity in Crystal Springs Reservoir to 56,800 acre-feet (18.5 billion gallons) due to concerns regarding the ability of the dam spillway to safely pass the largest floods that could occur in the watershed. The other system improvements, also a part of the WSIP, would increase the SFPUC’s ability to convey Tuolumne River water across the San Joaquin Valley and thus improve its ability to maintain storage in Crystal Springs Reservoir. With the WSIP, storage in the reservoir would typically fluctuate during the year between full and 58,000 acre-feet (19 billion gallons), except during maintenance of the conveyance components of the Hetch Hetchy system (primarily



SOURCE: SFPUC, HH/LSM (see Appendix H)

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Figure 5.5.1-7
Average Monthly Storage Volume,
Crystal Springs Reservoir

Mountain Tunnel and the San Joaquin Valley Pipeline) and during years of little local inflow or curtailed imports from the Tuolumne River.

Because the WSIP would restore Crystal Springs Reservoir storage, average monthly water levels would rise by 2 to 8 feet compared to the existing condition, with an average increase of 5 feet. The average monthly water levels with the WSIP would fluctuate more than under the existing condition. Currently, the difference between the annual average monthly maximum and minimum water levels is 7 feet; with the WSIP it would be 9 feet. The increased fluctuation would be due in part to periodic drawdown of storage in Crystal Springs Reservoir during maintenance of the conveyance components of the Hetch Hetchy system, as described below.

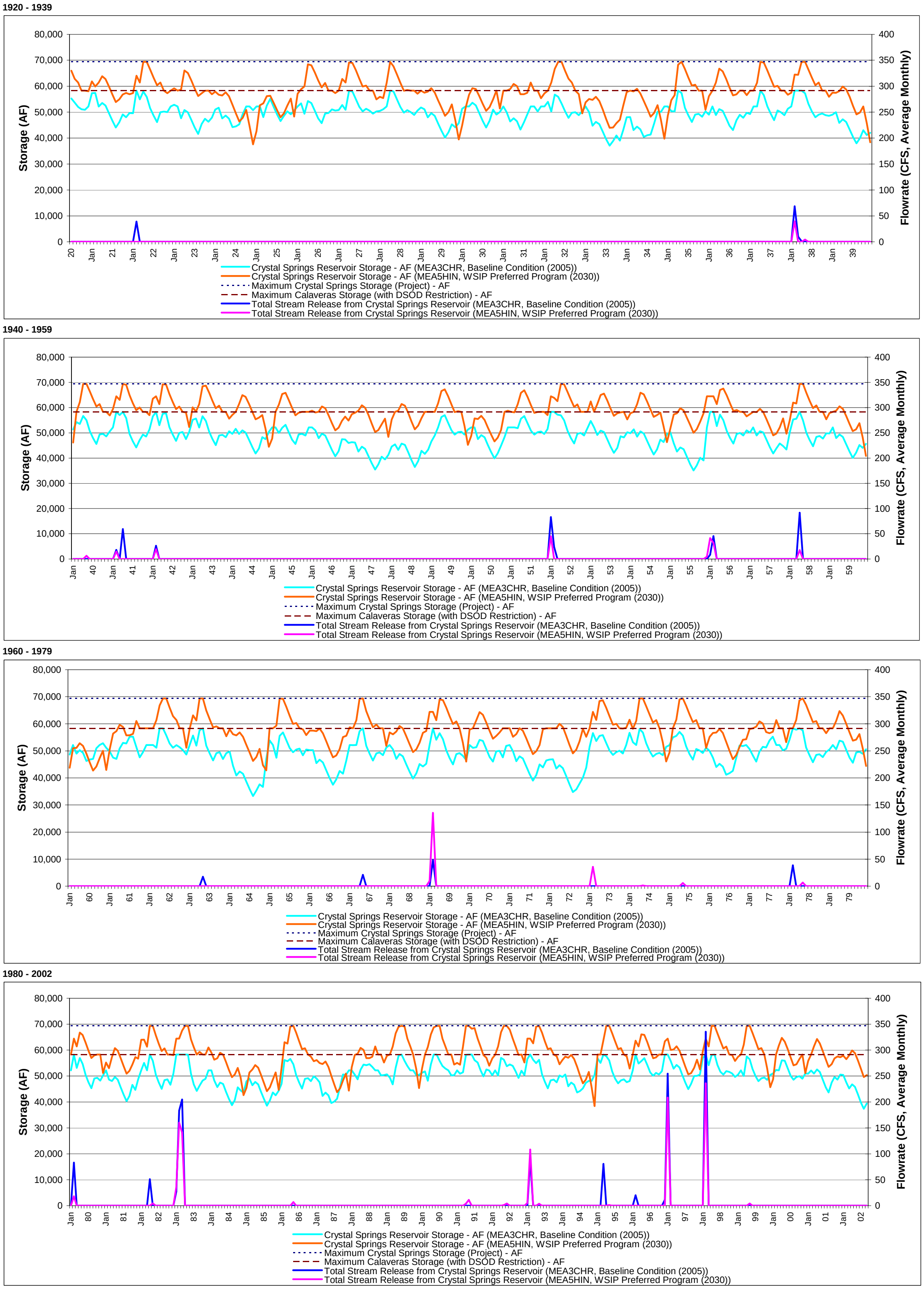
Figure 5.5.1-8 shows chronological modeled storage in Crystal Springs Reservoir using hydrology data from the period 1920 to 2002. The figure compares the WSIP to the existing condition and shows that Crystal Springs Reservoir storage with the WSIP would be greater in most years. The exception occurs every fifth year, as maintenance of the conveyance components of the Hetch Hetchy system would reduce the importation of water and require that water be withdrawn from local storage to meet water deliveries. Although maintenance is predicted to occur every five years, flexibility in the schedule could shift the years in which maintenance occurs. Maintenance would occur during the months of October, November, and December, when the demand for water is at its seasonal minimum. During these months, water levels in Crystal Springs Reservoir would fall by as much as 16 feet, and then recover when maintenance is completed.

Average monthly storage in San Andreas Reservoir is shown in **Figure 5.5.1-9** with the WSIP and under the existing condition. Under both scenarios, storage in the reservoir would typically fluctuate during the year between the full capacity of 19,000 acre-feet (6.2 billion gallons) and 17,200 acre-feet (5.6 billion gallons). Average monthly water levels with the WSIP and under existing conditions would be within a foot or two of each other, except during maintenance activities, as described below.

With implementation of the WSIP, storage in San Andreas Reservoir would be drawn down in every fifth year for planned maintenance of the conveyance components of the Hetch Hetchy system. When maintenance occurs, it would be in the months of October, November, and December. During these months, water levels in San Andreas Reservoir would fall by as much as 14 feet, and then recover when maintenance is completed.

Flow in San Mateo Creek

The SFPUC attempts to capture as much runoff as possible from the upper San Mateo Creek watershed in San Andreas and Crystal Springs Reservoirs. Most of the time, the SFPUC captures all of the runoff from the upper watershed, and no water is released to San Mateo Creek below Crystal Springs Dam. During the rainy season, the operators of the reservoir obtain frequent weather forecasts and manage the reservoir to capture as much runoff as possible from the sequence of winter storms that cross the watershed. The operators' decisions with respect to reservoir management are made on a day-to-day, sometimes hour-to-hour basis. In some



SOURCE: SFPUC, HH/LSM (see Appendix H).

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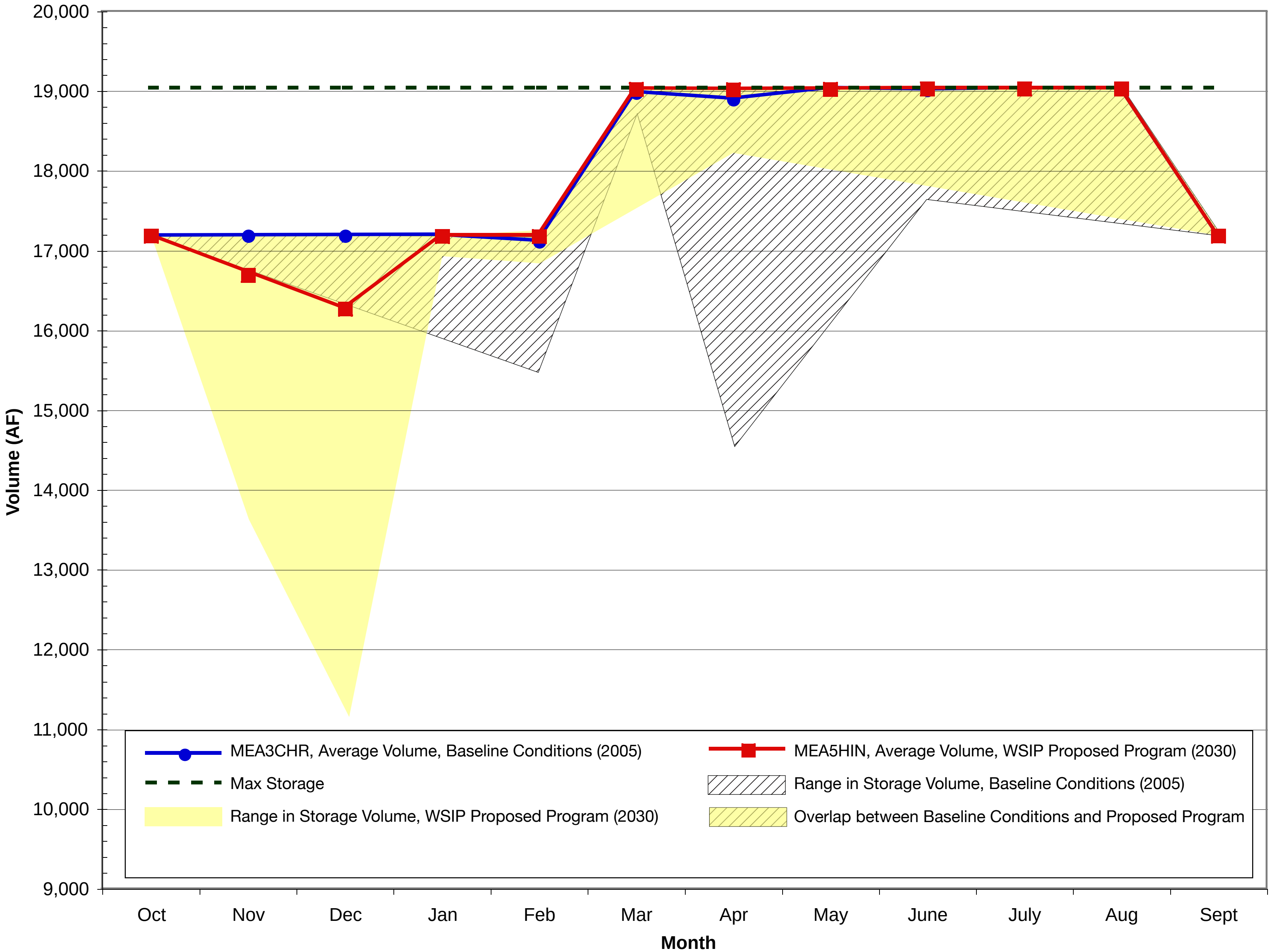
Figure 5.5.1-8
Crystal Springs Storage and Releases to San Mateo Creek



SOURCE: SFPUC, HH/LSM (see Appendix H)

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Figure 5.5.1-9 (Revised)
Average Monthly Storage Volume, San Andreas Reservoir

circumstances, the operators are unable to capture all of the runoff due to the unpredictability of the weather. Releases to the creek only occur when runoff cannot be contained in the reservoirs or conveyed to customers after treatment at the Harry Tracy Water Treatment Plant.

As a consequence of the reservoir operations described above, no releases are usually made from Crystal Springs Reservoir in dry, below-normal, and normal hydrologic years, and flow in San Mateo Creek immediately below Lower Crystal Springs Dam typically occurs only as a result of groundwater infiltration and seepage around the dam. Occasionally in wet months of wet and above-normal years, the SFPUC releases water from the reservoir, thus increasing flow in San Mateo Creek. As the creek flows toward San Francisco Bay, it gains flow from tributaries, groundwater infiltration, and discharges of urban stormwater. There is no stream gage on San Mateo Creek, so actual flows are not known. When the infrequent releases from Crystal Springs Reservoir occur, they probably represent a substantial proportion of flow in the creek. In the dry season, flow in the nontidal reach of the creek is minimal, consisting primarily of groundwater infiltration and urban stormwater associated with car washing and over-irrigation of landscaping.

With the WSIP in place, the SFPUC would operate the reservoirs in the San Mateo Creek watershed as they are currently operated. Releases to San Mateo Creek would occur infrequently, as they do under the existing condition, and would be of a similar magnitude.

Impact Conclusions

The WSIP would not alter the character of San Mateo Creek immediately below Lower Crystal Springs Dam—it is an intermittent stream under the existing condition and would remain so with the WSIP. Releases to the creek are infrequent under the existing condition and would remain so with the WSIP. The total volume of releases might be somewhat higher or lower than under the existing condition depending on circumstances, but the range of flows with the WSIP would be similar to those under the existing condition. Adverse impacts on flow along San Mateo Creek would be *less than significant*, and no mitigation measures would be required.

Impact 5.5.1-2: Effects on flow along Pilarcitos Creek.

Reservoir Operations

Pilarcitos Reservoir fills with runoff from the upper Pilarcitos Creek watershed. It receives only local runoff and cannot be filled with imported water. Water from the upper Pilarcitos Creek watershed is diverted to Crystal Springs and San Andreas Reservoirs for use by the SFPUC and is used to supply water to the Coastside CWD. Coastside CWD diverts water from Pilarcitos Creek at Stone Dam, about two miles below Pilarcitos Reservoir. During the rainy season, flow in Pilarcitos Creek at Stone Dam is sufficient to meet the Coastside CWD’s needs. During the drier months, when creek flow below Pilarcitos Reservoir subsides, the SFPUC releases water from the reservoir for diversion by Coastside CWD. Pilarcitos Reservoir is drawn down in the drier months and then refilled in the rainy season. Pilarcitos Reservoir and Stone Dam are typically operated to minimize spills from Stone Dam to Pilarcitos Creek, although small experimental releases are currently being made as part of a study of aquatic resources. The WSIP would not change the SFPUC's operational goals for Pilarcitos Reservoir and Stone Dam, but, assuming implementation of the scenario described earlier, the program would affect water levels in the reservoir and flow in Pilarcitos Creek, both between Pilarcitos Reservoir and Stone Dam and below Stone Dam.

Water Storage and Water Levels in Pilarcitos Reservoir

Seasonal changes in storage and water surface elevation in Pilarcitos Reservoir under the existing condition are shown in Figure 5.5.1-6. **Figure 5.5.1-10** shows chronological modeled storage in Pilarcitos Reservoir using hydrology data from the period 1920 to 2002. The figure compares the WSIP to the existing condition. With the WSIP, storage in the reservoir would follow a similar seasonal pattern as under the existing condition, but would average somewhat less than under the existing condition and would be drawn down more rapidly in some years in the late spring and summer. The increased rate of drawdown is primarily attributable to increased water demand in the Coastside CWD service area, which is served by releases from the reservoir, and increased transfers of water to the San Mateo Creek watershed. As water demand increases in the Coastside CWD service area, additional water would be drawn from Pilarcitos Reservoir to meet demand, although diversion of water from Pilarcitos Creek to Coastside CWD is currently limited to a maximum of 2 mgd because of pipeline capacity. The HH/LSM assumes that when Coastside CWD's monthly demand from Pilarcitos Creek exceeds 2 mgd the SFPUC serves Coastside CWD from Crystal Springs Reservoir. Additional water would also be transferred from the Pilarcitos Creek watershed to the SFPUC's reservoirs in the San Mateo Creek watershed with the WSIP than under the existing condition. This is because with the WSIP more reservoir capacity in the San Mateo Creek watershed would be available at times when water is available from Pilarcitos Creek.

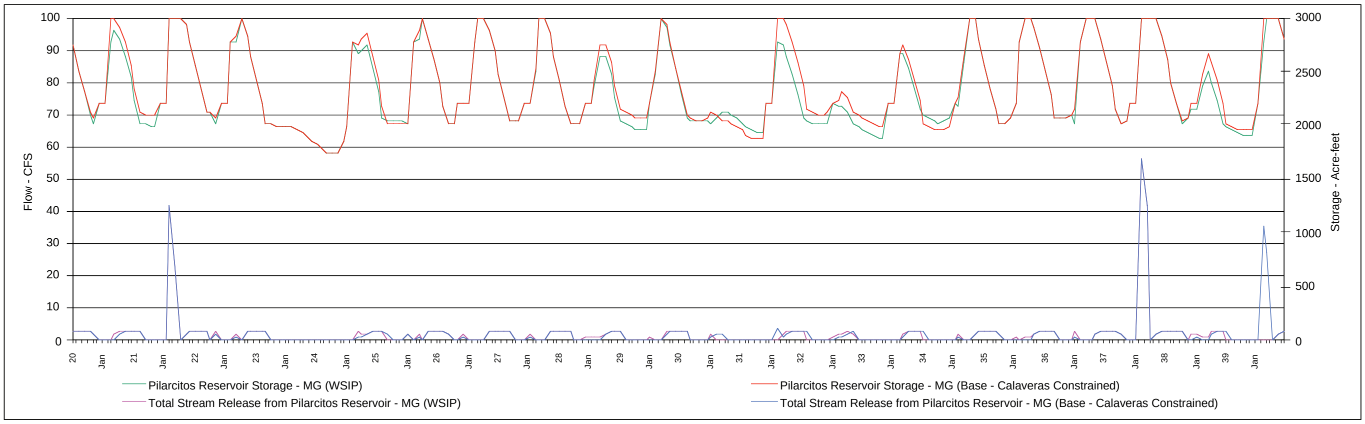
Under existing conditions and in most years, storage in Pilarcitos Reservoir becomes depleted by the late summer, and the only releases made to Pilarcitos Creek are the consequence of inflow from groundwater and tributary streams. Depletion of the reservoir in dry periods would occur earlier in the year with the WSIP.

Flow in Pilarcitos Creek between Pilarcitos Reservoir and Stone Dam

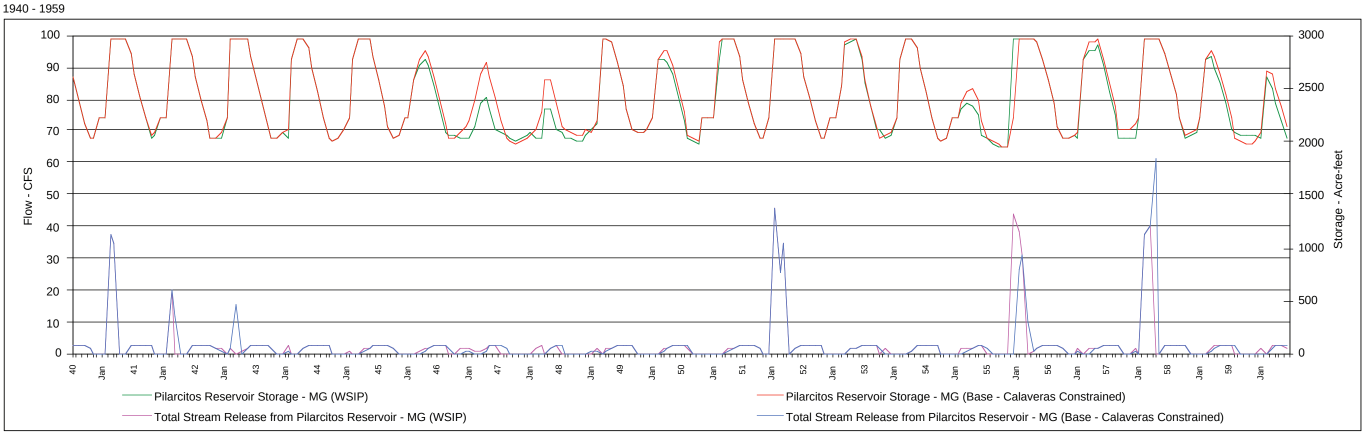
Releases to Pilarcitos Creek from Pilarcitos Reservoir under the existing condition and with the WSIP are shown in Figure 5.5.1-10. In normal, below normal, and dry years, the WSIP would have little or no effect on releases to Pilarcitos Creek from the reservoir. In average wet years and with the WSIP, releases would be reduced by about 6 percent. In average above normal years and with the WSIP, releases would be reduced by about 34 percent. The differences between releases under the existing condition and with the WSIP are shown in **Table 5.5.1-2** in every month for the period 1921 through 2002. Negative values indicate the months in which releases to the creek with the WSIP would be less than under the existing condition.

Under the existing condition, releases are typically made from Pilarcitos Reservoir to the creek to provide water to Coastside CWD, with the releases rising to the capacity of Coastside CWD's delivery pipeline in the summer when water demand is at its seasonal maximum. No releases are

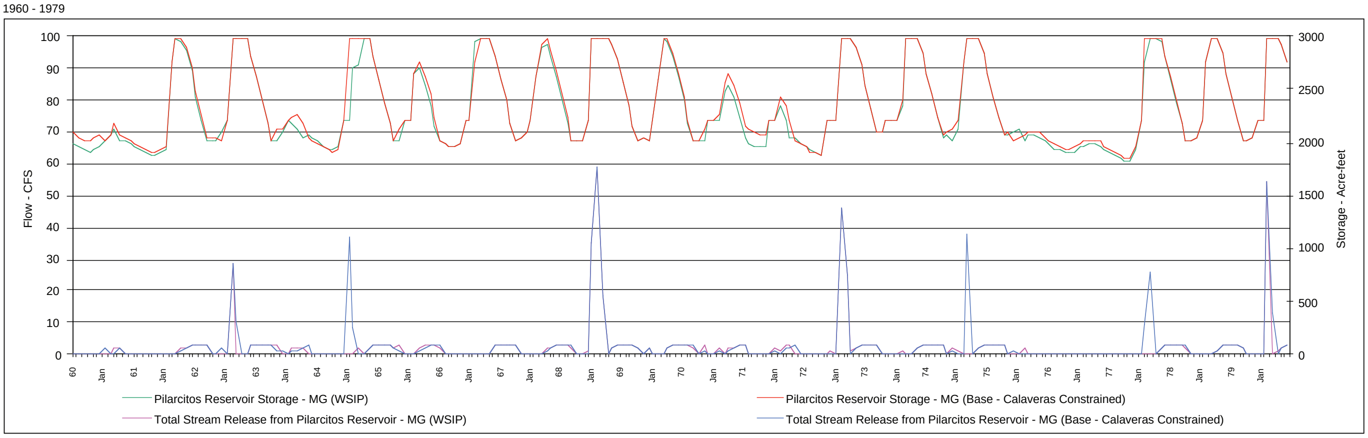
1920 - 1939



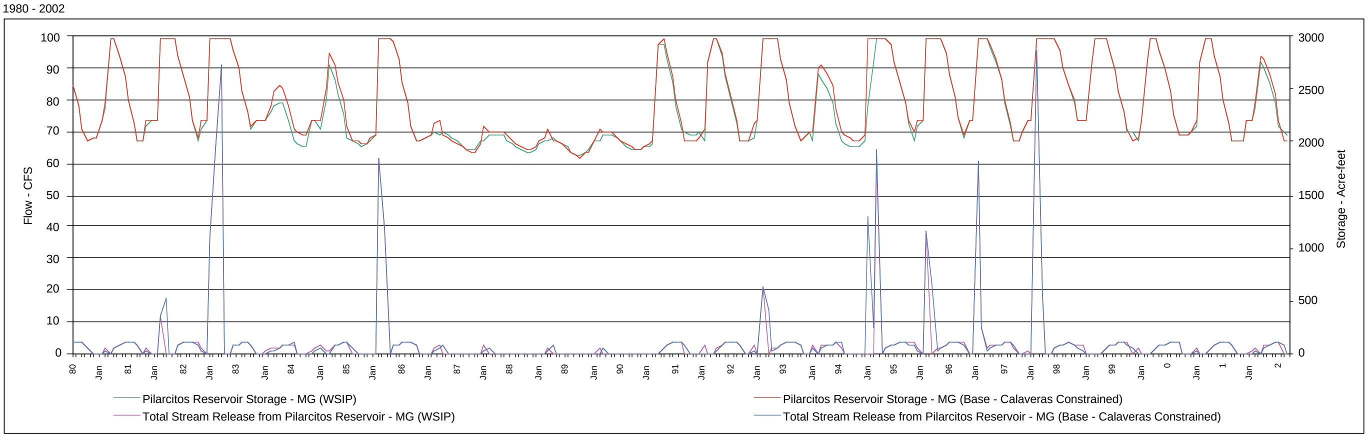
1940 - 1959



1960 - 1979



1980 - 2002



SOURCE: SFPUC, HH/LSM (see Appendix H)

SFPUC Water System Improvement Program . 203287

Figure 5.5.1-10 (New)
Pilarcitos Reservoir Storage and Stream Release

**TABLE 5.5.1-2 (New)
AVERAGE MONTHLY CHANGES IN PILARCITOS CREEK FLOW
BELOW PILARCITOS RESERVOIR ATTRIBUTABLE TO THE WSIP
(CUBIC FEET PER SECOND)**

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Year Type
1983	6	4	0	74	131	182	0	0	5	5	6	6	Wet
1998	0	0	2	0	192	37	0	0	3	5	5	6	Wet
1958	0	0	5	0	74	81	-62	0	5	6	6	6	Wet
1941	4	0	0	0	76	69	0	0	5	6	6	6	Wet
1982	0	4	0	0	23	-17	0	0	5	6	6	6	Wet
1995	0	0	0	-43	-8	118	0	2	4	5	6	6	Wet
1956	0	0	131	90	62	-10	3	4	5	6	6	6	Wet
1952	4	0	0	92	51	70	0	4	5	6	6	6	Wet
1938	4	0	0	0	112	84	0	3	5	6	6	6	Wet
1997	6	0	0	122	16	4	5	5	6	6	6	3	Wet
1969	0	0	3	70	119	37	1	4	5	6	6	6	Wet
1973	0	0	3	0	92	51	2	4	5	6	6	6	Wet
1986	0	0	0	0	123	79	0	4	5	6	6	6	Wet
1980	0	0	2	0	109	-13	2	4	5	6	6	6	Wet
1942	6	0	0	0	41	-12	0	0	5	6	6	6	Wet
1967	0	0	0	0	0	0	0	0	5	6	6	6	Wet
1963	0	0	-2	0	57	-10	0	0	5	6	6	6	AN
1940	0	0	0	0	-36	-27	0	4	5	6	6	6	AN
1965	0	0	0	-37	-9	5	0	4	5	6	6	6	AN
1996	6	7	4	0	77	-22	3	4	5	6	6	6	AN
1922	0	0	0	0	83	46	0	4	6	6	6	6	AN
1975	6	0	6	4	0	-38	0	3	5	6	6	6	AN
1974	0	2	0	0	4	0	0	3	5	6	6	6	AN
1978	0	0	0	0	-9	-26	0	4	5	6	6	6	AN
1993	0	0	7	0	43	-13	3	4	6	6	6	6	AN
1951	0	0	0	0	0	0	4	4	5	6	6	6	AN
1943	5	4	5	0	3	-16	1	4	5	6	6	6	AN
1927	0	0	4	0	0	0	0	5	6	6	6	6	AN
1937	0	0	0	8	0	0	0	4	6	6	6	6	AN
2000	6	-2	5	0	0	0	4	5	6	6	6	6	AN
1921	7	4	0	0	0	4	5	5	6	6	5	0	AN
1999	6	7	5	0	0	0	0	3	5	6	6	6	AN
1923	0	6	0	0	0	5	0	5	6	6	6	5	AN
1953	6	0	0	0	1	0	4	4	6	6	6	6	NORMAL
1928	0	0	1	4	1	0	0	5	6	6	6	5	NORMAL
1970	4	0	4	0	0	0	4	5	6	6	6	4	NORMAL
1984	6	0	0	2	4	4	4	4	6	4	0	0	NORMAL
1946	3	0	0	0	0	4	4	4	6	6	6	-2	NORMAL
1926	0	0	0	5	0	5	0	5	6	6	6	4	NORMAL
1936	3	0	0	2	0	2	2	4	6	6	6	6	NORMAL
1945	0	0	0	4	0	0	3	4	6	6	6	6	NORMAL
1971	0	7	0	0	5	2	4	5	6	6	0	0	NORMAL
1935	0	0	0	0	5	0	0	3	6	6	6	6	NORMAL
1932	0	0	0	0	-4	5	6	6	6	6	-3	0	NORMAL
1979	5	0	0	0	0	0	3	5	6	6	6	5	NORMAL
1962	0	0	0	0	0	0	5	5	6	6	6	5	NORMAL
1949	0	0	0	-1	4	0	3	4	6	6	6	6	NORMAL
1992	0	0	0	7	0	0	5	6	6	6	6	4	NORMAL
1981	3	0	0	0	4	0	4	5	6	6	6	4	NORMAL
2001	0	0	0	4	0	0	4	5	6	6	6	4	BN
1930	0	0	0	2	1	0	5	5	6	6	6	0	BN
1954	-2	6	0	0	0	0	3	5	6	6	6	6	BN
1968	5	0	0	0	0	2	4	5	6	6	6	4	BN
1959	6	0	0	0	0	5	5	5	6	6	-2	0	BN
1925	0	0	0	0	0	6	4	3	6	6	6	-2	BN
1944	4	0	0	6	0	0	4	5	6	6	6	6	BN
2002	0	0	0	0	4	0	5	5	6	6	-3	0	BN
1950	0	0	0	0	0	5	4	5	6	6	3	0	BN
1966	4	7	0	1	0	5	6	6	6	2	0	0	BN
1955	0	0	0	0	4	4	4	5	6	-2	0	0	BN
1957	4	0	0	5	0	4	4	3	6	6	6	6	BN
1934	0	0	1	0	0	5	6	6	6	-3	0	0	BN
1985	0	2	4	6	1	1	6	5	6	6	-2	0	BN
1991	0	0	0	0	0	0	5	6	6	6	6	-2	BN
1929	0	0	2	3	3	2	4	6	6	6	0	0	BN
1964	5	7	-1	0	5	6	5	-3	0	0	0	0	BN

TABLE 5.5.1-2 (New) (Continued)
AVERAGE MONTHLY CHANGES IN PILARCITOS CREEK FLOW BELOW PILARCITOS RESERVOIR ATTRIBUTABLE TO THE WSIP
(cubic feet per second)

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Year Type
1947	0	6	4	4	4	3	4	5	6	-3	-2	0	DRY
1994	4	0	0	6	0	6	5	5	6	2	0	0	DRY
1939	6	0	4	5	2	4	5	6	6	-2	0	0	DRY
1948	0	0	0	0	6	9	1	4	6	-3	0	0	DRY
1960	0	0	0	6	0	6	6	6	4	0	0	0	DRY
1972	0	0	1	5	3	7	6	-3	0	0	0	0	DRY
1933	0	0	0	2	5	5	5	3	0	0	0	0	DRY
1961	0	0	0	-2	0	5	3	0	0	0	0	0	DRY
1990	0	0	0	0	5	-1	0	0	0	0	0	0	DRY
1987	4	0	0	0	5	5	-2	0	0	0	0	0	DRY
1988	0	0	0	7	-1	0	0	0	0	0	0	0	DRY
1989	0	0	0	0	0	5	-2	0	0	0	0	0	DRY
1931	0	0	0	6	-1	-1	0	0	0	0	0	0	DRY
1976	6	0	-2	0	6	0	0	0	0	0	0	0	DRY
1977	0	0	0	0	0	0	0	0	0	0	0	0	DRY
1924	0	0	0	0	0	0	0	0	0	0	0	0	DRY

NOTES: Hydrologic year types were determined by rank ordering of total SFPUC Bay Area reservoir inflow.
Year Types: Wet, AN -- Above Normal, Normal, BN -- Below Normal, and Dry

SOURCE: SFPUC, HH/LSM (see Appendix H)

made if the runoff from tributary streams between Pilarcitos Reservoir and Stone Dam is sufficient to meet demand in the Coastside CWD service area, although spills from the reservoir may occur if it is full. With the WSIP, releases would follow the same seasonal pattern of water demand as under the existing condition, but the releases would be at the capacity of Coastside CWD's delivery pipeline more of the time in order to meet increased water demand in the Coastside CWD service area.

Under the existing condition during normal, below-normal, and dry years, storage in Pilarcitos Reservoir is routinely drawn down so far by late summer that the releases do not meet Coastside CWD's needs. During these times, Coastside CWD activates a pump and draws water from Crystal Springs Reservoir. This would occur more frequently in the future with the WSIP, given the expected increase in Coastside CWD's water demand.

Most runoff into Pilarcitos Reservoir occurs between November and April. In normal, above-normal, and wet years, when the reservoir is full and runoff exceeds the capacity of the diversion tunnels to San Andreas and Crystal Springs Reservoirs, or those reservoirs are full, the reservoir spills to Pilarcitos Creek.

As shown in Figure 5.5.1-10, the WSIP would not affect wintertime spills in most years, but it would reduce spills in some wet and above normal years. Occasionally (for example, under 1940, 1943, 1965 and 1976 hydrologic conditions), wintertime spills that occur under the existing condition would be completely or almost completely eliminated with the WSIP.

The WSIP would increase flow in Pilarcitos Creek immediately below Pilarcitos Reservoir in some late spring and summer months of most hydrologic year types as a result of increased releases from the reservoir to meet Coastside CWD's needs. The increases are shown as positive values in April, May, June and July in Table 5.5.1-2. In the summer months of some years, Pilarcitos Reservoir would become depleted earlier in the year with the WSIP than it does under the existing condition. Coastside CWD would activate its pumps and draw water from Crystal Springs Reservoir earlier in the year than it does under the existing condition. At such times, there would be no releases from Pilarcitos Reservoir to the creek except for dry season inflow to the reservoir. Flow in the creek below the reservoir would be the same as under the existing condition, consisting of inflow releases, seepage from the dam, infiltration from groundwater, and tributary flow. The period of minimal flow below Pilarcitos Reservoir would be extended with the WSIP, because the reservoir would be drawn down to its minimum elevation earlier in the year. Table 5.5.1-2 shows negative values in some years between May and September. These are months in which releases from Pilarcitos Reservoir occur under the existing condition but which would be reduced or eliminated under the WSIP.

Flow in Pilarcitos Creek Below Stone Dam

Under the existing condition, water occasionally spills over Stone Dam to Pilarcitos Creek. There is little flow in Pilarcitos Creek immediately below Stone Dam most of the time, and no flow in dry periods. Spills over Stone Dam occur when releases from Pilarcitos Reservoir and runoff into Pilarcitos Creek between the reservoir and Stone Dam exceed the capacity of the diversion at Stone Dam. Occasional spills over Stone Dam would continue under the WSIP. The volume of spills would be reduced by the additional amount of Pilarcitos Creek water the SFPUC supplies to Coastside CWD or diverts to its reservoirs in the San Mateo Creek watershed.

Spills at Stone Dam typically occur when Pilarcitos Reservoir is full, Coastside CWD's demand is met, and the SFPUC cannot transfer water to the San Mateo Creek watershed, either because available water in the Pilarcitos Creek watershed exceeds the capacity of the SFPUC's tunnels to San Andreas and Crystal Springs Reservoirs, or those reservoirs are already full. Spills very rarely occur in dry and below normal years under the existing condition and would very rarely occur with the WSIP. With the WSIP, average annual spills in wet, above normal and normal years would be reduced by about 11, 60, and 25 percent, respectively, compared to the existing condition.

Because most flow from the upper watershed of Pilarcitos Creek is diverted for municipal water supply, most of the flow in the creek below Stone Dam is supplied by runoff from the lower watershed. For example, in the four-month period between January and April of 1998 (a wet year), total measured flow in Pilarcitos Creek at Half Moon Bay, near the mouth of the creek, was about 32,300 acre-feet (equivalent to a continuous flow of 136 cfs). At a gage that records both spills at Stone Dam and flow in a Pilarcitos Creek tributary downstream of the dam, flow was measured at 10,500 acre-feet (equivalent to a continuous flow of 44.2 cfs) for the same period. Thus, spills in 1998 over Stone Dam represented less than one-third of total flow in Pilarcitos Creek.

Impact Conclusions

The WSIP would not alter the character of Pilarcitos Creek immediately below Stone Dam. Flow in the creek immediately below the dam is intermittent under the existing condition and would continue to be intermittent with the WSIP, so no adverse hydrologic effects would occur. With the WSIP, total spills to the creek immediately below Stone Dam would be reduced, but the magnitude of the flows in the lower reaches of the creek would be similar to those under existing conditions. Therefore, adverse impacts on water levels in Pilarcitos Reservoir and on flow along Pilarcitos Creek below Stone Dam would be *less than significant*, and no mitigation measures would be required.

Flow in Pilarcitos Creek immediately below Pilarcitos Reservoir would be the same or greater with the WSIP than under the existing condition most of the time. In dry periods and in the summer, releases to the creek from Pilarcitos Reservoir would be reduced to dry-season reservoir inflow at an earlier date than under the existing condition. The creek's character in the reach immediately below Pilarcitos Reservoir would not be altered from its existing condition. The creek experiences minimal flow in most summers under the existing condition and would continue to do so with the WSIP. Therefore, this impact would be *less than significant*, and no mitigation measures would be required.

References – Stream Flow and Reservoir Water Levels

Todd Engineers, *Lower Pilarcitos Creek Groundwater Basin Study*, 2003.

5.5.2 Geomorphology

The following setting section describes the geomorphology of the streams on the San Francisco Peninsula that could be affected by the WSIP. The impact section (Section 5.5.2.2) provides a description of the changes in stream channel form and erosion and siltation rates that would result from WSIP-induced changes in stream flow, as described in Section 5.5.1.

5.5.2.1 Setting

Geomorphology

The geomorphology of the SFPUC Peninsula watershed is defined by the San Andreas fault and its associated steep terrain, northwest-trending ridges and valleys, and ongoing uplifting and erosional processes. Fifield and Cahill Ridges divide the two principal watersheds, San Mateo Creek to the east and Pilarcitos Creek to the west. The San Mateo Creek watershed above Crystal Springs Dam is 22.5 square miles in size, in addition to the 4.4-square-mile watershed above San Andreas Reservoir. The Pilarcitos Creek watershed above Pilarcitos Reservoir is 3.8 square miles.

San Mateo Creek below Crystal Springs Dam initially flows eastward through a steep canyon for about 1.5 miles, then enters the broad, gently sloping lands surrounding San Francisco Bay. The canyon itself is rather narrow, but contains several alluvial terraces for most of its length. In the canyon, San Mateo Creek has a 1 percent slope. It passes through Franciscan Complex sandstone and some serpentine, then through the Colma Formation, a Pleistocene formation of marine and nonmarine sands and clays, and the recent Temescal Formation, which is composed primarily of fine-textured sand. The channel in San Mateo Creek canyon is primarily riffle and pool. The creek channel is comparatively deep and broad for the current flow due to the high historical unimpaired flows. The channel bed is composed primarily of sand and silt, with some gravel deposits. Below the canyon, San Mateo Creek is a meandering channel with a slope of about 0.25 percent. This reach of the creek has been highly modified and constrained by urbanization. The creek flows through several culverts before discharging to San Francisco Bay.

Above Crystal Springs Dam, San Andreas Creek empties into San Andreas Reservoir. Its natural course below the dam follows a straight, narrow valley along the San Andreas fault southeasterly into Lower Crystal Springs Reservoir. San Mateo Creek itself originates to the southwest, in the steep country between Fifield and Sawyer Ridges. It follows a relatively straight course for nearly eight miles before emptying into Lower Crystal Springs Reservoir. The creek's slope varies from about 1 percent in the upper reaches and about 2 percent in the narrow canyon before it enters the reservoir. From the southeast, Laguna Creek is the principal tributary to Upper Crystal Springs Reservoir, which is connected via culverts with Lower Crystal Springs Reservoir. Rainfall within the watershed ranges from about 30 to 40 inches per year (USDA, 1961).

The northern portion of the upper San Mateo Creek watershed is steep and rugged. Like the Pilarcitos Creek watershed, average hillslope gradients range from 3:1 to 1:1 (horizontal to vertical ratio), while the southern portion of the watershed has average gradients ranging from

5:1 to 3:1 (San Francisco Planning Department, 2001). The San Andreas Creek and San Mateo Creek watersheds are composed of Franciscan Complex sedimentary and metamorphic rocks. Sandstone, shale, chert, and conglomerate marine deposits are predominant to the southwest of the San Andreas fault, while metamorphosed Franciscan rock, such as serpentine, is widespread on the northeastern side of the fault. The watershed surrounding Upper Crystal Springs Reservoir is composed of Butano Formation, Eocene marine sedimentary rocks such as fine-textured sandstones and shale (Jennings and Burnett, 1961).

Sediment transport thresholds and rates have not been monitored or evaluated in these reaches. No sediment transport data have been quantified for these watersheds. However, the steep slopes are inherently highly erodible, and natural landslides are an important landscape-forming influence. This watershed has been unaffected by livestock grazing and wildfire for many decades. The SFPUC has constructed and maintains a system of sediment catchment basins around the reservoirs to capture the incoming sediment.

Pilarcitos Creek originates in between Fifield Ridge and the western Coast Ranges. It follows the Pilarcitos fault, parallel to and west of the San Andreas fault. Three unnamed tributaries flow into Pilarcitos Reservoir through relatively low-gradient valleys consisting of Farallone coarse sandy loam. Below the reservoir, Pilarcitos Creek flows in a southeasterly direction past Stone Dam, eventually emptying into the Pacific Ocean near Half Moon Bay. The upper reaches above Pilarcitos Reservoir are composed of Franciscan Complex volcanic, metavolcanic (metamorphosed volcanic rock), and sedimentary Cretaceous rock. Below the dam, Mesozoic granite underlies the western side of the creek, and Franciscan Complex bedrock underlies the eastern side (Jennings and Burnett, 1961). The corresponding soils are Hugo and Josephine loam and Sheridan coarse sandy loam.

Slopes in the Pilarcitos Creek watershed have average gradients ranging from 3:1 to 1:1 (San Francisco Planning Department, 2001). The slopes in the canyon below Pilarcitos Dam are extremely steep. For about a mile downstream from Pilarcitos Dam, Pilarcitos Creek has a slope of about 1 percent. Soils are mapped as a gravelly substrate with no further classification (USDA, 1961). There is very little terracing in the narrow valley, and bedrock is frequently exposed. Average annual rainfall is 45 inches at Pilarcitos Reservoir, and the typical five-year storm brings 3.6 inches of rainfall in 24 hours (USDA, 1961).

5.5.2.2 Impacts

Significance Criteria

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

- Substantially change the topography such that ecological, hydrologic, or aesthetic functions are adversely affected, or substantially change any unique geologic or physical features of the site or area

- Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of the stream or river, in a manner that would result in substantial erosion or siltation or adversely affect the ecological, hydrologic, or aesthetic functions of the site or area

Although the "substantial change in topography" criterion is typically applied to upland areas, it is considered applicable to stream channel/bank topography in this instance because of the sensitivity of the resources that depend on the topography of these features (i.e., riparian vegetation and fisheries). For a stream channel, the relevant aspect of topography to be evaluated are those associated with channel form and the related movement and distribution of sediment.

Approach to Analysis

This impact section presents a discussion of projected changes in sediment transport and geomorphology based on changes in stream flow, reservoir storage, and related reservoir water levels that would result from WSIP implementation, as described in Section 5.5.1. A qualitative assessment of potential effects was conducted based on generalized channel bed/bank characteristics and consideration of proposed changes in stream flow that would result from implementation of the WSIP.

Impact Summary

Table 5.5.2-1 presents a summary of the impacts on sediment transport and geomorphology in the Peninsula watershed that could result from implementation of the proposed water supply and system operations.

TABLE 5.5.2-1
SUMMARY OF IMPACTS – GEOMORPHOLOGY
OF SAN FRANCISCO PENINSULA STREAMS AND RESERVOIRS

Impact	Significance Determination
Impact 5.5.2-1: Changes in sediment transport and channel morphology in the Peninsula watershed	LS

LS = Less than Significant impact, no mitigation required

Impact Discussion

Impact 5.5.2-1: Changes in sediment transport and channel morphology in the Peninsula watershed.

Changes in storage and water levels in reservoirs in the San Mateo Creek watershed attributable to the WSIP were estimated using the HH/LSM. An overview of the model is presented in Section 5.1. Detailed information on the model and the assumptions that underlie it is provided in Appendix H. Changes in stream flow and reservoir storage and water levels in the Pilarcitos

Creek watershed attributable to the WSIP were estimated semi-quantitatively by reviewing historical data and consulting with individuals knowledgeable about past and expected future reservoir operations.

Releases to San Mateo Creek downstream of Lower Crystal Springs Dam are expected to be approximately the same with the WSIP as they are under the existing condition. Thus, the WSIP would have no effect on channel-forming events and sediment transport in this already highly impaired creek.

Implementation of the WSIP would also result in higher average reservoir levels in Upper and Lower Crystal Springs Reservoirs, which in turn would cause tributary streams to deposit their sediment at correspondingly higher elevations. The amount of incoming sediment would not be affected. The reservoir level at San Andreas Reservoir is projected to change very little, so no impact on sediment transport and channel morphology would occur, even at the mouths of tributary streams.

Increased releases from Pilarcitos Reservoir into Pilarcitos Creek in most spring and early summer months would increase sediment transport and channel-forming processes in the creek compared to the existing condition. The projected lower flows in the summer months of dry years would reduce sediment transport and channel-forming processes compared to the existing condition. Both the increases and decreases in sediment transport would be small and relatively inconsequential, because channel form is largely a function of the magnitude and frequency of occasional large winter flows, which would not be affected by the WSIP.

Under the WSIP, spills over Stone Dam in the wet months of above-normal and wet years would be reduced in frequency and magnitude. This could in turn reduce sediment movement and channel-forming processes in the reach of Pilarcitos Creek immediately below the dam, but with decreasing effect in a downstream direction as tributaries add flow to the creek.

WSIP-induced changes in flow in San Mateo and Pilarcitos Creeks and the changes in reservoir level in Pilarcitos, San Andreas, and Upper and Lower Crystal Springs Reservoirs would result in small incremental reductions or no change in sediment transport and channel-forming processes.

The projected changes in flow would result in insignificant changes in topography, drainage patterns, erosion, and siltation in and away from the creeks and reservoirs in the Peninsula watershed. Therefore, impacts on fluvial geomorphologic characteristics in the Peninsula watershed would be *less than significant*, and no mitigation is required.

References – Geomorphology

Jennings, Charles W. and John Burnett, *Geologic Map of California, San Francisco Sheet*, California Department of Natural Resources, Sacramento, 1961.

San Francisco Planning Department, *Peninsula Watershed Management Plan EIR*, prepared by Environmental Science Associates for the San Francisco Planning Department, 2001.

U.S. Department of Agriculture (USDA), *Soil Survey, San Mateo Area*, 1961.

5.5.3 Surface Water Quality

The following setting section describes surface water quality in streams and reservoirs on the San Francisco Peninsula that could be affected by the WSIP. The impact section (Section 5.5.3.2) provides a description of the changes in water quality in streams and reservoirs that would result from WSIP-induced changes in stream flow and reservoir water levels.

5.5.3.1 Setting

The SFPUC operates four reservoirs on the Peninsula: the Pilarcitos, Upper and Lower Crystal Springs, and San Andreas Reservoirs. The Upper and Lower Crystal Springs Reservoirs function as a single water body. The WSIP could affect water quality in the reservoirs. Water quality in two streams on the San Francisco Peninsula could also be affected by the WSIP. They are San Mateo Creek and Pilarcitos Creek, both of which rise in the Coast Range mountains. San Mateo Creek, and its tributary San Andreas Creek, flow southward in the rift valley formed by the San Andreas fault and then turn east, flowing to San Francisco Bay. Pilarcitos Creek also flows southward, but it turns to the west and flows to the Pacific Ocean.

Crystal Springs Reservoir, San Andreas Reservoir, and San Mateo Creek

Water quality in San Andreas and Crystals Springs Reservoirs reflects that of its sources—local runoff, Alameda Creek, Pilarcitos Creek, and the Tuolumne River. Because the Tuolumne River is the source of most of the water, it is the predominant influence on water quality in the reservoirs. Water quality is generally very good, exhibiting low concentrations of total dissolved solids and plant nutrients (nitrates and phosphates).

Crystal Springs Reservoir stratifies in the summer months; that is, the upper part of the reservoir (the “epilimnion”) warms, while water in the lower part of the reservoir (the “hypolimnion”) remains cool. The dividing line between the two zones is called the thermocline and is typically 25 to 50 feet below the surface of the reservoir. The two zones do not mix, and water in the hypolimnion becomes depleted of oxygen. As air temperatures drop in the fall and water in the epilimnion cools, the reservoir “turns over.” The reservoir then destratifies and water in the two zones mixes.

Although nutrient concentrations in the reservoirs are low, they are sufficient to support the growth of algae in the summer months. Algae in a water source can make water treatment more difficult and cause taste and odor problems with finished water. In 2005, the SFPUC changed the method it uses to disinfect water in order to comply with drinking water standards. Formerly, the SFPUC disinfected water with chlorine; now it uses chloramine, a chemical compound that contains both chlorine and ammonia. Ammonia is a form of nitrogen that rapidly decomposes in natural waters to another form of nitrogen called nitrate. Past studies have shown that the growth of algae in Crystal Springs Reservoir is limited by a lack of nitrogen and phosphorus, both of which are plant nutrients; therefore, an increase in the concentration of either could increase the growth of algae. To avoid the discharge of nitrogen and the possible consequent increase in algae concentration in Crystal Springs Reservoir, the SFPUC constructed dechloramination facilities at the same time it constructed chloramination facilities. The dechloramination facilities completely remove the chlorine and remove most of the ammonia from water before it is discharged to Crystal Springs Reservoir. The use of chloramine as a disinfectant has resulted in a small increase in the concentration of nitrate in Crystal Springs Reservoir (SFPUC, 2006).

When Lower Crystal Springs Reservoir spills, water quality in San Mateo Creek is very similar to reservoir water quality. However, most of the time, when creek flow immediately below Lower Crystal Springs Dam consists of seepage from the dam and inflow from the ground, the quality of water in the creek is lower than that in the reservoir. **Table 5.5.3-1** shows water quality at three locations along San Mateo Creek below Lower Crystal Springs Dam as measured between May 2003 and February 2004. Water quality at the Polhemus sampling station 0.7 mile below Lower Crystal Springs Dam was generally good, with a total dissolved solids concentration in the range 124 to 211 milligrams per liter (mg/L) and dissolved oxygen concentrations at or near saturation. Water quality deteriorated as San Mateo Creek flowed through the urban areas to San Francisco Bay. Total dissolved solids concentrations at the Gateway Park station, 5.1 miles downstream of Crystal Springs Dam, were in the range of 332 to 427 mg/L, except on one occasion when sampling results were affected by the tide. Late-summer and fall dissolved oxygen concentrations were at about 50 percent saturation.

Pilarcitos Reservoir and Pilarcitos Creek

Water quality in Pilarcitos Reservoir is good because the Pilarcitos Creek watershed above the reservoir is largely undeveloped. Plant nutrient concentrations in Pilarcitos Reservoir water are low, but 50 to 100 percent greater than in the water stored in the San Andreas and Crystal Springs Reservoirs. Summertime algae concentrations in Pilarcitos Reservoir are also greater than those in Crystal Springs and San Andreas Reservoirs.

Like Crystal Springs Reservoir, Pilarcitos Reservoir stratifies in the summer months. Water in the bottom part of the reservoir becomes depleted of oxygen.

Beneficial Uses and Water Quality Objectives

Pursuant to the federal Clean Water Act and the Porter-Cologne Water Quality Control Act, the San Francisco Bay Regional Water Quality Control Board has designated beneficial uses that Crystal Springs, San Andreas, and Pilarcitos Reservoirs and San Mateo and Pilarcitos Creeks must support. Designated existing beneficial uses for Crystal Springs, San Andreas, and Pilarcitos Reservoirs are municipal and domestic water supply (MUN), non-water-contact recreation (REC-2), cold freshwater habitat (COLD), warm freshwater habitat (WARM), fish spawning (SPWN), wildlife habitat (WILD), and rare and endangered species (RARE). Pilarcitos Reservoir is listed as having water-contact recreation as a limited beneficial use.

Existing designated beneficial uses for San Mateo Creek are freshwater replenishment (FRSH), SPWN, and RARE. Potential beneficial uses of San Mateo Creek are water contact recreation (REC-1), REC-2, and COLD. Current designated beneficial uses of Pilarcitos Creek are agricultural water supply (AGR), MUN, COLD, WARM, SPWN, RARE, WILD, and migration of aquatic organisms (MGR). Potential designated uses of Pilarcitos Creek are REC-1 and REC-2.

TABLE 5.5.3-1
WATER QUALITY IN SAN MATEO CREEK BELOW CRYSTAL SPRINGS RESERVOIR

Water Quality Parameter (Median Values)	Monitoring Station		
	Polhemus	**Arroyo Court Park**	**Gateway Park**
Distance downstream of Crystal Spring Dam, miles	0.7	4.2	5.1
Median Electrical Conductivity, µS/cm (total dissolved solids, mg/L)			
May 2003	230 (133)	514 (298)	607 (352)
Aug 2003	214 (124)	551 (320)	737 (427)
Oct 2003	183 (106)	493 (286)	27,600 (16,000)[a]
Feb 2004	364 (211)	681 (395)	572 (332)
Dissolved Oxygen, mg/L (% of saturation)			
May 2003	10.8 (101%)	5.5 (52%)	9.5 (91%)
Aug 2003	7.9 (85%)	7.2 (76%)	3.8 (43%)
Oct 2003	8.2 (83%)	9.4 (92%)	4.3 (46%)
Feb 2004	10.4 (91%)	11.8 (102%)	10.8 (93%)
Temperature, °C			
May 2003	13	13	13
Aug 2003	19	18	19
Oct 2003	16	15	16
Feb 2004	9	9	9

[a] This measurement was influenced by the tidal incursion of saline water.
°C = degrees Celsius
mg/L = milligrams per liter
µS/cm = microsiemens per centimeter

SOURCE: SFPUC, 2004.

Prior to being discharged into Upper Crystal Springs Reservoir, Hetch Hetchy system water that has been disinfected with chloramine is treated to remove chlorine and ammonia and to adjust its pH. Chloramine contains chlorine and ammonia, both of which are toxic to aquatic organisms. The Regional Water Quality Control Board has established a discharge limit of 0.0 mg/L for chlorine residual, which includes both free chlorine[1] and chloramine. In order to meet this limit, the SFPUC neutralizes the chloramine residual in Hetch Hetchy water before it is discharged to the two reservoirs, thus eliminating toxicity to aquatic life. However, some residual ammonia remains after neutralization (SFPUC, 2006).

1 Free chlorine consists of a compound, hypochlorous acid, and the hypochlorite ion, both of which form when chlorine gas is added to water.

Unlike chlorine, ammonia is regulated as a water quality objective for receiving waters. Ammonia exists in two forms in water: un-ionized and ionized forms. Un-ionized ammonia is toxic, whereas its ionized form is relatively harmless. The water quality objective for ammonia is specified as un-ionized ammonia (the toxic form), and the water quality objective of 0.40 mg/L of un-ionized ammonia as nitrogen applies. The relative concentration of the two forms of ammonia depends on the pH and temperature of the water. The un-ionized (toxic) form increases as the temperature and pH increase. In the temperature and pH range of natural waters, the nontoxic form of ammonia predominates; in most instances, ammonia in discharges is diluted or degraded to a nontoxic form fairly rapidly. In the SFPUC water supply, the maximum total ammonia concentration before dechloramination is about 0.5 mg/L. When added to Crystal Springs Reservoir under typical receiving-water conditions (pH = 8.5, and water temperature = 24 °C), the maximum resulting concentration of un-ionized ammonia would be about 0.07 mg/L, which is well below the objective of 0.40 mg/L. However, because water is dechloraminated prior to discharge into the reservoir, the actual concentrations of un-ionized ammonia would be close to zero.

5.5.3.2 Impacts

Significance Criteria

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

- Substantially impair a water body's ability to support beneficial uses designated by the State Water Resources Control Board or Regional Water Quality Control Board
- Otherwise substantially degrade water quality

Approach to Analysis

Changes in reservoir storage and water levels in the San Mateo Creek watershed and changes in reservoir storage, water levels and stream flows in the Pilarcitos Creek watershed attributable to the WSIP were estimated using the HH/LSM. An overview of the model is presented in Section 5.1. Detailed information on the model and the assumptions that underlie it are provided in Appendix H. Changes in stream flows in the San Mateo Creek watershed attributable to the WSIP were estimated semi-quantitatively in consultation with individuals knowledgeable about historical, current, and expected future (with-WSIP) water system operations.

Impact Summary

Table 5.5.3-2 presents a summary of the impacts on the water quality of Peninsula watershed streams and reservoirs that could result from implementation of the proposed water supply and system operations.

TABLE 5.5.3-2
SUMMARY OF IMPACTS – WATER QUALITY
OF SAN FRANCISCO PENINSULA STREAMS AND RESERVOIRS

Impact	Significance Determination
Impact 5.5.3-1: Effects on water quality in Crystal Springs Reservoir, San Andreas Reservoir, and San Mateo Creek	LS
Impact 5.5.3-2: Effects on water quality in Pilarcitos Reservoir and along Pilarcitos Creek	PSM

LS = Less than Significant impact, no mitigation required
PSM = Potentially Significant impact, can be mitigated to less than significant

Impact Discussion

Impact 5.5.3-1: Effects on water quality in Crystal Springs Reservoir, San Andreas Reservoir, and San Mateo Creek.

Crystal Springs and San Andreas Reservoirs

The proposed program would affect water quality in Crystal Springs and San Andreas Reservoirs. Average monthly storage would increase in Crystal Springs Reservoir by 5 to 10 percent. The reservoir would capture more local runoff and hold more water from the Hetch Hetchy system. However, the proportions of local runoff and Hetch Hetchy water in the reservoir with the WSIP would remain about the same most of the time compared to existing conditions.

It is possible, however, that with the WSIP the proportion of Hetch Hetchy water in Crystal Springs Reservoir could increase at times relative to existing conditions, particularly in the winter. An increase in the proportion of Hetch Hetchy water, which is disinfected with chloramine, would increase the concentration of nitrogen to the reservoir. Although the SFPUC removes chlorine and ammonia, the constituents of chloramine, from Hetch Hetchy water before it is discharged into Crystal Springs Reservoir, the removal of ammonia is not complete, and so some nitrogen is added to the reservoir. As noted earlier, the nitrate concentration has risen in Crystal Springs Reservoir waters since chloramine disinfection was initiated. If the proportion of Hetch Hetchy water placed in Crystal Springs Reservoir increased as a result of the WSIP, then the rate of discharge of nitrogen into the reservoir would also increase. The increase in nitrogen concentration in the reservoir would have the potential to increase the growth of algae.

The increase in storage and water level in Upper Crystal Springs Reservoir could increase the stability of thermal stratification. The increase in storage would be a result of restored capacity in Crystal Springs Reservoir and improvements to the conveyance components of the Hetch Hetchy system that would enable the SFPUC to refill local reservoirs with Tuolumne River water more reliably than under the existing condition. More stable thermal stratification combined with the input of oxygen-demanding substances associated with chloramination and dechloramination could deplete oxygen levels below the thermocline to a greater degree than under existing conditions. Under oxygen-depleted conditions, nutrients are released from the sediments at the bottom of the reservoir. If the proposed program increased the volume of oxygen-depleted water at the bottom of the reservoir, it could increase the release of phosphorus. Increased release of phosphorus and increased phosphorus concentrations in reservoir water would have the potential to increase the growth of algae.

Studies completed over the last several years indicate that the growth of algae in Crystal Springs Reservoir has historically been limited by both nitrogen and phosphorus concentrations. After the SFPUC began disinfecting Hetch Hetchy water with chloramine, the nitrogen concentration in the reservoir increased, and the concentration of phosphorus in reservoir water became the factor limiting the growth of algae. Thus, the addition of more nitrogen as a result of a WSIP-induced increase in the proportion of Hetch Hetchy water in Crystal Springs Reservoir would not alone increase the growth of algae. Increased phosphorus concentrations in the reservoir as a result of the more stable thermal stratification induced by the WSIP would increase the growth of algae.

The WSIP would have very little effect on average monthly storage in San Andreas Reservoir. The proportion of local runoff and Hetch Hetchy water is expected to remain the same as under existing conditions.

The WSIP could have a minor effect on water quality in Crystal Springs Reservoir and a negligible effect on water quality in San Andreas Reservoir. Any water quality changes would be too small to affect beneficial uses. If water quality changes in Upper Crystal Springs Reservoir resulted in increased growth of algae, water treatment could become more difficult and expensive. Adverse impacts of the WSIP on water quality in Crystal Springs and San Andreas Reservoirs would be less than significant, and no mitigation is required.

San Mateo Creek

Most of the time, flow in San Mateo Creek immediately below Lower Crystal Springs Dam is very low and consists of seepage through and around the dam. Occasionally, in wet months of wet and above-normal years, the SFPUC releases water to the creek from the dam. The creek then gains water from tributaries, groundwater, and urban runoff as it flows to San Francisco Bay. Water quality is good immediately below the dam and deteriorates in a downstream direction.

Under current conditions, the releases from Crystal Springs Reservoir in the winter and spring months of wet and above-normal years probably affect water quality in San Mateo Creek in two ways. The releases have a direct and beneficial effect on water quality during the releases themselves because a higher proportion of stream flow consists of high-quality Crystal Springs Reservoir water. The second effect of the releases is to contribute to periodic large "flushing flows" that serve to wash debris and accumulated organic matter out of the stream and into San Francisco Bay. In California's Mediterranean climate, leaves, lawn clippings, and the detritus of urban life tend to accumulate in the beds of urban streams during the dry summer months. The accumulated organic matter has an adverse effect on water quality, depleting the dissolved oxygen content of stream water and producing plant nutrients. Wintertime flushing flows remove some of the organic matter, reducing its ability to adversely affect water quality.

Under current conditions, releases of high-quality Crystal Springs Reservoir water occur about 10 percent of the time, with beneficial effects on creek water quality. With the WSIP, releases would also occur about 10 percent of the time and at about the same magnitude. Water quality in the creek would be improved by the releases, as it is under the current condition.

Impact Summary

Overall, impacts of the WSIP on water quality in Crystal Springs and San Andreas Reservoirs and in San Mateo Creek would be *less than significant*, and no mitigation is required.

Impact 5.5.3-2: Effects on water quality in Pilarcitos Reservoir and along Pilarcitos Creek.

Pilarcitos Reservoir

Figure 5.5.1-6 shows recent past storage levels in Pilarcitos Reservoir from 1998 to 2006. Under the existing condition, the reservoir is drawn down through the summer, reaching minimum storage in October and November, just before the rainy season begins. With the WSIP, drawdown would occur more rapidly in some years. The more rapid drawdown attributable to the proposed program could cause the reservoir to destratify earlier than under existing conditions. This would not adversely affect water quality; in fact, mechanical destratification in the fall has been recommended to the SFPUC as a means of improving water quality (SFPUC, 2002).

One of the beneficial uses of Pilarcitos Reservoir is cold freshwater habitat (COLD). Because water is released from Pilarcitos Reservoir near the surface, a pool of cool water is retained through the summer near the bottom of the reservoir and below the lowest release point. Under the WSIP, the volume of the pool of cool water below the thermocline would be reduced compared to the existing condition, but would never be exhausted (for the reason noted above). However, the ability of Pilarcitos Reservoir to support the COLD beneficial use under the WSIP could be reduced. This impact would be potentially significant.

Pilarcitos Creek Between Pilarcitos Reservoir and Stone Dam

The WSIP could affect water quality in Pilarcitos Creek between Pilarcitos Reservoir and Stone Dam in two ways – by altering the quality of water released from Pilarcitos Reservoir to the creek and by altering flow in the creek. As discussed above, with the WSIP in place, the volume of the pool of cool water in Pilarcitos Reservoir below the thermocline would be reduced earlier in the year in some years compared to the existing condition, but the quality of water released to Pilarcitos Creek from the reservoir would change little.

The WSIP would increase flow in this reach of the creek in most spring and summer months compared to the existing condition because larger volumes of water would be released from Pilarcitos Reservoir to meet the Coastside CWD's water demand. This increased flow would generally have a beneficial effect on water quality, because water temperature in the spring and summer months would not rise as rapidly in the stream as it flows from the foot of Pilarcitos Dam to Stone Dam as it does under the existing condition. On the other hand, during dry years the

WSIP would extend the period in which no releases are made from Pilarcitos Reservoir to Pilarcitos Creek compared to the existing condition. This is because increased releases to meet Coastside's demand would deplete storage in Pilarcitos Reservoir earlier than under the existing condition. Water quality in the reach of Pilacitos Creek between Pilarcitos Reservoir and Stone Dam could deteriorate as a result. Creek flow would consist only of seepage from Pilarcitos Reservoir, groundwater infiltration, and tributary flow, none of which would be expected to contribute much water to the stream during the summer of a dry year for a longer period with the WSIP than under the existing condition. Water in the creek immediately below Pilarcitos Reservoir at such times could be reduced to isolated pools. Water temperature in the pools could rise, although the extensive vegetative cover in this reach of the creek would likely limit the potential for any such increase.

The proposed program would also reduce flow in Pilarcitos Creek between Pilarcitos Reservoir and Stone Dam in wet months of some wet years. It is not expected that the wet-year flow reductions would have an adverse effect on water quality in the stream because, during the winter, water in the creek would be cool and well oxygenated.

Two of the beneficial uses of Pilarcitos Creek are cold freshwater habitat (COLD) and migration of aquatic organisms (MGR). The MGR beneficial use cannot currently be supported in Pilarcitos Creek above Stone Dam because the dam prevents fish passage. The WSIP would extend the period in which releases from Pilarcitos Reservoir would be eliminated in the summer of dry years, which would degrade water quality in the creek between the reservoir and Stone Dam and reduce the creek's ability to support the COLD beneficial use. This impact would be potentially significant.

Pilarcitos Creek Below Stone Dam

The proposed program would have no effect on flow in Pilarcitos Creek below Stone Dam in dry and below-normal years, and consequently would have no effect on water quality in those hydrologic year types. There is no flow in the creek immediately below Stone Dam in dry and below-normal years under existing conditions, and there would be no flow with the proposed program.

With the WSIP, less water would pass over Stone Dam in winters of wet, above normal, and normal years than it does under the existing condition. It is unlikely that the reductions in spill over Stone Dam would have much effect on water quality in Pilarcitos Creek below Stone Dam. The reductions in spills would occur in months of wet, above normal, and normal years when runoff from the Pilarcitos Creek watershed below Stone Dam would be high. For this reason, the effect of the flow reductions on water quality in the creek below Stone Dam would be minor.

Two of the beneficial uses of Pilarcitos Creek are cold freshwater habitat (COLD) and migration of aquatic organisms (MGR). Because the proposed program would have little effect on water quality in Pilarcitos Creek below Stone Dam, impacts on water quality in Pilarcitos Creek below Stone Dam would be less than significant.

Impact Summary

The adverse impacts of the WSIP on water quality along Pilarcitos Creek between Pilarcitos Reservoir and Stone Dam would be *potentially significant*; however implementation of Measure 5.5.3-2a Low-head Pumping Station at Pilarcitos Reservoir, would restore flow to this reach of Pilarcitos Creek in the late summer and reduce the impact to a less than significant level.

The adverse impacts of the WSIP on water quality in Pilarcitos Reservoir would also be potentially significant. Furthermore, Measure 5.5.3-2a, Low-head Pumping Station at Pilarcitos Reservoir, would exacerbate adverse impacts on water quality at the reservoir by lowering the water level in some summers. Implementation of Measure 5.5.3-2b, Aeration System at Pilarcitos Reservoir, would improve water quality and reduce impacts in the reservoir to a less than significant level.

References – Surface Water Quality

San Francisco Public Utilities Commission (SFPUC), *Reservoir Water Quality Management Plans*, prepared for the SPFUC by Merritt Smith Consulting in cooperation with Malcom Pirnie, Olivia Chen Consultants, Water Resources Engineering, Inc., and Alex Horne Associates, March 2002.

San Francisco Public Utilities Commission (SFPUC), unpublished, Water Quality Monitoring Data for San Mateo Creek Watershed, 2004.

San Francisco Public Utilities Commission (SFPUC), *Water Quality Investigation and Assessment: Impacts of Chloramination and Associated Water Quality Implications at Crystal Springs*, prepared by Merritt Smith Consulting, 2006.

5.5.4 Groundwater

The following setting section identifies groundwater bodies in the Peninsula watershed that could be affected by the WSIP. The impact section (Section 5.5.4.2) provides a description of the changes in groundwater levels and quality that would result from WSIP-induced changes in stream flow.

5.5.4.1 Setting

The upper reaches of the San Mateo and Pilarcitos Creek watersheds are composed primarily of non-water-bearing igneous, metamorphic, and sedimentary rocks, together with recent alluvium and colluvium.[1] The main groundwater-bearing units associated with San Mateo and Pilarcitos Creeks are in their lower watersheds. Groundwaters in the lower San Mateo Creek watershed are not used for municipal water supply. Groundwaters in the lower Pilarcitos Creek provide a portion of Coastside CWD's municipal supply (Coastside CWD, 2005).

Within the lower Pilarcitos Creek watershed, the main water-bearing units are the marine terrace deposits, which are sand and gravel deposits ranging from 30 to 60 feet thick. The aquifer is bounded on the east by bedrock and on the west by the Pacific Ocean, and is underlain by the relatively impermeable Purisima Formation. Within this groundwater basin, flow is from east to west, discharging to the ocean. Total aquifer storage is estimated at 10,600 acre-feet (Todd Engineers, 2003). Percolation of Pilarcitos Creek flow is an important part of overall local aquifer recharge.

Groundwater quality is of concern in the lower Pilarcitos Creek groundwater basin, especially with respect to iron and manganese; in addition, the water is hard. Seawater intrusion is not considered a problem in the basin, but slightly elevated salt contents were probably incorporated into the aquifer during its formation. A summary of local groundwater quality is presented in **Table 5.5.4-1**; the table provides an average from a sampling program of five wells in the lower Pilarcitos Creek groundwater basin.

5.5.4.2 Impacts

Significance Criteria

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

- 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)

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

TABLE 5.5.4-1
SUMMARY OF GROUNDWATER QUALITY PARAMETERS, LOWER PILARCITOS CREEK BASIN

Parameter	Average Value (mg/L, unless otherwise noted)
Total Hardness	228
Alkalinity	184
pH Units	6.9
Total Dissolved Solids	426
Calcium	43
Sodium	60
Bicarbonate	188
Sulfate	50
Chloride	93
Iron	7.5
Manganese	0.61
Nitrate	8.7
Boron	0.166
Arsenic	0.0030

SOURCE: Todd Engineers, 2003.

- Substantially impair a water body's ability to support beneficial uses designated by the State Water Resources Control Board or Regional Water Quality Control Board
- Otherwise substantially degrade water quality

Approach to Analysis

Information on potentially affected groundwater bodies was obtained from published sources related to hydrogeology and groundwater management in the potentially affected area. Impact assessments were performed by reviewing WSIP-induced changes in stream flow and examining their potential to affect groundwater levels or quality.

Impact Summary

Table 5.5.4-2 presents a summary of the impacts on groundwater bodies in the Peninsula watershed that could result from implementation of the proposed water supply and system operations.

TABLE 5.5.4-2
SUMMARY OF IMPACTS – GROUNDWATER BODIES IN PENINSULA WATERSHED

Impact	Significance Determination
Impact 5.5.4-1: Alteration of stream flows along Pilarcitos Creek, which could affect groundwater levels and water quality	LS

LS = Less than Significant impact, no mitigation required

Impact Discussion

Impact 5.5.4-1: Alteration of stream flow along Pilarcitos Creek, which could affect groundwater levels and water quality.

As discussed in Impact 5.5.1-2, the proposed program would have very little effect on flow in Pilarcitos Creek below Stone Dam. There would be some reduction in wintertime spills over the dam in wet and above-normal years as a result of the WSIP, but the reduction would be too small to have an appreciable effect on groundwater recharge in the lower Pilarcitos Creek watershed. Under the existing condition and with the proposed program, the upper Pilarcitos Creek watershed contributes very little flow to the lower watershed. Most wintertime flow in the stream originates below Stone Dam, and this stream flow is the primary source of groundwater recharge. Overall, the effects of the WSIP on groundwater levels and groundwater quality would be *less than significant*, and no mitigation measures would be required.

References – Groundwater

Coastside County Water District (Coastside CWD), *2005 Urban Water Management Plan*, 2005.

Todd Engineers, *Lower Pilarcitos Creek Groundwater Basin Study*, 2003.

5.5.5 Fisheries

The following setting section describes the fishery resources within the streams and reservoirs of the San Francisco Peninsula that could be affected by the WSIP. The impact section (Section 5.5.5.2) provides a description of the effects of WSIP-induced changes in stream flow and reservoir levels on fishery resources.

5.5.5.1 Setting

Water Development

The Crystal Springs, San Andreas, and Pilarcitos Reservoirs are located in the Peninsula watershed at the base of San Mateo, Pilarcitos, and San Andreas Creeks, which are fed by coastal mountain drainage headwaters. Crystal Springs and Pilarcitos Reservoirs are stratified and become slightly anoxic during the late summer and fall, while San Andreas Reservoir remains well mixed. Water flow in San Mateo Creek below Crystal Springs Reservoir is dependent on stormwater runoff from the watershed below Lower Crystal Springs Dam, seepage from the dam, and groundwater infiltration. Water flow in Pilarcitos Creek below Stone Dam is similarly dependent on stormwater runoff from the watershed below Stone Dam and groundwater infiltration. Releases from Crystal Springs Reservoir and Stone Dam historically have occurred only in wet months of wet years. The SFPUC permits only limited recreational activity on its lands and reservoirs within the Peninsula watershed; water-contact activities, fishing, and boating on the reservoirs are not allowed.

Aquatic Habitat

San Mateo Creek

San Mateo Creek and its tributary watersheds, including San Andreas Creek, are tributary to the southern portion of San Francisco Bay. San Mateo Creek enters South San Francisco Bay approximately 1.6 miles south of the Hayward–San Mateo Bridge. Stream flows and associated fishery habitat within the San Mateo Creek watershed are affected by seasonal patterns in local rainfall and runoff as well as by San Andreas Dam (constructed in 1870), Upper Crystal Springs Reservoir (constructed in 1877), and Lower Crystal Springs Dam (constructed in 1890). Crystal Springs Reservoir is a barrier to upstream migration by Central California Coast anadromous steelhead. Central California Coast steelhead, which inhabit tributaries to South San Francisco Bay as well as coastal watersheds, have been listed by the National Marine Fisheries Service (NMFS) as a threatened species under the Federal Endangered Species Act. The common species inhabiting the watershed include steelhead/rainbow trout and threespine stickleback (Leidy *et al.* 2005); other species present include suckers, tule perch, and sculpin (RWQCB, 2002). Other fish species recently documented in San Mateo Creek include sculpin, which are found to inhabit the upper part of the watershed, and suckers, carp, and stickleback, which are found within the lower reaches of the creek (Taylor, 2002; Leidy, 2002).

The San Mateo Creek watershed originates in undeveloped lands flowing downstream through urbanized areas adjacent to South San Francisco Bay. The creek corridor within this downstream urban region has been highly modified. The upstream impoundments, in combination with channel modifications within the downstream reaches, are intended in part to provide flood control protection for urban areas. Changes in channel structure and function as a result of both reservoir impoundments and channel modifications have affected instream habitat for steelhead and other fish species.

In 1860, prior to construction San Andreas and Upper and Lower Crystal Springs Reservoirs, steelhead/rainbow trout were collected from San Mateo Creek (Leidy *et al.*, 2005). Leidy (1984) and Smith (1991) collected rainbow trout within San Mateo Creek both upstream and downstream of Lower Crystal Springs Reservoir. Leidy *et al.* (2005) concluded that San Mateo Creek historically supported resident rainbow trout populations, and that small numbers of anadromous steelhead may have utilized the creek downstream of Crystal Springs Reservoir as spawning and juvenile rearing habitat. For purposes of management under the Federal Endangered Species Act, the NMFS defines “steelhead” to include resident rainbow trout inhabiting streams and rivers downstream of impassable reservoirs (including Crystal Springs Dam) and other barriers to migration. Therefore, trout inhabiting the stream upstream of the dam are considered to be resident rainbow trout, while trout downstream of the dam (which could potentially migrate successfully to the ocean) are considered to be steelhead. Fishery studies conducted within other watersheds tributary to South San Francisco Bay have also reported small populations of both spawning and rearing adult steelhead (and in some tributaries, fall-run Chinook salmon). Modification of many of these tributaries, including the lower reaches of San Mateo Creek, present impediments or barriers to upstream access by migrating salmonids and have therefore affected the ability of many of the tributary streams to successfully support populations of anadromous steelhead. Streambank erosion into the creek within the lower reaches may also be contributing to compromised steelhead habitat quality. Potentially compromised water quality in this reach of the creek may have decreased substrate quality, increased temperatures, and reduced dissolved oxygen levels, which can reduce habitat for both salmonids, resident fish populations, and other benthic macroinvertebrate species (RWQCB, 2002). Local watershed groups and state and federal resource agencies are currently developing habitat enhancement measures for San Mateo Creek and other South San Francisco Bay tributaries to enhance access to suitable spawning and juvenile rearing habitat and to improve overall fishery habitat conditions within these small streams.

Pilarcitos Creek

Pilarcitos Creek, a small coastal stream approximately 12 miles long, flows into the Pacific Ocean near Half Moon Bay. Two impoundments regulate flow within Pilarcitos Creek: Pilarcitos Dam and Reservoir, located 10.8 miles upstream (constructed in 1866), and Stone Dam, located 8.5 miles upstream (constructed in 1874). Pilarcitos Creek and Spring Valley Creek provide water supplies to Pilarcitos Reservoir, which can convey water through a tunnel into San Andreas Reservoir and Lower Crystal Springs Reservoir. A total of six small tributaries—four of which enter Pilarcitos Creek in the reach between Pilarcitos Dam and Stone Dam, and two located downstream of Stone Dam—provide additional inflow to Pilarcitos Creek. Water can be diverted from Stone Dam to Lower Crystal Springs Reservoir, and also to the Coastside County Water District. Flow within Pilarcitos Creek downstream of Stone Dam, which has no outlet structure other than a flashboard weir and spillway, primarily originates as tributary inflow.

Stone Dam has been identified as a barrier that prohibits access by anadromous steelhead to upstream habitat. Therefore, Pilarcitos Creek has been characterized as having two separate fishery habitat reaches: the anadromous salmonid reach located downstream of Stone Dam and a resident trout reach located upstream of Stone Dam. The NMSF has expressed interest in developing fish passage opportunities at Stone Dam that would allow anadromous steelhead access to upstream habitat for spawning and juvenile rearing. Alternatives identified for providing upstream access at Stone Dam include complete dam removal, partial dam removal, or construction and operation of a fish ladder.

Information on seasonal stream flows within Pilarcitos Creek downstream of Stone Dam is available from the U.S. Geological Survey Gaging Station No. 11162620. Flow at the gaging station reflects the effects of the upstream impoundments and water diversions on Pilarcitos Creek. Flow within the creek downstream of Stone Dam shows a typical seasonal pattern within coastal watersheds, with consistently low flows during the spring, summer, and early fall (April–November) and higher stream flows during the winter months (December–March) in response to rainfall and runoff. The highest average monthly flows and peak daily flows have occurred during January and February. Peak daily flows during January and February have exceeded 90–100 cfs, with corresponding average monthly flows of approximately 7 cfs in January and 15 cfs in February. Average monthly flows during the spring, summer, and fall within Pilarcitos Creek downstream of Stone Dam typically range from approximately 0.1 to 0.5 cfs. The increased flows during January and February within the tributaries and watershed generally correspond with the seasonal life history of Central California Coast anadromous steelhead, with adult upstream migration and juvenile downstream migration during the winter.

Pilarcitos Creek is characterized by a moderately steep stream gradient downstream of Stone Dam. The substrate within the creek is predominantly fine sediment, sand, and small gravel. Although present, boulders and bedrock outcroppings are rare. Upstream and downstream of Stone Dam, reaches of the creek are characterized predominantly by run habitat and, to a lesser extent, pools and riffles. During the summer months, pool habitat is typically shallow (generally less than 1.5 feet deep). Pilarcitos Creek to the Highway 92 crossing has an adequate riparian corridor, with instream cover provided by overhead vegetation, undercut banks, and other structures. From that point downstream, the creek traverses agricultural and residential areas, and riparian habitat in these areas is limited.

Several barriers or impediments to fish movement have been identified within Pilarcitos Creek, including culverts that would prevent or impede migration under low-flow conditions but would potentially be passable at higher flows. As noted above, Stone Dam is a complete barrier to anadromous steelhead migration at all flow levels within Pilarcitos Creek. Pilarcitos Dam is also a barrier to fish movement within the creek. Several additional passage impediments, such as low-flow riffles, limit fish movement within the creek under low-flow conditions, but are expected to be passable at higher stream flows such as those occurring during the winter.

Another possible factor in reducing available fishery habitat within Pilarcitos Creek, particularly for steelhead, is increased sedimentation and siltation, which may limit spawning grounds and reduce the ability of fishes to capture their prey (RWQCB, 2001). Although these effects have not been quantified, there is a linkage between degradation of steelhead habitat and sedimentation within this watershed. Future studies by stakeholders and others may provide more conclusive data on the extent and effects of sedimentation within the creek (RWQCB, 2001).

Results of limited fishery sampling within Pilarcitos Creek during the mid-1990s (Balance Hydrologics, 1997) confirm that steelhead/rainbow trout successfully spawn and rear within reaches of Pilarcitos Creek both upstream and downstream of Stone Dam. Evidence of multiple year-classes (based on length frequency analysis) confirms successful rearing and oversummering of salmonids within the creek. The relative contribution of resident rainbow trout and anadromous steelhead to the population of fish inhabiting Pilarcitos Creek has not been determined. In addition to steelhead/rainbow trout, other resident fish species such as sculpin are expected to inhabit the creek. Specific instream flows needed to support resident fish populations downstream of Pilarcitos Reservoir or anadromous steelhead downstream of Stone Dam have not been identified.

Pilarcitos Reservoir

Pilarcitos Reservoir, at the base of Pilarcitos Creek, is one of three reservoirs in the Peninsula watershed; it contains populations of rainbow trout, Sacramento sucker, tule perch, and various species of sculpin (RWQCB, 2002). In 1931, Pilarcitos Reservoir was documented as having a good trout population (Skinner, 1962). During the Depression, bass were introduced to the reservoir to serve as a food source and are thought to have contributed to the decline of native fish due to predation. Conditions within Pilarcitos Reservoir are stratified and anoxic during the late summer and fall.

Crystal Springs Reservoir

Water from San Mateo Creek and Pilarcitos Creek can be diverted into Crystal Springs Reservoir, a lake that has been a designated fish and game refuge for many years (Skinner, 1962). A number of important and sensitive fish species are present within the reservoir, including such native fishes as rainbow trout. Crystal Springs Reservoir also contains populations of Sacramento sucker, tule perch, and various species of sculpin (RWQCB, 2002). During the Depression, bass were introduced to Crystal Springs Reservoir to serve as a food source; this planting of largemouth bass, the first in California, is thought to have contributed to the decline of native fish due to predation. Although rainbow trout have been collected throughout the reservoir, native fish species such as Sacramento sucker, tule perch, and various sculpin species appear to be either absent or few in number. Sacramento sucker and tule perch are not listed as threatened or endangered species; however, their decline as a result of the presence and operation of the reservoirs indicates their sensitivity to environmental disturbances. A variety of factors are thought to affect the abundance of resident fish within the reservoir, including predation by species such as largemouth bass and seasonal water quality conditions. Crystal Springs Reservoir exhibits stratification and anoxic conditions in late summer and fall.

San Andreas Reservoir

San Andreas Reservoir contains populations of rainbow trout, Sacramento sucker, tule perch, and various species of sculpin (RWQCB, 2002). Bass were also introduced to this reservoir during the Depression to serve as a food source and are thought to have contributed to the decline of native fish due to predation. San Andreas Reservoir, much like Crystal Springs Reservoir, contains a population of warmwater fishes (Skinner, 1962). San Andreas Reservoir remains well mixed, with relatively good water quality for fishery populations throughout the year.

5.5.5.2 Impacts

Significance Criteria

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

- Have a substantial adverse effect, either directly or through habitat modifications, on any species identified as a candidate, sensitive, or special-status species in local or regional plans, policies, or regulations, or by the California Department of Fish and Game or U.S. Fish and Wildlife Service
- Interfere substantially with the movement of any native resident or migratory fish or wildlife species or with established native resident or migratory wildlife corridors, or impede the use of native wildlife nursery sites
- Have the potential to degrade the quality of the environment, substantially reduce the habitat of a fish or wildlife species, cause a fish or wildlife population to drop below self-sustaining levels, threaten to eliminate a plant or animal community, substantially reduce the number or restrict the range of an endangered, rare, or threatened species

Approach to Analysis

Changes in reservoir storage and water levels in the San Mateo Creek watershed and changes in reservoir storage, water levels and stream flows in the Pilarcitos Creek watershed attributable to the WSIP were estimated using the HH/LSM. An overview of the model is presented in Section 5.1. Detailed information on the model and the assumptions that underlie it are provided in Appendix H. Changes in flow in streams in the San Mateo Creek watershed attributable to the WSIP were estimated semi-quantitatively based on interviews with individuals knowledgeable about the historical, current, and expected future (with-WSIP) water system operations.

Impact Summary

Table 5.5.5-1 presents a summary of the impacts on water bodies in the Peninsula watershed that could result from implementation of the proposed water supply and system operations.

TABLE 5.5.5-1
SUMMARY OF IMPACTS – FISHERIES
IN SAN FRANCISCO PENINSULA STREAMS AND RESERVOIRS

Impact	Significance Determination
Impact 5.5.5-1: Effects on fishery resources in Crystal Springs Reservoir (Upper and Lower)	PSU
Impact 5.5.5-2: Effects on fishery resources in San Andreas Reservoir	LS
Impact 5.5.5-3: Effects on fishery resources along San Mateo Creek	LS
Impact 5.5.5-4: Effects on fishery resources in Pilarcitos Reservoir	PSM*
Impact 5.5.5-5: Effects on fishery resources along Pilarcitos Creek below Pilarcitos Reservoir	PSM

LS = Less than Significant impact, no mitigation required
PSM = Potentially Significant impact, can be mitigated to less than significant
PSU = Potentially Significant impact, unavoidable

* Based on the refined Pilarcitos watershed impact analysis (see Section 13.3), this impact is PSM due to adverse effects that would result from implementing replacement Measure 5.5.3-2a.

Impact Discussion

Impact 5.5.5-1: Effects on fishery resources in Crystal Springs Reservoir (Upper and Lower).

Results of hydrologic modeling indicate that average monthly storage within Crystal Springs Reservoir would be greater under proposed WSIP operations than under existing conditions. An increase in storage within the reservoir offers the potential for increased coldwater pool volume within the reservoir hypolimnion, which could benefit coldwater fish species inhabiting the stream downstream of the reservoir. In addition, increased reservoir storage would provide an increase in the volume of habitat available for resident fish species inhabiting the reservoir, including both warmwater and coldwater fish species. The increase in storage elevation under the WSIP could also provide greater opportunities for connectivity and migration of fish between the reservoir and upstream tributary habitat. As a result of these factors, increased reservoir storage under proposed operations is considered a beneficial impact on fishery resources.

Only minor changes in water quality conditions would occur within Crystal Springs Reservoir under proposed WSIP operations compared to existing conditions (see Section 5.5.1). Based on the general similarity in water quality conditions with and without the proposed program, potential changes in water quality in Crystal Springs Reservoir and related impacts on fishery resources would be less than significant.

Restoring the levels of the reservoir under the Lower Crystal Springs Dam Improvements project (PN-4) would eliminate approximately 750 linear feet of trout spawning habitat from Laguna and San Mateo Creeks, the two named tributaries to the reservoir, resulting in a total loss of approximately 1,500 linear feet of spawning habitat. However, upstream areas may provide suitable replacement habitat to support the population and this prospect is currently under evaluation in the project-level CEQA review for the Lower Crystal Springs Dam Improvements project. Thus, implementation of Measure 5.5.5-1, Create New Spawning Habitat Above Crystal Springs Reservoir, if feasible, may reduce this impact to less than significant. The project-level CEQA review for the Lower Crystal Springs Dam Improvements project will further evaluate the severity of this impact and the efficacy of Measure 5.5.5-1. To be conservative, at the program-level of analysis, this impact is considered *potentially significant and unavoidable*.

Impact 5.5.5-2: Effects on fishery resources in San Andreas Reservoir.

Results of hydrologic modeling indicate that average monthly storage in San Andreas Reservoir would be similar under proposed operations and existing conditions. Reservoir storage would continue to fluctuate seasonally, as under existing conditions. Based on the similarity of water storage operations, potential impacts on resident fishery resources within San Andreas Reservoir under proposed operations are considered less than significant.

Only minor changes in water quality conditions would occur within San Andreas Reservoir under proposed WSIP operations compared to existing conditions (see Section 5.5.1). Based on the general similarity in water quality conditions with and without the proposed program, potential changes in water quality in San Andreas Reservoir and related impacts on fishery resources would be *less than significant*, and no mitigation measures would be required.

Impact 5.5.5-3: Effects on fishery resources along San Mateo Creek.

San Mateo Creek is an intermittent stream and would remain so under the proposed program. Similar to existing conditions, no releases would be made under the proposed program from Crystal Springs Reservoir to San Mateo Creek in normal, below-normal, or dry years. In wet and above-normal years, releases to the creek would be similar to those under existing conditions. The upper third of San Mateo Creek downstream of the reservoir provides suitable fishery habitat, while the lower creek reaches serve only as a potential migratory corridor. Since actual operations and fishery habitat conditions on San Mateo Creek would be comparable under existing and proposed operations, impacts on fisheries in San Mateo Creek would be *less than significant*, and no mitigation measures would be required.

Impact 5.5.5-4: Effects on fishery resources in Pilarcitos Reservoir.

Storage in Pilarcitos Reservoir varies seasonally. The reservoir typically fills in the winter and is drawn down in the late spring and summer. By late summer, releases from the reservoir are typically limited to reservoir inflow. The volume of habitat available for resident aquatic species varies seasonally from about 3,000 acre-feet in the winter and spring to 1,600 acre-feet in the late summer or fall.

With the WSIP, the reservoir would be drawn down more rapidly and earlier in the season than under the existing condition. The period in which the reservoir would be at its minimum elevation would be extended by days or weeks. The volume of habitat available for resident aquatic species would be at its minimum. Because the WSIP would cause the volume of water stored within Pilarcitos Reservoir to reach its seasonal minimum several days or weeks earlier in the year than under the existing condition, it would also be expected to reduce the coldwater pool volume within the reservoir hypolimnion to its seasonal minimum earlier in the year. This could in turn have an adverse effect on resident coldwater species in the reservoir. However, because water is released from close to the surface of the reservoir, a cool water pool is usually retained below the level of the outlet. Overall, the impacts of the proposed program on resident aquatic species in Pilarcitos Reservoir would be *less than-significant.*

Implementation of Measure 5.5.3-2a, Low-head Pumping Station at Pilarcitos Reservoir, would reduce the storage volume in Pilarcitos Reservoir by about 350 acre-feet in the late summer and fall of about one in four years. In these years, the seasonal minimum storage volume in Pilarcitos Reservoir would be 1,600 to 1,700 acre-feet. However, implementation of Measure 5.5.3-2b, Aeration System at Pilarcitos Reservoir, would improve water quality at such times as the reservoir was drawn down. The periodic reduction in volume of water available to aquatic species, attributable to Measure 5.5.3-2a, coupled with the improvement in water quality attributable to Measure 5.5.3-2b would have a *less-than-significant* impact on resident aquatic species.

Impact 5.5.5-5: Effects on fishery resources along Pilarcitos Creek below Pilarcitos Reservoir.

Pilarcitos Creek Below Pilarcitos Reservoir

Flow in Pilarcitos Creek would increase during many spring and early summer months as a result of the WSIP; however, flow reductions would occur during the summer of dry years. Under the WSIP, instream flow releases (other than dam seepage and reservoir inflow) would cease in Pilarcitos Creek downstream of Pilarcitos Reservoir during summer months of dry years at an earlier date than under the existing condition. Flow reductions in Pilarcitos Creek downstream of Pilarcitos Reservoir under the WSIP would result in potentially significant impacts on resident trout, other resident fish species and aquatic resources.

In addition, as described above, releases from Pilarcitos Reservoir to Pilarcitos Creek are made from close to the surface of the reservoir, so summer and fall releases under existing conditions are warm. With the proposed program in place, summer and fall releases would also be warm (possibly warmer at times), because Pilarcitos Reservoir would be drawn down several days or weeks earlier than under the existing condition. Exposure to higher water temperatures in the late summer and fall could significantly affect habitat quality and availability for coldwater fish species inhabiting Pilarcitos Creek below Pilarcitos Reservoir, including resident trout. This would be a potentially significant impact.

Pilarcitos Creek Below Stone Dam

Pilarcitos Creek supports a population of anadromous steelhead. The creek channel is used as a migration corridor for upstream migration of adults and downstream migration of both adults and juvenile steelhead between approximately December 1 and May 31. Under the proposed WSIP, winter flows within the creek below Stone Dam, during normal or wetter hydrologic years, would be reduced. Although no specific barriers to passage have been identified downstream of Stone Dam, this reduction in peak winter flows could potentially adversely impact steelhead migratory passage and spawning at critical riffles and gravel bars due to the shallow nature of these habitat types.

Currently, there are occasional spills over Stone Dam when releases from Pilarcitos Reservoir and runoff into Pilarcitos Creek above Stone Dam exceed the capacity of the diversion at the dam. The spills occur in the winter months of wet, above normal and normal years. With implementation of the proposed program, occasional spills over Stone Dam would continue but with reduced frequency and magnitude. The volume of spills in average wet, above normal, and normal years would be reduced by 11, 60, and 25 percent, respectively.

Approximately, one-third of the Pilarcitos Creek watershed lies upstream of Stone Dam, and most of the runoff from the watershed is used for municipal water supply by the SFPUC and Coastside CWD. Spills over Stone Dam currently provide up to 15 percent of the flow in the lower reach of Pilarcitos Creek in Half Moon Bay, based on data from gages just downstream of Stone Dam and in Half Moon Bay.

With the WSIP, spills would be reduced and flow in Pilarcitos Creek would be reduced in the winter months, when occasional large flows are important to migratory fish. The effects of the reduced spills would be primarily felt in the reach of Pilarcitos Creek from Stone Dam to the first major downstream tributary at Albert Canyon. The reduction in flows due to the WSIP and related impacts on fish habitat would be potentially significant. In addition, the National Marine Fisheries Service has raised concerns regarding stream flows in Pilarcitos Creek below Stone Dam, and the SFPUC is currently making experimental summer releases and undertaking studies in an effort to address these concerns.

Impact Conclusions

Overall, impacts on fishery resources along Pilarcitos Creek between Pilarcitos Reservoir and Stone Dam related to reduced flows, degraded water quality and elevated temperatures in the late summer and fall would be *potentially significant*. Implementation of Measures 5.5.3-2a, Low-head Pumping Station at Pilarcitos Reservoir, and Measure 5.5.3-2b, Aeration System at Pilarcitos Reservoir, would reduce this potential impact to a less-than-significant level.

Impacts on fishery resources in Pilarcitos Creek below Stone Dam related to reduced wintertime flows would be *potentially significant*. Implementation of Measure 5.5.5-5, Establish Flow Criteria, Monitor and Augment Flow, would reduce this potential impact to a *less-than-significant* level.

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5.5.6 Terrestrial Biological Resources

The following setting section describes the terrestrial biological resources within the streams and reservoirs of the San Francisco Peninsula that could be affected by the WSIP. The impact section (Section 5.5.6.2) provides a description of the effects of WSIP-induced changes in stream flow and reservoir levels on terrestrial biological resources.

5.5.6.1 Setting

The Peninsula watershed is a unique ecological resource that hosts extensive and varied habitats in a predominantly urbanized region. It supports the highest concentration of rare, threatened, and endangered species in the entire Bay Area (SFPUC, 1994; 2006). The watershed supports over 550 species of plants (Oberlander, 1953). A high diversity of animals can also be found in the Peninsula watershed, including many that require large areas of contiguous, relatively undisturbed habitat such as mountain lions, deer, bobcats, coyotes, bald eagles, and golden eagles. Due to the extent and variety of habitats, total vertebrate species diversity is likely to include virtually all species found in upland and freshwater habitats in San Mateo County.

This assessment of impacts focuses on sensitive natural communities such as riparian communities and wetlands, and on special-status species (excluding fish) specifically associated with streams and reservoirs that could be affected by WSIP operations. This section distinguishes between WSIP projects for which separate, project-level CEQA analysis would address operational impacts in greater detail (such as the Lower Crystal Springs Dam project [PN-4], which would affect Upper and Lower Crystal Springs Reservoirs and San Mateo Creek below the dam), and projects for which no further CEQA analysis would take place (such as the operation of San Andreas and Pilarcitos Reservoirs and Pilarcitos Creek).

Figure 4.6-1 in Section 4.6, Biological Resources, shows the habitat types found in the Peninsula watershed within the WSIP program area. Habitat types are broader groupings than natural communities, but are useful when describing both wildlife and vegetation resources together.

San Mateo Creek

Immediately below Crystal Springs Dam, seepage supports a small area of freshwater marsh. Below this, San Mateo Creek flows through a steep, largely undeveloped canyon where it supports a well-developed central coast arroyo willow (*Salix lasiolepis*) riparian forest, with coast live oak (*Quercus agrifolia*) riparian forest farther downstream. Coast live oak woodland, mixed evergreen forest, and coastal scrub grow on the adjacent uplands. San Mateo Creek then flows through the town of Hillsborough and the city of San Mateo, emptying into San Francisco Bay south of Coyote Point. In this section the creek is not culverted, but is closely surrounded by urbanization.

Riparian processes along San Mateo Creek have already been considerably affected by the presence of the Crystal Springs Dam. Sediment supply and base flows have been cut off to lower San Mateo Creek, and the magnitude of peak flows at all recurrence intervals has been greatly diminished. Stream releases are infrequent under existing conditions and occur only when runoff into Crystal Springs Reservoir cannot be contained by available storage or conveyed elsewhere. There are no releases during the summer months, and none during normal, below-normal, and dry years.

Upper and Lower Crystal Springs Reservoirs

Lower Crystal Springs Reservoir is surrounded primarily by oak woodland and Douglas-fir (*Pseudotsuga menziesii*) forest on the western side, with oak woodland, serpentine grassland, valley needlegrass grassland, and non-native grassland on the eastern side. Lower Crystal Springs Reservoir supports a large area of valley and foothill freshwater marsh on its northwestern tip where San Andreas Creek enters the reservoir (referred to as Tracy Lake). This area currently supports more extensive freshwater marsh than it did in the 1950s, when Crystal Springs Dam was operated at full capacity (Oberlander, 1953). White alder riparian forest extends to Lower Crystal Springs Reservoir along San Mateo Creek. Central coast arroyo willow riparian forest is present along the smaller creeks, sometimes expanding where creeks enter the reservoir.

Upper Crystal Springs Reservoir is surrounded primarily by coast live oak woodland, with extensive areas of serpentine and valley needlegrass grassland and small areas of northern coastal scrub on the eastern side. Large areas of arroyo willow riparian forest and freshwater marsh are found at Adobe Marsh and at the mouth of Laguna Creek at the southeastern end. The overall extent of current freshwater marsh wetland vegetation surrounding Upper Crystal Springs Reservoir is less than existed historically, and many areas have converted to arroyo willow riparian forest (Oberlander, 1953; San Francisco Planning Department, 2001).

San Andreas Reservoir

San Andreas Reservoir is surrounded primarily by northern coastal scrub. In the absence of fire, a coast live oak tree layer is developing within the scrub on deeper soils. The eastern edge of the reservoir supports non-native grassland and exotic forests dominated by Monterey pine (*Pinus radiata*) and eucalyptus (*Eucalyptus* sp.). Some small areas of native grassland may also be present. The two northern arms of the reservoir support some of the largest freshwater marshes in the watershed. Depending on elevation, these marshy areas variously support cattails, bulrushes, spikerush, rush, and other emergent species. Historically, the freshwater marsh wetland was less extensive on the eastern arm of the upper portion of the reservoir; in 1993, this area was mapped as open water. The western upper arm of the reservoir supported more extensive freshwater marsh wetland. The truncated shoreline mapped by Oberlander (1953) suggests that there may have been an impoundment in this area that functioned to increase the extent of freshwater marsh.

Pilarcitos Creek and Reservoir

The vegetation above Pilarcitos Dam consists mostly of coastal scrub, with areas of Douglas-fir and redwood (*Sequoia sempervirens*) forest and mixed evergreen/coast live oak forest in the deeper and more sheltered slopes. A small area of freshwater marsh was mapped by Oberlander (1953) on the southern arm of the reservoir. Central coast arroyo willow riparian forest lines the major tributaries to Pilarcitos Reservoir for a considerable distance upstream. Below Pilarcitos Dam, Pilarcitos Creek follows a deep canyon heavily wooded with Douglas-fir forest. A well-developed white alder (*Alnus rhombifolia*) riparian forest grows along the creek between Pilarcitos Dam and Stone Dam. Below Stone Dam, Pilarcitos Creek is lined with central coast arroyo willow riparian forest.

Natural Communities, including Sensitive Natural Communities

The *Peninsula Watershed Management Plan Environmental Impact Report* (San Francisco Planning Department, 2001) identified 14 natural communities occurring within the watershed, eight of which are listed as sensitive in the California Natural Diversity Database (CNDDB) (CDFG, 2006). Eleven natural communities, including all eight of the sensitive natural communities, occur adjacent to San Andreas, Pilarcitos, and Upper and Lower Crystal Springs Reservoirs and associated creeks. The natural community name, CNDDB code, sensitivity, and occurrence within the WSIP program area are presented in **Table 5.5.6-1** and briefly described below. More detail will be provided in the project-specific EIR for the Lower Crystal Springs Dam project (PN-4).

TABLE 5.5.6-1
POTENTIAL FOR OCCURRENCE OF NATURAL COMMUNITIES IN AND NEAR THE WSIP IN THE PENINSULA WATERSHED

	WSIP Program Location		
Natural Community	**Upper/Lower Crystal Springs Reservoirs and San Mateo Creek (PN-4)**	**San Andreas Reservoir**	**Pilarcitos Reservoir and Pilarcitos Creek**
Serpentine grassland	X		
Valley needlegrass grassland	X	X	
Non-native grassland	X	X	
Northern mixed chaparral	X	X	
Northern coastal scrub	X	X	X
Mixed evergreen forest/coast live oak woodland	X	X	X
Douglas-fir forest/redwood forest	X		X
Non-native forests	X	X	
Central coast arroyo willow riparian forest	X	X	X
White alder riparian forest			X
Central coast live oak riparian forest	X		
Coastal and valley freshwater marsh	X	X	X

[a] California Natural Diversity Database code; asterisk (*) indicates sensitive natural community (CDFG, 2006).

Grasslands

Serpentine grassland and valley needlegrass grassland are found on the open ridges of the Peninsula watershed, often on less fertile soils. Serpentine grassland is specifically associated with soils derived from serpentine rock. Both grasslands are characterized by a high proportion of native species, many perennial grasses, and low productivity. Typical perennial grasses include needlegrass (*Nassella* spp.), pine bluegrass (*Poa secunda*), fescue (*Festuca* spp.), and junegrass (*Koeleria cristata*). Within the WSIP study area, extensive areas of serpentine grassland are found along the eastern shores of Upper and Lower Crystal Springs Reservoirs. Valley needlegrass grassland is found on the eastern shores of San Andreas Reservoir and Upper and Lower Crystal Springs Reservoirs. Disturbed Valley needlegrass grassland may also be present in San Mateo Canyon below Crystal Springs Dam.

Non-native grassland is found in many areas with a history of disturbance. It is dominated by a variety of non-native annual grasses such as brome (*Bromus* spp.), oats (*Avena* spp.), and wild barley (*Hordeum* spp.) as well as herbs such as filaree (*Erodium* spp.), with less abundant native annual and perennial grasses and herbs. This community is found along the shores of San Andreas Reservoir and Upper and Lower Crystal Springs Reservoirs.

Chaparral and Scrub

Northern mixed chaparral and northern coastal scrub are shrub-dominated communities typically found on steep, rocky, exposed slopes. Both tend to form dense, rather impenetrable stands that are regenerated by periodic wildfires. On the Peninsula watershed, northern mixed chaparral is dominated by scrub oak (*Quercus dumosa*), chamise (*Adenostoma fascicularis*), and several species of ceanothus (*Ceanothus* spp.). Northern coastal scrub is dominated by coyote brush (*Baccharis pilularis*), poison-oak (*Toxicodendron diversilobum*), and bush monkeyflower (*Mimulus aurantiacus*). Northern coastal scrub is found on much of the western shore of San Andreas Reservoir, the shores of most of the upper, northern branches of Pilarcitos Reservoir, and in small areas around Upper and Lower Crystal Springs Reservoirs.

Forests and Woodlands

Mixed evergreen forest and coast live oak woodland are the most abundant forest communities on the watershed. These communities are typically found in more sheltered sites that have deeper soils than scrubs and grasslands. Mixed evergreen forest is dominated by coast live oak, California bay (*Umbellularia californica*), madrone (*Arbutus menziesii*), Douglas-fir, and big-leaf maple (*Acer macrophyllum*). It tends to form a closed canopy with shrubby or grassy understory and is found in more sheltered sites such as canyons. Coast live oak woodland is dominated by a single species, coast live oak, which forms a nearly closed canopy forest in favorable sites with deep soils and ample soil moisture, or open woodland with a grassy understory in drier areas. Mixed evergreen forest and coast live oak are found in nearly all of the deep canyons on the east side of San Andreas and Crystal Springs Reservoirs, and most of the sheltered western sides of these reservoirs. A small stand is also found on the west side of Pilarcitos Reservoir. Douglas-fir forest and redwood forest are tall, dense, forests dominated by Douglas-fir and coast redwood. Some of the largest old-growth stands in the Bay Area are found on the eastern slopes of the larger ridges in the Peninsula watershed. These communities extend to the shores of Pilarcitos

Reservoir. Small areas of Douglas-fir forest also occur on the western shore of Lower Crystal Springs Reservoir.

Riparian Forests

Central coast arroyo willow riparian forest occurs in moist canyons, usually with perennial stream flow or seepage. It is a dense, broadleaved, winter-deciduous forest dominated by arroyo willow (*Salix lasiolepis*), which grows as a large, tree-like shrub. This common riparian natural community is found in sections of Pilarcitos Creek both above Pilarcitos Reservoir and below Stone Dam, on the major tributaries draining into San Andreas and Upper and Lower Crystal Springs Reservoirs, and in portions of San Mateo Creek below Crystal Springs Dam. White alder riparian forest is a medium-tall, broadleaved, deciduous streamside forest dominated by white alder (*Alnus rhombifolia*) with a shrubby, deciduous understory. It is found along rapidly flowing perennial streams with coarse sediments and is more typical of the North Coast. It is found along Pilarcitos Creek between Pilarcitos Dam and Stone Dam and in San Mateo Creek between Mud Dam and Lower Crystal Springs Reservoir. Central coast live oak riparian forest is an evergreen riparian forest dominated by coast live oak. This community may be present in portions of San Mateo Creek below Crystal Springs Dam.

Coastal and Valley Freshwater Marsh

Coastal and valley freshwater marsh is a wetland community dominated by usually dense stands of perennial, emergent grass and grass-like plants up to 15 feet tall. Typical species include cattails (*Typha* spp.), tule (*Scirpus* spp.), rushes (*Juncus* spp.), and sedges (*Carex* spp.). Coastal and valley freshwater marsh is found in areas that are permanently flooded or saturated. Examples of this community are found around the perimeter of all of the reservoirs in the Peninsula watershed, usually in areas of gentle topography and fine-textured alluvial soils where streams deposit sediment. Upper and Lower Crystal Springs Reservoirs and San Andreas Reservoir support extensive areas of freshwater marsh, while Pilarcitos Reservoir has little of this habitat.

Key Special-Status Species and Other Species of Concern

The name and status of key plant and animal special-status species and species of concern with the potential to occur within the WSIP program area on the Peninsula watershed, based on the EIR for the *Peninsula Watershed Management Plan* (San Francisco Planning Department, 2001), are shown in Appendix D. **Tables 5.5.6-2** and **5.5.6-3** present the name, status, habitat, and potential for occurrence of key plant and animal species that could be affected by WSIP projects in the Peninsula watershed; these species are further discussed in the text below.

Because of proposed changes in the operation of Upper and Lower Crystal Springs Reservoirs and the presence of extensive serpentine grassland habitats along their shores, many species could be affected by the Lower Crystal Springs Dam project (PN-4). These species are discussed briefly below and will be described in more detail in the project-specific EIR. The consultant team (Lebednik, 2006) provided preliminary survey results of 2006 wildlife and botanical surveys for the Lower Crystal Springs Dam project area.

TABLE 5.5.6-2
KEY SPECIAL-STATUS PLANTS AND PLANT SPECIES OF CONCERN IN THE WSIP PENINSULA WATERSHED OPERATIONAL AREA

		Potential to Occur, by WSIP Operational Area[a]			
Common Name ***Scientific Name***	**USFWS/CDFG/ CNPS Status[b]**		**Upper/Lower Crystal Springs Reservoirs, San Mateo Creek**	**San Andreas Reservoir**	**Pilarcitos Reservoir and Creek**
San Mateo thorn-mint *Acanthomintha duttonii*	FE/CE/1B*	Open areas in serpentine clay soils	Low potential		
Franciscan onion *Allium peninsulare* var. *franciscanum*	–/–/1B	Woodland, grassland, clay soils, often on serpentine	Present		
Bent-flowered fiddleneck *Amsinckia lunaris*	–/–/1B	Woodland and valley grassland	Potential	Potential	Potential
Fountain thistle *Cirsium fontinale var. fontinale*	FE/CE/1B*	Serpentine seeps	Present		
San Francisco collinsia *Collinsia multicolor*	–/–/1B	Closed-cone coniferous forest, coastal scrub, sometimes serpentinite	Present		
Western leatherwood *Dirca occidentalis*	–/–/1B	Mesic sites in forest, woodland, and scrub	Present	Potential	Potential
San Mateo woolly sunflower *Eriophyllum latilobum*	FE/CE/1B*	Openings in oak woodland on serpentine	Present		
Fragrant fritillary *Fritillaria liliacea*	–/–/1B	Clay soils, often on serpentine	Present nearby		
Marin western flax *Hesperolinon congestum*	FT/CT/1B*	Grassland and chaparral, often on serpentine	Present		
Hillsborough chocolate lily *Fritillaria biflora* var. *ineziana* (=*F. grayiana*)	–/–/1B	Woodland and grassland, often on serpentine	Low potential		
Crystal Springs lessingia *Lessingia arachnoidea*	–/–/1B	Woodland, scrub, grassland, usually on serpentine	Present		
Arcuate bush mallow *Malacothamnus arcuatus* (=*M. fasciculatus*)	–/–/1B	Chaparral on gravelly alluvium	Present	Potential	Potential
Dudley's lousewort *Pedicularis dudleyi*	–/CR/1B*	Maritime chaparral, north coast coniferous forest, and cismontane woodland; deep shady woods of redwood forests	Low potential		Potential
White-rayed pentachaeta *Pentachaeta bellidiflora*	FE/CE/1B*	Open dry rocky slopes and grassy areas, usually on serpentine soils	Low potential		

[a] The WSIP operational area is the extent that could be affected by program operations, such as below reservoir maximum elevations, or within riparian areas where changes in flows could affect habitat.
[b] Federal (USFWS), state (CDFG), and California Native Plant Society protection status codes are as follows:

FC: Federal candidate for listing
FE: Federal endangered
FT: Federal threatened
FD: Federal delisted
CE: California endangered
CT: California threatened
CR: California rare
1B: California Native Plant Society rare and endangered
– Indicates no federal or state protection

* Indicates key special-status species, defined as having a state or federal listing as rare, threatened, or endangered.

SOURCES: CDFG, 2007; CNPS, 2006; Lebednik, 2006.

TABLE 5.5.6-3
KEY SPECIAL-STATUS ANIMALS AND ANIMAL SPECIES OF CONCERN IN THE WSIP PENINSULA WATERSHED OPERATIONAL AREA

			WSIP Operational Area[a]		
Common Name ***Scientific Name***	**USFWS/CDFG Status[b]**	**Habitat**	**Upper/Lower Crystal Springs Reservoirs, San Mateo Creek**	**San Andreas Reservoir**	**Pilarcitos Reservoir and Creek**
Invertebrates					
Bay checkerspot butterfly *Euphyhydras editha bayensis*	FT/–*	Serpentine bunchgrass and valley needlegrass grassland	Low potential		
Mission blue butterfly *Plebejus (=Icaricia) icarioides bayensis*	FE/–*	Grasslands supporting *Lupinus albifrons, L. variicolor,* and *L. formosus* larval host plants		Potential	
Reptiles and Amphibians					
California red-legged frog *Rana aurora draytonii*	FT/CSC*	Slow-moving streams and ponds	Present	Present	Present
Foothill yellow-legged frog *Rana boylii*	–/CSC*	Shallow, moving water with sunny banks	Potential in tributary streams	Potential	Potential
Western pond turtle *Emys marmorata*	–/CSC	Permanent water such as streams or ponds	Present	Potential	Potential
San Francisco garter snake *Thamnophis sirtalis tetrataenia*	FE/CE, FP*	Freshwater marshes, ponds, and slow-moving streams with dense cover	Present	Present	Present
Birds					
Cooper's hawk *Accipiter cooperi*	–/CSC	Nests in deciduous riparian vegetation and oaks	Potential	Potential	Potential
Sharp-shinned hawk *Accipiter striatus*	–/CSC	Nests in deciduous riparian vegetation and oaks	Potential	Potential	Potential
Tricolored blackbird *Agelaius tricolor*	–/CSC	Colonial nester in emergent vegetation; forages over open water	Present	Potential	
Bell's sage sparrow *Amphispiza belli belli*	–/CSC	Nests in chaparral and coastal scrub	Potential	Potential	Potential
Marbled murrelet *Brachyramphus marmoratus*	FT/CE*	Nests high in old-growth conifers; feeds on near-shore fish			Present nearby
Vaux's swift *Chaetura vauxi*	–/CSC	Nests in hollow trees; forages over open water, woodlands	Present	Potential	Potential
Northern harrier *Circus cyaneus*	–/CSC	Nests and forages in wet meadows	Potential	Potential	
Merlin *Falco columbarius*	–/CSC	Winter visitor in foothills, valleys	Potential	Potential	Potential
Peregrine falcon *Falco peregrinus anatum*	FD/CE, FP*	Nests in cliffs and outcrops; forages near wetlands and other water	Potential	Potential	Potential

TABLE 5.5.6-3 (Continued)
KEY SPECIAL-STATUS ANIMALS AND ANIMAL SPECIES OF CONCERN IN THE WSIP PENINSULA WATERSHED OPERATIONAL AREA

			WSIP Operational Area[a]		
Common Name ***Scientific Name***	**USFWS/CDFG Status[b]**	**Habitat**	**Upper/Lower Crystal Springs Reservoirs, San Mateo Creek**	**San Andreas Reservoir**	**Pilarcitos Reservoir and Creek**
Saltmarsh common yellowthroat *Geothlypis trichas sinuosa*	–/CSC	Nests and forages in riparian scrub	Present	Potential	
Loggerhead shrike *Lanius ludovicianus*	–/CSC	Open country for hunting; nests in riparian woodland and open woodlands	Potential	Potential	Potential
California black rail *Laterallus jamaicensis coturniculus*	–/CT*	Mainly nests in saltmarsh but may also occur in freshwater and brackish marshes at low elevations	Potential	Potential	
Double-crested cormorant *Phalcrocorax auritus*	–/CSC	Colonial nester on coastal cliffs and along lake margins; forages in open water	Present	Potential	
Bank swallow *Riparia riparia*	–/CSC	Colonial nester in riparian cliffs	Potential	Potential	
Mammals					
Pallid bat *Antrozous pallidus*	–/CSC	Roosts in trees; forages over grassland	Potential		
Pacific western big-eared bat *Corynorhinus (=Plecotus) townsendii*	–/CSC	Roosts in caves and buildings; forages in open country	Potential	Potential	
Small-footed myotis *Myotis ciliolabrum*	–/CSC	Roosts in caves and trees; forages in open country	Potential	Potential	Potential
Long-eared myotis *Myotus evotis*	–/CSC	Roosts in hollow trees and buildings; forages at streams and ponds	Potential	Potential	Potential
Fringed myotis *Myotis thysanodes*	–/CSC	Roosts in hollow trees and buildings; forages at forest edge	Potential	Potential	Potential
Long-legged myotis *Myotis volans*	–/CSC	Roosts in caves, old buildings and under bark	Potential	Potential	Potential
Yuma myotis *Myotis yumanensis*	–/CSC	Roosts in riparian vegetation; forages over open water	Potential	Potential	Potential
San Francisco dusky-footed woodrat *Neotoma fuscipes annectens*	–/CSC	Many forest habitats, especially with oaks	Present	Potential	Potential

[a] The WSIP operational area is the extent that could be affected by program operations, such as areas below maximum reservoir water levels, or within riparian areas where changes in flows could affect habitat.
[b] Federal (USFWS) and state (CDFG) protection status codes are as follows:
FC: Federal candidate for listing
FE: Federal endangered
FT: Federal threatened
FD: Federal delisted
CE: California endangered
CT: California threatened
CP: California fully protected
CSC: California species of special concern
– Indicates no federal or state protection
* Indicates key special-status species, defined as having a state or federal listing as endangered or threatened.

SOURCES: CDFG, 2007; Lebednik, 2006.

Serpentine-Associated Plants

Several upland special-status plants occur in serpentine-influenced habitats near the margins of Upper and Lower Crystal Springs Reservoirs, especially on the eastern side of Upper Crystal Springs Reservoir, where a large serpentine outcrop adjoins the reservoir. Franciscan onion (*Allium peninsulare* var. *franciscanum*, federal species of concern, CNPS List 1B), fountain thistle (*Cirsium fontinale* var. *fontinale*, federal endangered, California endangered), Marin western flax (*Hesperolinon congestum*, federal threatened, California threatened), and Crystal Springs lessingia (*Lessingia arachnoidea*, federal species of concern, CNPS List 1B) have been observed in serpentine grassland below the elevation of 291 feet along the eastern shoreline of Upper Crystal Springs Reservoir (Lebednik, 2006). San Mateo thorn-mint (*Acanthomintha duttonii*, federal endangered, California endangered), Hillsborough chocolate lily (*Fritillaria grayiana*, CNPS List 1B), fragrant fritillary (*Fritillaria liliacea*, CNPS List 1B), and white-rayed pentachaeta (*Pentachaeta bellidiflora*, federal endangered, California endangered, CNPS List 1B) are known to occur in serpentine grasslands near Upper Crystal Springs Reservoir, but have not been identified in the WSIP program area during recent protocol-level surveys. San Mateo woolly sunflower (*Eriophyllum latilobum*, federal endangered, California endangered, CNPS List 1B) is known to occur serpentine soils in woodland openings in San Mateo Canyon.

Other Upland Plants

Western leatherwood (*Dirca occidentalis*, CNPS List 1B) occurs in woodland, forest, and scrub habitats in many localities in the Peninsula watershed, and suitable habitat is present in the vicinity of all three reservoirs. Arcuate bush mallow (*Malacothamnus fasciculatus=M. arcuatus*, CNPS List 1B) grows in chaparral on gravelly alluvium. It was observed on the shore of Upper and Lower Crystal Springs Reservoirs in 2006, and suitable habitat may also be present in coastal scrub near the other reservoirs. Although not observed during 2006 field surveys (Lebednik, 2006), suitable habitat is present in the vicinity of Upper and Lower Crystal Springs Reservoirs for bent-flowered fiddleneck (*Amsinckia lunaris*, CNPS List 1B) and for Dudley's lousewort (*Pedicularis dudleyi*, federal species of concern, California rare, CNPS List 1B) near Upper and Lower Crystal Springs Reservoirs and Pilarcitos Reservoir and Creek.

Perennial Grassland Invertebrates

Bay checkerspot butterfly (*Euphyhydras editha bayensis*, federal threatened), is discussed in Chapter 4, Section 4.6. It is believed to be extirpated from the Peninsula watershed lands. Mission blue butterfly (*Icaricia icarioides missionensis*, federal endangered) is found in native grasslands and coastal scrub, where it depends on three perennial species of lupine (*Lupinus* spp.) for its larval foodplant. This species was originally believed to be restricted to San Francisco as far south as San Bruno Mountain; however, a population was discovered in the vicinity of San Andreas Dam in 1985 (San Francisco Planning Department, 2001). It is not known to occur in the vicinity of Upper and Lower Crystal Springs Reservoirs, but foodplants were observed in this area during surveys in 2006 (Lebednik, 2006).

Aquatic-Dependent Reptiles and Amphibians

California red-legged frog (*Rana aurora draytonii*, federal threatened, California species of special concern) is discussed in Section 4.6. According to recent surveys (LSA, in prep.), the distribution of California red-legged frog in the Peninsula watershed is patchy despite the presence of widespread, apparently suitable habitat. Within the WSIP program area, the species is known to occur in Upper and Lower Crystal Springs Reservoirs and Tracy Lake, San Andreas Reservoir, Stone Dam, Pilarcitos Creek, San Mateo Creek below Crystal Springs Dam, and on the parapet of the dam itself, as well as in many other localities within the Peninsula watershed (CDFG, 2006; Swaim, 2006; CDFG, 2007).

Foothill yellow-legged frog (*Rana boylii*, federal species of concern, California species of special concern) is a stream-dwelling species, preferring shallow, flowing water, preferentially in small to moderate sized streams. Although this species is historically known to occur in low-elevation streams in the Sierra Nevada, Transverse Ranges, and Coast Ranges northward to Oregon, its current distribution is not well known. There are historical records for many streams on the San Francisco Peninsula, including some in or near the Peninsula watershed (Swaim, 2006), but the current extent of the species in the Peninsula watershed is not known. Potential habitat may be present in Pilarcitos Creek and the tributaries to San Andreas and Upper and Lower Crystal Springs Reservoirs. Western pond turtle (*Actinemys = Clemmys marmorata*, federal species of concern, California species of special concern) lives in permanent water such as lakes, ponds, and deep areas in streams. It requires logs, rocks, or emergent vegetation for basking. Western pond turtle is known to occur in Upper and Lower Crystal Springs Reservoirs, and suitable habitat is present at San Andreas Reservoir and Pilarcitos Reservoir.

San Francisco garter snake (*Thamnophis sirtalis tetrataenia*, federal endangered, California endangered) is discussed in Section 4.6. Within the WSIP program area on the Peninsula watershed, this species is known to occur in San Andreas Reservoir, Upper and Lower Crystal Springs Reservoirs, the Pulgas Water Temple, the upper headwaters of Pilarcitos Creek, the vicinity of Pilarcitos Reservoir, and at Stone Dam.

Marbled Murrelet

The marbled murrelet (*Brachyramphus marmoratus*, federal threatened) is a small, diving seabird that nests in large trees in coniferous forests as much as 50 miles inland, and forages on small fish and invertebrates in near-shore marine waters. A nesting murrelet was detected in 1998 and 2003 on the west side of Pilarcitos Creek within designated critical habitat for the species.

Riparian-Dependent Birds

Several bird species of special concern are closely associated with the riparian habitats in the WSIP program area. Riparian trees throughout the watershed have a moderate potential to support nesting and foraging Cooper’s hawk (*Accipiter cooperi*, California species of special concern) and sharp-shinned hawk (*A. striatus*, California species of special concern). The riparian vegetation at the southern end of Upper Crystal Springs Reservoir supports a breeding population of saltmarsh common yellowthroat (*Geothlypis trichas sinuosa*, California species of special concern). Suitable habitat may also be present at San Andreas Reservoir. Loggerhead shrike

(*Lanius ludovicianus*, California species of special concern) nests in riparian and other woodlands and forages over open country. It may be present throughout the Peninsula watershed in suitable habitat.

Marsh- and Lake-Dependent Birds

Tricolored blackbird (*Agelaius tricolor*, California species of special concern) has been observed during the breeding period in the vicinity of Upper and Lower Crystal Springs Reservoirs and thus may breed there. Suitable habitat may also be present at San Andreas Reservoir. Northern harrier (*Circus cyaneus*, California species of special concern) nests and forages in wet meadows and pastures such as those found at San Andreas Reservoir and Upper and Lower Crystal Springs Reservoirs. California black rail (*Laterallus jamaicensis coturniculus*, California threatened) generally breeds in saltmarsh habitat, but sometimes breeds in freshwater marsh at low elevations. Suitable habitat may be present at Upper and Lower Crystal Springs Reservoirs and San Andreas Reservoir. Double-crested cormorant (*Phalacrocorax auritus*, California species of special concern) nests in rookeries on cliffs and along lake margins, and forages for fish. It has been observed at Crystal Springs Reservoir and may also forage at San Andreas Reservoir. The bank swallow (*Riparia riparia*, California threatened) nests in banks along large rivers and forages over open water. Although there are no current records for this species in the Peninsula watershed, it may forage at Crystal Springs and San Andreas Reservoirs. Peregrine falcon (*Falco peregrinus anatum*, federal delisted, California endangered) nests in cliffs and outcrops and forages near wetlands and open water. Foraging habitat may be present throughout the Peninsula watershed, especially near Crystal Springs and San Andreas Reservoirs.

Upland Birds

Bell's sage sparrow (*Amphispiza belli belli*, California species of special concern) nests in chaparral and coastal scrub. Suitable habitat may be present on the shores of all of the reservoirs. Vaux's swift (*Chaetura vauxi*, California species of special concern) nests in hollow trees and forages over woodlands and open water. The species was observed at Upper and Lower Crystal Springs Reservoirs, and suitable habitat may be present near San Andreas and Pilarcitos Reservoirs. Merlin (*Falco columbarius*, California species of special concern) is a winter visitor and may forage in all project areas.

Mammals

Pallid bat (*Antrozous pallidus*, California species of special concern) roosts in trees and forages over open grassland. The species could occur throughout the watershed, but foraging areas within the WSIP program area would be found primarily along the shores of Upper and Lower Crystal Springs Reservoirs. Pacific western big-eared bat (*Corynorhinus townsendii*) roosts in caves and buildings and forages in open country. Suitable habitat is present at Upper and Lower Crystal Springs Reservoirs and San Andreas Reservoir. Small-footed myotis (*Myotis ciliobabrum*, California species of special concern) roosts in trees as well as old buildings and caves and forages in open country. Like the pallid bat, the primary foraging areas near the WSIP program area would be along the shores of Upper and Lower Crystal Springs Reservoirs, but roosting habitat would be present throughout the program area within the Peninsula watershed. Long-eared myotis (*Myotis evotis*, California species of special concern) roosts in hollow trees and forages along rivers, streams, and ponds. It would be expected to occur throughout the WSIP program area in the Peninsula watershed. Fringed myotis (*Myotis thysanodes*, California species of special concern) roosts in trees and forages at the forest edge. It would be expected to occur throughout the WSIP program area. Long-legged myotis *(Myotis volans*) roosts in hollow trees and feeds primarily in open areas. Suitable roosting habitat could be present throughout the WSIP program area in the Peninsula watershed, but foraging areas would be present primarily at the margins of San Andreas and Upper and Lower Crystal Springs Reservoirs. Yuma myotis (*Myotis yumanensis*, California species of special concern) roosts in trees and crevices and forages over emergent vegetation and still water. It would be most likely to occur near the reservoirs—Pilarcitos, San Andreas, and Upper and Lower Crystal Springs.

The San Francisco dusky-footed woodrat (*Neotoma fuscipes annectens*, California species of special concern) inhabits oak woodlands where it forages primarily on oak leaves. Suitable habitat is present in oak woodlands throughout the Peninsula watershed.

5.5.6.2 Impacts

Significance Criteria

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

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

- Have a substantial adverse effect on any riparian habitat or other sensitive natural community identified in local or regional plans, policies, regulations or by the CDFG or USFWS

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

- Interfere substantially with the movement of any native resident or migratory fish or wildlife species or with established native resident or migratory wildlife corridors, or impede the use of native wildlife nursery sites

- Have the potential to degrade the quality of the environment, substantially reduce the habitat of a fish or wildlife species, cause a fish or wildlife population to drop below self-sustaining levels, threaten to eliminate a plant or animal community, or reduce the number or restrict the range of a rare or endangered plant or animal

- 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

Approach to Analysis

The assessment of WSIP operational impacts on terrestrial biological resources is based primarily on the extent to which altered operations would change the existing habitat near reservoirs and creeks. Operational changes consist of increased diversions during winter high flows, increased releases to streams to maintain minimum flows, and changes in the elevation, annual range, and seasonal timing of reservoir water levels. Section 5.5.1 presents an assessment of the changes in hydrology in the Peninsula watershed that would occur under the WSIP.

This section discusses impacts related to sensitive habitats, key special-status species, other species of concern, and common habitats and species. The discussion of riparian and wetland habitats addresses the second and third significance criteria listed above. "Key special-status species" include species that are formally listed as endangered or threatened under the state or federal endangered species acts, as well as a few other species (such as foothill yellow-legged frog) that are afforded some degree of legal protection and have a high risk of local population decline or extirpation. The key special-status species discussion addresses the first significance criterion. "Other species of concern" and "common habitats and species" are more general categories relevant to the fourth and fifth significance criteria.

There would be no impacts related to conflicts with local policies or ordinances protecting biological resources or the provisions of a habitat conservation plan (the last two significance criteria). The SFPUC has prepared a management plan for the Peninsula watershed and is preparing a habitat conservation plan, but the WSIP would be consistent with their provisions.

The responses of terrestrial biological resources to changes in stream and reservoir operations are complex in both space and time. This section describes the general impacts associated with certain categories of operational changes to reservoirs and streams. The project EIR for the Lower Crystal Springs Dam project (PN-4) would address operational impacts in detail. The other Peninsula Region projects would have limited, if any, operational impacts on creeks and reservoirs. Potential impacts on San Andreas Reservoir, Pilarcitos Reservoir, and Pilarcitos Creek are analyzed in this PEIR at a project level because the operational effects on these facilities would not be analyzed in a project-specific EIR.

Unlike the Alameda Creek watershed and Calaveras Reservoir, which have experienced DSOD-mandated operational changes for a relatively short period of time, Crystal Springs Reservoir has been maintained at lower, DSOD-mandated water levels since 1983—nearly 25 years. The freshwater marsh and riparian habitats have adapted to the prevailing conditions, and no reference to earlier operational conditions is required in this assessment of impacts.

Impact Summary

Table 5.5.6-4 presents a summary of the impacts on terrestrial biological resources in the Peninsula watershed that could result from implementation of the proposed water supply and system operations.

TABLE 5.5.6-4
SUMMARY OF IMPACTS –
TERRESTRIAL BIOLOGICAL RESOURCES IN THE PENINSULA WATERSHED

Impacts	Sensitive Habitats	Key Special-Status Species	Other Species of Concern	Common Habitats and Species
Impact 5.5.6-1: Impacts on biological resources in Upper and Lower Crystal Springs Reservoirs	PSM	PSM	PSM	PSM
Impact 5.5.6-2: Impacts on biological resources in San Andreas Reservoir	LS	LS	LS	LS
Impact 5.5.6-3: Impacts on biological resources along San Mateo Creek below Lower Crystal Springs Dam	LS	LS	LS	LS
Impact 5.5.6-4: Impacts on biological resources in Pilarcitos Reservoir	LS	PSM*	LS	LS
Impact 5.5.6-5: Impacts on biological resources along Pilarcitos Creek below Pilarcitos Reservoir	LS	LS	LS	LS
Impact 5.5.6-6: Impacts on biological resources along Pilarcitos Creek below Stone Dam	LS	LS	LS	LS
Impact 5.5.6-7: Conflicts with the provisions of adopted conservation plans or other approved biological resource plans	LS			

LS = Less than Significant impact, no mitigation required
PSM= Potentially Significant impact, can be mitigated to less than significant

* Based on the refined Pilarcitos watershed impact analysis (see Section 13.3), this impact is PSM due to adverse effects that would result from implementing replacement Measure 5.5.3-2a.

Impact Discussion

Impact 5.5.6-1: Impacts on biological resources in Upper and Lower Crystal Springs Reservoirs.

Sensitive Habitats

Elevating the average storage and reservoir levels under the WSIP would inundate all existing freshwater marsh and riparian habitats below an elevation of 283 feet, resulting in the loss of these sensitive habitats. Freshwater marsh would become established at higher elevations in response to higher reservoir levels. As the reservoir fills, there could be a short-term reduction in the overall extent of freshwater marsh, although the greater perimeter of the reservoir at the higher levels could eventually support an increase in the extent of these habitats. This impact would be potentially significant.

Under the WSIP, the average monthly water levels in Crystal Springs Reservoir would fluctuate more than under the existing condition. This increased fluctuation would be due in part to periodic drawdown (up to 16 feet) for Hetch Hetchy system maintenance, which would occur approximately every five years. This drawdown would expose deep-water emergent vegetation such as cattails and tules and could dry the soils supporting shallow emergent vegetation and wet meadow vegetation. However, the maintenance would be scheduled during the onset of cool fall or early winter weather (October–December), when wetland vegetation is entering its winter dormancy period. Provided the reservoir was refilled during the winter, impacts on sensitive habitats related to this change in operations would be less than significant, and no mitigation measures would be required.

Other than the periodic drawdown, the annual range of fluctuation in reservoir water levels would be similar to levels under existing conditions; therefore, the impact on riparian and wetland resources would be less than significant, and no mitigation measures would be required.

The WSIP proposes to maintain maximum reservoir water levels for longer periods during the summer than under existing conditions. This operational strategy could favor perennial freshwater marsh habitats over willow scrub, but any such effect cannot be quantified at the program level of analysis. Therefore, this PEIR conservatively considers this impact to be potentially significant.

Sensitive upland habitats would be affected by the higher reservoir water levels. Maximum water levels would be sustained higher and longer with the WSIP than under existing conditions (or before the DSOD-imposed operational restrictions). Habitats and species that could not tolerate these longer periods of inundation would be lost, including oak woodland, mixed evergreen forest, serpentine grassland, and valley needlegrass grassland. This impact would be potentially significant.

The EIR for the Lower Crystal Springs Dam project (PN-4) will provide a more detailed analysis of project impacts, including a determination of the acreage of sensitive upland, wetland, and riparian habitat that would be affected by the change in reservoir water levels. However, this PEIR conservatively considers the effects of the WSIP on sensitive upland, wetland, and riparian habitats to be *potentially significant*.

Key Special-Status Species

Proposed operation of Upper and Lower Crystal Springs Reservoirs under the WSIP would affect several key special-status species. Populations of serpentine-associated fountain thistle and Marin western flax would be inundated and their habitat potentially permanently lost. At the program level of analysis, this impact is considered potentially significant. More detailed impact analysis will be conducted as part of the project-level CEQA review for the Lower Crystal Springs Dam project (PN-4).

WSIP-related operations could also affect San Francisco garter snake and California red-legged frog in several ways. Direct mortality by drowning could occur if the reservoir level is raised while San Francisco garter snakes are in hibernation. Both species would experience a loss of habitat throughout Upper and Lower Crystal Springs Reservoirs when existing freshwater marsh vegetation is inundated. Once freshwater marsh wetland is established at higher levels, the WSIP could increase the extent of available habitat for California red-legged frog and San Francisco garter snake. However, raising the water level in reservoirs could permit largemouth bass (*Micropterus salmoides*) and other predators to gain access to habitat for San Francisco garter snake and California red-legged frog in areas that are currently isolated due to elevational barriers. Examples include Tracy Lake in the northern arm of Lower Crystal Springs Reservoir, and the proposed Laguna Creek sedimentation basin at the southern end of Upper Crystal Springs Reservoir. Thus, at the program level of analysis, potentially significant adverse and beneficial impacts on habitat for special-status species would be expected to occur due to higher and more variable water levels in Upper and Lower Crystal Springs Reservoirs. Impacts will be analyzed in more detail in the project-specific EIR for the Lower Crystal Springs Dam project (PN-4).

Annual summer drawdown has been cited as a potential problem for San Francisco garter snakes because the exposed, unvegetated shoreline separates emergent vegetation foraging habitat from water and protective cover (Barry, no date). Hydrologic models of the proposed program indicate that summer drawdown would be about the same as the current pattern, except for the drawdown that would occur for periodic maintenance. San Francisco garter snakes usually enter their winter hibernation period by mid-November (Barry, no date). Because the drawdown period overlaps somewhat with the active period of this species, this impact would be potentially significant with respect to foraging habitat for both adult and young garter snakes.

Other key special-status species that could be affected by reservoir operations under the WSIP include peregrine falcon and black rail. Both species utilize freshwater marsh habitats, but to a limited degree. Therefore, impacts on these species due to alteration of habitats would be less than significant.

Overall, the effects of the WSIP on key special-status species would be *potentially significant*.

Other Species of Concern

The loss of existing habitat and ultimate establishment of habitat at higher elevations would also affect a number of reptile, bird, and bat species of concern that depend on freshwater marsh and riparian habitat. Those that depend on freshwater marsh habitat would experience a loss of habitat when the reservoir level is raised, but would ultimately benefit when freshwater marsh becomes established at higher elevations. Such species include western pond turtle, tricolored blackbird, saltmarsh yellowthroat, northern harrier, Vaux’s swift, and double-crested cormorant, all known to occur at the reservoirs. Individuals of these species could be directly affected by a rise in water level during the breeding season, and a temporary loss of suitable habitat could result if wetland vegetation changes occur. Both of these changes would result in potentially significant impacts.

Bird and mammal species of concern that depend on large trees and woodland for nesting, roosting, or foraging would be adversely affected by the loss of upland trees along the shoreline. Such species include Cooper’s hawk, sharp-shinned hawk, loggerhead shrike, several bat species, and San Francisco dusky-footed woodrat. Species of concern that depend on grassland and coastal scrub, including Bell’s sage sparrow and pallid bat, could be affected by the loss of these habitats when reservoir water levels are raised. Due to the extent of habitat and the number of species that would be affected, impacts on species of concern due to the loss of upland habitat would be potentially significant.

Serpentine- and grassland-associated plant species of concern and their habitats could be lost due to increased water levels at Upper and Lower Crystal Springs Reservoirs, depending on species tolerance for extended inundation, saturation of the seed bank, and the length of inundation. Species that could be affected include Franciscan onion, Crystal Springs lessingia, western leatherwood, and arcuate bush mallow. San Francisco collinsia would potentially be affected by loss of forested or coastal scrub habitat. Impacts due to the loss of habitat and populations of these species of concern would be potentially significant.

Overall, the effects of the WSIP on other species of concern would be *potentially significant*.

Common Habitats and Species

The WSIP proposes to maintain Upper and Lower Crystal Springs Reservoirs at maximum levels for longer periods during the summer than under existing conditions, and for longer periods than under the DSOD imposed operational restrictions. Many upland plant species can tolerate inundation for brief periods, especially during their winter dormant period, but lack adaptations for surviving extended flooding during their period of active growth. Longer periods of maximum reservoir levels may result in mortality of valley oaks, coast live oaks, and other upland species at elevations below 283 feet. The loss of common upland habitats and species at the periphery of Upper and Lower Crystal Springs Reservoirs is considered a *potentially significant* impact because of the extent of area involved.

Impact Conclusions

Impacts on sensitive habitats, key special-status species, species of concern, and common habitats and species at Upper and Lower Crystal Springs Reservoirs would be *potentially significant*. For all resources except plant species adapted to serpentine seeps, such as the fountain thistle, implementation of Measure 5.5.6-1a, Adaptive Management of Freshwater Marsh and Wetlands at Upper and Lower Crystal Springs Reservoirs, and Measure 5.5.6-1b, Compensation for Impacts on Terrestrial Biological Resources, would be sufficient to fully mitigate impacts of the WSIP. For the fountain thistle (key special-status species) and other plant species adapted to serpentine seeps, the additional implementation of Measure 5.5.6-1c, Compensation for Serpentine Seep-Related Special-Status Plants, would reduce the impact to a less-than-significant level.

Impact 5.5.6-2: Impacts on biological resources in San Andreas Reservoir.

Sensitive Habitats

With the WSIP, San Andreas Reservoir would be maintained in much the same pattern as it is under existing conditions, and operation of the reservoir would not substantially affect sensitive freshwater marsh habitats. Every fifth year, the reservoir would be drawn down for maintenance during the winter months, when freshwater marsh vegetation is not typically in active growth. As a result, impacts on sensitive habitat at San Andreas Reservoir would be *less than significant*.

Key Special-Status Species

Since the composition and extent of emergent vegetation is not expected to change significantly at San Andreas Reservoir as a result of WSIP operations, impacts on San Francisco garter snake and California red-legged frog would be *less than significant*. Since the maximum reservoir water level would not change, no impact would occur on key terrestrial upland special-status species such as Mission blue butterfly.

Other Species of Concern

Since changes in the extent and composition of freshwater emergent and upland habitat are expected to be minimal, no impact would occur on upland plant species such as western leatherwood, and arcuate bush mallow. Likewise, any impact on western pond turtle, foraging and roosting bats, tricolored blackbird, northern harrier, merlin, peregrine falcon, Vaux's swift, saltmarsh yellowthroat, and double-crested cormorant would be *less than significant*.

Common Habitats and Species

Impacts on common habitats and species would be *less than significant*, since the extent and composition of upland and wetland habitats are expected to remain stable.

Impact Conclusions

Impact on sensitive habitats, key special-status species, species of concern, and common habitats and species at San Andreas Reservoir would be *less than significant*.

Impact 5.5.6-3: Impacts on biological resources along San Mateo Creek below Lower Crystal Springs Dam.

Sensitive Habitats

Under the WSIP, Crystal Springs Dam and Reservoir would be operated in much the same way as under existing conditions with respect to maximizing storage and minimizing releases to San Mateo Creek. Because the volume, magnitude, and frequency of releases are projected to be much the same as at present, the impact of the WSIP on riparian vegetation in San Mateo Creek would be *less than significant*.

Key Special-Status Species

Section 4.6, Biological Resources, discusses impacts on freshwater-marsh-dwelling species (such as California red-legged frog) due to the alteration of freshwater marsh habitat immediately below the dam. Since releases from Crystal Springs Dam to San Mateo Creek are projected to be much the same as under existing conditions, any impacts on aquatic-dependent key special-status species would be *less than significant*. WSIP operations would not affect key special-status plants such as San Mateo woolly sunflower.

Other Species of Concern

Any impacts on riparian- and creek-associated species of concern (such as western pond turtle) would be so small as to not be quantifiable and would therefore be *less than significant*.

Common Habitats and Species

Operations under the WSIP would not affect common upland habitats. The impacts on common species would be *less than significant*.

Impact Conclusions

Impacts of WSIP operations on sensitive habitats and key special-status species at San Mateo Creek would be *less than significant*.

Impact 5.5.6-4: Impacts on biological resources in Pilarcitos Reservoir.

Sensitive Habitats

The earlier drawdown of the reservoir under the WSIP would not increase the extent of unvegetated, weedy, or seasonal wetland areas below the maximum water levels, although these areas would be exposed several days or weeks earlier than under the existing condition in some years. This impact would be less-than-significant.

Key Special-Status Species

Proposed operations with the WSIP at Pilarcitos Reservoir would have no effect on the extent of suitable habitat at the reservoir for California red-legged frog and San Francisco garter snake. Similarly, the extent and condition of adjacent upland vegetation would not be affected by the proposed reservoir operations. As a result, the WSIP would have no effect on species such as the marbled murrelet that nest or forage in upland habitats adjacent to the reservoir.

Other Species of Concern

Proposed operations at Pilarcitos Reservoir could slightly reduce the extent of suitable habitat for western pond turtle, Vaux's swift, Yuma myotis, long-eared myotis, and bird species that forage over open water and emergent vegetation, but this impact would be *less than significant*. However, the extent and condition of adjacent upland vegetation would not be affected by the proposed reservoir operations. As a result, this impact would not apply to nesting or foraging upland habitats for species such as Cooper's hawk, sharp-shinned hawk, Bell's sage sparrow, Vaux's swift, merlin, peregrine falcon, loggerhead shrike, special-status bat species, San Francisco dusky-footed woodrat, and western leatherwood.

Common Habitats and Species

No impact on common habitats would occur as a result of WSIP operations. The potential impact on common species that depend on water levels in Pilarcitos Reservoir and flow in Pilarcitos Creek would be *less than significant*.

Impact Conclusions

Impacts of the WSIP on sensitive habitats, key special-status species, other species of concern, and common habitats and species at Pilarcitos Reservoir would be *less than significant.* However, implementation of Measure 5.5.3-2a, Low-head Pumping Station at Pilarcitos Reservoir, would lower the water level in the reservoir by 3 or 4 feet in some summers. This could have a potentially significant impact on the extent of suitable habitat at the reservoir for California red-legged frog and the San Francisco garter snake. Implementation of Measure 5.5.3-2c, Habitat Monitoring and Compensation, would reduce this impact to a less-than-significant level.

Impact 5.5.6-5: Impacts on biological resources along Pilarcitos Creek below Pilarcitos Reservoir.

Sensitive Habitats

Under the WSIP, flow in Pilarcitos Creek between Pilarcitos Reservoir and Stone Dam would increase in some spring months, a beneficial impact. In the summer months of some drier years, the period during which releases from Pilarcitos Reservoir would be limited to reservoir inflow would be extended, potentially for up to three months. Because willows exist in the riparian forest in this section, it is apparent that the riparian forest is adapted to periods without flowing water. The channel-forming processes in Pilarcitos Creek would be reduced insignificantly under the WSIP. Thus, some changes in flow would be beneficial and some adverse. The overall impact on sensitive riparian habitat is considered *less than significant.*

Key Special-Status Species

Flows in Pilarcitos Creek below Pilarcitos Dam would have a minor impact on riparian habitat; therefore, the impact on habitat for foothill yellow-legged frog would be *less than significant*.

Other Species of Concern

Proposed operations at Pilarcitos Reservoir could slightly reduce the extent of suitable habitat for western pond turtle, Vaux's swift, Yuma myotis, long-eared myotis, and bird species that forage over open water and emergent vegetation, but this impact would be less than significant. However, the extent and condition of adjacent upland vegetation would not be affected by the proposed reservoir operations. As a result, this impact would not apply to nesting or foraging upland habitats for species such as Cooper's hawk, sharp-shinned hawk, Bell's sage sparrow, Vaux's swift, merlin, peregrine falcon, loggerhead shrike, special-status bats, San Francisco dusky-footed woodrat, western leatherwood, and Dudley's lousewort.

Flows in Pilarcitos Creek below Pilarcitos Dam and below Stone Dam would have a less-than-significant impact on riparian habitat; therefore, the impact on habitat for foothill yellow-legged frog and any special-status birds and bats that forage over streams would be less than significant.

Overall, WSIP impacts on other species of concern would be *less than significant*.

Common Habitats and Species

No impacts on common habitats would occur as a result of WSIP operations. The potential impact on common species that depend on water levels in Pilarcitos Reservoir and flow in Pilarcitos Creek would be *less than significant*.

Impact Conclusions

Impacts on sensitive riparian habitat at Pilarcitos Creek between Pilarcitos Reservoir and Stone Dam would be *less than significant*.

Impact 5.5.6-6: Impacts on biological resources along Pilarcitos Creek below Stone Dam.

Sensitive Habitats

The central coast arroyo willow riparian forest below Stone Dam, which relies on seepage and on the contribution of tributary creeks, would not be significantly affected by the WSIP. The overall reduction in high winter flows would result in a slight incremental reduction in channel-forming processes, but the overall impact on sensitive riparian resources along Pilarcitos Creek below Stone Dam would be *less than significant*.

Key Special-Status Species

Flows in Pilarcitos Creek below Stone Dam would have a minor impact on riparian habitat; therefore, the impact on habitat for foothill yellow-legged frog would be *less than significant*.

Other Species of Concern

Flows in Pilarcitos Creek below Stone Dam would have a minor impact on riparian habitat; therefore, the impact on habitat for foothill yellow-legged frog and any special-status birds and bats that forage over streams would be *less than significant*.

Common Habitats and Species

No impacts on common habitats would occur as a result of WSIP operations. The potential impact on common species that depend on water levels in Pilarcitos Reservoir and flow in Pilarcitos Creek would be *less than significant*.

Impact Conclusions

Impacts on biological resources along Pilarcitos Creek below Stone Dam would be *less than significant*, and no mitigation measures would be required.

Impact 5.5.6-7: Conflicts with the provisions of adopted conservation plans or other approved biological resources plans.

The only plan relevant to proposed WSIP operations is the *Peninsula Watershed Management Plan*. The WSIP program as a whole would be consistent with the provisions of this plan, which places priority on resource protection while ensuring that the objective of delivering adequate, high-quality water is met. The SFPUC is currently preparing a habitat conservation plan for the Peninsula watershed; however, WSIP operations are not considered in this plan, which covers only existing operations. Therefore, impacts related to conflicts with adopted plans would be *less than significant.*

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5.5.7 Recreational and Visual Resources

Chapter 4, Section 4.12, Recreational Resources, provided a general overview of the park and recreational facilities and resources near proposed WSIP facility projects. This section discusses specific recreational resources and activities within the Peninsula watershed that could be affected by the proposed water supply and system operations. The discussion focuses primarily on water-related recreation, including fishing, swimming, boating, rafting, or activities such as scenic viewing, walking, hiking, or camping adjacent to water bodies, that could be affected by the WSIP.

5.5.7.1 Setting

The water features of interest for this analysis are the four SFPUC Peninsula reservoirs (Upper Crystal Springs Reservoir, Lower Crystal Springs Reservoir, San Andreas Reservoir, and Pilarcitos Reservoir) and San Mateo and Pilarcitos Creeks. All four reservoirs and portions of the two creeks are located within the SFPUC Peninsula watershed, as shown on Figure 5.5.1-2. The recreational uses and visual resources in the Peninsula watershed that could be affected by the WSIP water supply or system operations are described below.

As described in Section 4.2, Plans and Policies, and 4.3, Land Use and Visual Quality, the Peninsula watershed area is protected by two easements that were established through a four-party agreement among the CCSF, the U.S. Department of the Interior, the California Department of Transportation, and San Mateo County. The scenic and recreation easement covers 4,000 acres located in the eastern periphery of the watershed, generally along the I-280 corridor and adjacent to the communities to the east. The easement abuts Upper and Lower Crystal Springs Reservoirs and the southern end of San Andreas Reservoir. Recreational activities are permitted in this easement area, but are limited to those considered compatible with water quality protection. Portions of these reservoirs are visible from trails within the easement, but public access to the four reservoirs is prohibited, along with all forms of water sports. The scenic easement, which covers 19,000 acres, does not permit recreational activities. This area encompasses the four reservoirs and a stretch of Pilarcitos Creek (SFPUC, 2002). Only a very short stretch of San Mateo Creek is located within the scenic easement; the rest of the creek is outside of both easements and outside of Peninsula watershed lands.

The *Peninsula Watershed Management Plan* also prohibits recreational activities that are detrimental to watershed resources, including swimming, boating, fishing, and hiking at or near the shoreline (SFPUC, 2002).

Recreational Uses

Public trails in the watershed provide both recreational opportunities and scenic views of the Upper Crystal Springs, Lower Crystal Springs, Pilarcitos, and San Andreas Reservoirs. The trails are generally located between the reservoirs and I-280, along the eastern edge of the watershed, where they are easily accessible from the adjacent communities. They are available to the public for hiking, running, bicycling, rollerblading, and horseback riding (though horseback riding and bicycles are allowed only on certain designated trails).

Sawyer Camp Trail

When the SFPUC fenced off the watershed lands in the vicinity of Crystal Springs Reservoir, it left the six-mile Sawyer Camp Trail open to the public for nonmotorized recreational use. This trail, once the main highway between San Francisco and Half Moon Bay, is visited by approximately 300,000 people each year. The trail parallels Crystal Springs and San Andreas Reservoirs and is currently managed by San Mateo County under the name Crystal Springs Park. San Mateo County envisions the Sawyer Camp Trail as an uninterrupted multi-use route from San Bruno to Woodside (San Mateo County, 2007).

San Andreas Trail

The San Andreas Trail extends from San Bruno Avenue on the north to Hillcrest Boulevard on the south, where it connects to the Sawyer Camp Trail. In its northerly section, this popular trail provides scenic views of San Andreas Reservoir. A portion of the trail is paved and is heavily used by bicyclists, joggers, and hikers (San Mateo County, 2006).

Sweeney Ridge Trail

The Sweeney Ridge Trail, which extends from the end of Sneath Lane in San Bruno to the San Francisco Bay Discovery Site (a National Historic Landmark), provides views of the northern watershed and San Francisco Bay (San Mateo County, 2006).

Fifield-Cahill Ridge Trail

Since 2003, the Fifield-Cahill Ridge Trail has been open to the public on a reservation-only basis, with groups of up to 20 people led by docents three days a week. This trail segment is the SFPUC-managed component of the 400-mile-long Bay Area Ridge Trail (SFPUC 2007b).

Connector Trails

Numerous connector trails cross I-280 and provide linkages to communities to the east such as San Mateo, Belmont, and Redwood City. In addition, portions of the San Andreas Reservoir are visible from Junipero Serra County Park (located to the northeast of SFPUC Peninsula watershed).

Pulgas Water Temple

The Pulgas Water Temple is located south of the Upper Crystal Springs Reservoir, east of Cañada Road. It consists of a Roman Renaissance–style structure and pool, surrounded by manicured lawns, landscaping, and a parking lot. The site is open to the public on weekdays and for special events such as weddings, as well as on weekends (SPFUC, 2007c).

Crystal Springs Golf Course

There is one golf course within the watershed, the Crystal Springs Golf Course, but it does not offer any forms of water recreation to the public.

Pilarcitos Creek

Pilarcitos Creek starts at Pilarcitos Reservoir within the SFPUC Peninsula watershed. No water recreation or access to this reservoir is allowed. The creek runs south until it reaches Highway 92, then runs west to its mouth on the Pacific Ocean within Half Moon Bay State Beach. No organized recreational activities are established within or adjacent to the creek in the upper watershed. However, trails within Half Moon Bay State Beach run adjacent to and across Pilarcitos Creek, and the public is allowed access to portions of this stretch of the creek (Bay Area Hiker, 2007).

San Mateo Creek

San Mateo Creek starts at Lower Crystal Springs Reservoir within the SFPUC Peninsula watershed (see above for a description of activities allowed within the watershed). The creek runs east through the town of Hillsborough and city of San Mateo to San Francisco Bay. The San Mateo Creek Trail, maintained by San Mateo County, runs adjacent to the creek for several miles. The creek is not part of any City-managed recreation facility until it reaches San Mateo's Shoreline Parks on San Francisco Bay. Shoreline Parks, which includes Ryder Park and Seal Point Park, includes amenities such as trails, picnic areas, play areas, and an outdoor classroom. These parks incorporate the natural features of the creek and shoreline to some extent and provide some wilderness-based recreation, but are primarily paved and developed. The creek does not appear to be used for any purpose other than as a scenic resource (City of San Mateo, 2007).

Crystal Springs, Pilarcitos, and San Andreas Reservoirs

These reservoirs are located entirely within the SFPUC Peninsula watershed lands. As mentioned above, public access to the interior portion of these watershed lands is prohibited, and the reservoirs are not available for water-related recreation.

Visual Quality Considerations

Due to its use for water collection and storage, the Peninsula watershed area has been protected from urbanization. A wide variety of habitats exist on the watershed due to its diversity of climate, topography, geology and soils. These include old growth Douglas fir forests, grasslands dominated by native bunchgrasses, areas of coastal scrub and chaparral, stream corridors, and wetlands (SFPUC, 2007a). While many of the SFPUC facilities located within the Peninsula watershed are aboveground structures, they are typically screened with existing vegetation and blend with the watershed's landscape. The reservoirs appear as visually prominent water features in views from nearby trails and surrounding ridges as well as from I-280 and Highway 92.

The provisions of the scenic and scenic and recreation easements include the following:

- 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 so substantial excavation or topographic changes shall be made without the concurrence of a regional representative of the Department of the Interior…

- 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…

As discussed in Chapter 4, Section 4.2, Plans and Policies, the *Peninsula Watershed Management Plan* includes the following policy related to visual quality:

- *Policy WA 9*: If new facilities require additional new locations, require that view shed studies be conducted to minimize, eliminate or conceal the violation of scenic values.

However, the proposed WSIP water supply and system operations analyzed in this section would not require any new facilities, other than those already discussed and analyzed in Section 4.3, Land Use and Visual Quality. Therefore, this policy is not addressed further in this section.

5.5.7.2 Impacts

Significance Criteria

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

<u>*Recreation*</u>

- Increase the use of existing neighborhood and regional parks or other recreational facilities such that substantial physical deterioration of the facility would occur or be accelerated (Secondary impacts of growth are evaluated in Chapter 7, Growth-Inducement Potential and Indirect Effects of Growth)

- Include recreational facilities or require the construction or expansion of recreational facilities that might have an adverse physical effect on the environment (Secondary impacts of growth are evaluated in Chapter 7)

- Physically degrade existing recreational resources

The physical degradation of existing resources could occur if the WSIP were to: (1) remove or damage existing recreational resources directly; (2) cause environmental impacts (such as air quality or noise effects) that would indirectly result in deterioration in the quality of the recreational experience; or (3) disrupt access to existing recreation facilities (which would divide a community from some of the established amenities used by its members).

<u>*Visual Quality*</u>

- Have a substantial adverse effect on a scenic vista
- 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
- Substantially degrade the existing visual character or quality of the site and its surroundings

Approach to Analysis

The WSIP would change water levels in reservoirs and alter flow in streams in the Peninsula watershed. WSIP-induced changes in reservoir water levels in the San Mateo Creek watershed were estimated using the HH/LSM (see Appendix H). WSIP-induced changes in reservoir water levels in the Pilarcitos Creek watershed and stream flow in the Pilarcitos Creek and San Mateo Creek watersheds were estimate semi-quantitatively. A specialist in recreation and visual resources assessed the impacts of the WSIP on these environmental elements using the estimated WSIP-induced changes in reservoir water levels and stream flow (see Section 5.5.1).

Impact Summary

Table 5.5.7-1 presents a summary of the impacts on recreational and visual resources in the Peninsula watershed that could result from implementation of the proposed water supply and system operations.

TABLE 5.5.7-1
SUMMARY OF IMPACTS – RECREATIONAL AND VISUAL RESOURCES IN THE PENINSULA WATERSHED

Impact	Significance Determination
Impact 5.5.7-1: Effects on recreational facilities and/or activities	LS
Impact 5.5.7-2: Visual effects on scenic resources or the visual character of water bodies	LS

LS = Less than Significant impact, no mitigation required

Impact Discussion

Impact 5.5.7-1: Effects on recreational facilities and/or activities.

The WSIP would have no impact on water-related recreational facilities or other recreational activities in the Peninsula watershed. As described in the Setting, no water recreation is allowed on the SFPUC reservoirs; because there would be no change to this policy under the WSIP, no impacts on recreation would occur as a result of water level changes in the Peninsula reservoirs. In addition, new trails are prohibited at or near the shoreline, so no land-based recreation would be affected. With respect to recreation in and along the creeks in the watershed, there is either (1) no or only very limited water recreation occurring at present, and/or (2) the WSIP-related flow changes described in Section 5.5.1 would not appreciably change creek flows to an extent that existing recreational use would be affected. The changes in stream flow or reservoir levels would not physically degrade existing recreational resources. Therefore, impacts on recreation associated with the proposed WSIP system operations would be *less than significant*, and no mitigation is required.

Impact 5.5.7-2: Visual effects on scenic resources or the visual character of water bodies.

As described in Section 5.5.1 flow changes and reservoir water level changes that would occur under the WSIP in the future are not beyond the range of flow and water level variation that occurs now. The Lower Crystal Springs Dam Improvements project (PN-4) would restore the historic reservoir capacity and would raise the water level to historic conditions. The reservoir is visible from a number of trails, parks, and scenic roads. However, while the higher reservoir water level could change the visual appearance at close range, it would not change the scenic quality of the reservoir, either at close range or from distant viewpoints. Therefore, visual impacts associated with the proposed WSIP system operations would be *less than significant*, and no mitigation is required.

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